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HIV-related sexual behaviors, drugs, and violence among high risk populations in  
Baja California, Mexico

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

in

Public Health (Global Health)

by

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Professor John D. Clapp

2012

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Chair

University of California, San Diego

San Diego State University

2012

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Chapter 2, in full, is a reprint of the material as it was submitted to *The Journal of Sex Research*: Volkmann T, Wagner KD, Semple SJ, Strathdee SA, Goldenberg S, Patterson TL. Measuring Unprotected Sex: A Case Study of Two Analytical Approaches among Male Clients of Female Sex Workers. Tyson Volkmann was the primary investigator and author of this paper.

Chapter 3, in full, is a reprint of the material as it was submitted to *The Archives of Sexual Behavior*: Volkmann T, Wagner KD, Strathdee SA, Semple SJ, Ompad DC, Chavarin C, Patterson TL. Correlates of Self-efficacy for Condom Use among Male Clients of Female Sex Workers. Tyson Volkmann was the primary investigator and author of this paper.

Chapter 4, in full, is a reprint of the material as it appears in *Global Public Health*: Volkmann T, Fraga MA, Brodine SK, Iñiguez-Stevens E, Cepeda A, Elder JP, Garfein RS; for the VIIDAI team. Drug scene familiarity and exposure to gang violence among residents in a small community in Baja California, Mexico. *Glob Public Health* 2012 Oct 16. Published online 2012 October 16. DOI: 10.1080/17441692.2012.729220. The final publication is available at <http://www.tandfonline.com/doi/full/10.1080/17441692.2012.729220>. Tyson Volkmann was the primary investigator and author of this paper.

## VITA, PUBLICATIONS, AND FIELDS OF STUDY

### VITA

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### PUBLICATIONS

#### Published

1. Wagner KD, Pollini RA, Patterson TL, Lozada R, Ojeda VD, Brouwer KC, Vera A, Volkmann TA, Strathdee SA. Cross-border drug injection relationships among injection drug users in Tijuana, Mexico. *Drug and Alcohol Dependence*; 2010.
2. Volkmann T, Shin SS, Garfein, R, Patterson TL, Pollini RA, Wagner KD, Artamanova I, Strathdee SA. Border Crossing to Inject Drugs in Mexico among Injection Drug Users in San Diego, California. *Journal of Immigrant and Minority Health*; 2011.
3. Volkmann T, Lozada R, Anderson CM, Patterson TL, Vera A, Strathdee SA. Factors Associated with Drug-related Harms Related to Policing in Tijuana, Mexico. *Harm Reduction Journal*; 2011.
4. Semple SJ, Strathdee SA, Volkmann T, Zians J, Patterson TL. "High on my own supply": Correlates of drug dealing among heterosexually-identified methamphetamine users. *American Journal on Addictions*; 2011.
5. Patterson TL, Volkmann T, Gallardo M, Goldenberg S, Lozada R, Semple SJ, Strathdee SA. Identifying the HIV Transmission Bridge: which men are having unsafe sex with female sex workers and with their own wives or steady partners? *JAIDS*; 2012.
6. Volkmann T, Fraga MA, Brodine SK, Iñiguez-Stevens E, Cepeda A, Elder JP, Garfein RS; for the VIIDAI team. Drug scene familiarity and exposure to gang

violence among residents in a small community in Baja California, Mexico. *Global Public Health*; 2012.

7. Wagner KD, Moynihan MJ, Strathdee SA, Cuevas-Mota J, Clark M, Zuniga, ML, Volkmann TA, Teshale E, Garfein RS. The Social and Environmental Context of Cross-border Drug Use in Mexico: Findings from a Mixed Methods Study of Young IDUs Living in San Diego, CA. *Journal of Ethnicity in Substance Abuse* (accepted in press).

### **Submitted & Under Review**

1. Volkmann T, Wagner KD, Semple SJ, Strathdee SA, Goldenberg S, Patterson TL. Measuring Unprotected Sex: A Case Study of Two Analytical Approaches among Male Clients of Female Sex Workers. *The Journal of Sex Research* (submitted).
2. Volkmann T, Wagner KD, Strathdee SA, Semple SJ, Ompad DC, Chavarin C, Patterson TL. Correlates of Self-efficacy for Condom Use among Male Clients of Female Sex Workers. *Archives of Sexual Behavior* (submitted).

### **FIELDS OF STUDY**

Major Fields: Public Health (Epidemiology and Global Health)

Studies in drug abuse and sexually transmitted infections including HIV  
Professor Steffanie A. Strathdee  
Professor Thomas L. Patterson

## **ABSTRACT OF THE DISSERTATION**

HIV-related sexual behaviors, drugs, and violence among high risk populations in  
Baja California, Mexico

by

Tyson Alexander Volkmann

Doctor of Philosophy  
in Public Health (Global Health)

University of California, San Diego, 2012

San Diego State University, 2012

Professor Steffanie A. Strathdee, Chair

**Background:** In Baja California, Mexico, high risk populations of male clients of female sex workers (FSWs) are at risk for acquiring HIV and experiencing harms related to substance use, while residents of rural communities are susceptible to the harms of drug-related gang violence.

Nevertheless, factors related to HIV-related risk behavior, drug use, and gang violence remain under-studied in these vulnerable populations.

**Aims:** The aims of this dissertation were: (1) to examine two methods of measuring unprotected sex among male clients of female sex workers in Tijuana, Mexico; (2) to examine the correlates of self-efficacy for condom use among male clients of female sex workers in Tijuana, Mexico; and (3) to examine the association between drug-scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico.

**Methods:** In Chapter 2, 394 male clients of FSWs in Tijuana, Mexico were interviewed, and the results of measuring unprotected sex using dichotomous and count dependent variable approaches were compared. Chapter 3 examined quantitative survey data from Tijuana to identify socio-cognitive factors associated with self efficacy for condom use among 393 male clients. In Chapter 4, 169 residents in a small, rural community in Baja California completed surveys collecting information on drugs and gang violence.

**Results:** In Chapter 2, the results of modeling the two analytic approaches measuring unprotected sex among male clients of FSWs showed that each approach identified several unique correlates that were not identified by the other. Chapter 3 identified psychosocial and psychosexual factors that may influence self-efficacy for condom use among male clients of FSWs. Chapter 4 found that exposure to gang violence was common and was associated with drug scene familiarity, suggesting a close relationship between drugs and gang

violence in this community.

**Conclusions:** Results from these preliminary analyses have important implications for the development of interventions to increase self-efficacy for condom use in order to influence safer sex among male clients of FSWs in Tijuana, and for interventions to prevent drug- and violence-related harms in rural communities in Baja California.

## CHAPTER 1: INTRODUCTION

Globally, risky behaviors such as unprotected sex, drug use, and violence are associated with a variety of adverse health outcomes, including transmission of human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs), transmission of viral hepatitis, and drug- and violence-related morbidity and mortality. As are other regions globally, Baja California, Mexico is home to many populations at high risk for transmission of HIV/STIs and drug-related violence. These populations include female sex workers (FSWs), their clients, injection drug users (IDUs), and migrants. Among these high risk groups, the sexual risk behaviors of male clients of FSWs that may contribute to the HIV epidemic in Baja California remain largely unstudied, as does the prevalence of drug use and violence in rural communities in this region. Given the potential impact of the sexual behaviors of male clients of FSWs on HIV prevalence, and the risk for harms from drug use and increased morbidity and mortality due to violence in Baja, California, the specific aims of this dissertation study are:

1. To examine the results of two methods of measuring unprotected sex among male clients of FSWs in Tijuana, Mexico (Chapter 2);
2. To examine the correlates of self-efficacy for condom use among male clients of FSWs in Tijuana, Mexico (Chapter 3); and
3. To examine the association between drug-scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico (Chapter 4).



## OVERVIEW

This dissertation consists of five chapters, including the Introduction (Chapter 1) and the Discussion (Chapter 5). The remaining three chapters are composed of manuscripts from original research based on the three aims of the dissertation study. The first manuscript (Chapter 2), “Measuring Unprotected Sex: A Case Study of Two Analytic Approaches among Male Clients of Female Sex Workers,” uses data from a cross-sectional study of 400 male clients of FSWs in Tijuana, Mexico to examine the results of two approaches to measuring unprotected sex and makes recommendations about when each approach is useful for researchers. The second manuscript (Chapter 3), “Correlates of Self-efficacy for Condom Use among Male Clients of Female Sex Workers,” uses data from the baseline visit of a safer sex intervention study among 400 male clients of FSWs in Tijuana, to examine factors associated with self efficacy for condom use, using constructs from Social Cognitive Theory and other behavioral theories as a guiding framework. The third manuscript (Chapter 4), “Drug scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico,” uses original primary data, collected in a rural region of Baja California located outside the US-Mexico border region, to examine the prevalence of and familiarity with the drug scene, and the prevalence of and exposure to gang violence, and the association between these two factors in a rural sample in a small agricultural community in Baja California.

The differences and similarities between the populations and studies are noted in Chapters 1 & 5 of the dissertation. One of the similarities between the

population of male clients of FSWs in Tijuana and the rural residents of Baja California is their current geographic exposure to the drug trafficking corridor on the Pacific Coast of Mexico, which is discussed in detail. Another similarity that draws together the chapters of this dissertation is the association between drug use and unsafe sex among male clients of FSWs in Tijuana, which is relevant to Chapters 2 & 3. In Chapter 5, the findings from Chapters 2, 3, and 4 are synthesized to produce generalized results that apply to male clients with low self-efficacy for condom use who also use drugs (Chapters 2 & 3), and to male clients of FSWs in Tijuana and residents of the San Quintín Valley (Chapters 2, 3 & 4), who may face similar public health challenges due to a high availability of drugs in Baja California. The implications of these results are discussed and are subsequently applied to inform both targeted and generalized intervention development for the populations studied in this dissertation.

## **BACKGROUND AND SIGNIFICANCE**

### **Sex work, utilization of FSWs by male clients, and HIV/STI Transmission**

Transactional sex is common worldwide. A 2006 global review of household surveys from 78 countries found that an average of 9-10% of adult males paid a woman for sex within the previous year [1], though this proportion contains some variability by region [2]. Men who pay for sex may report more sexual risk behaviors and have an elevated prevalence of HIV/STIs compared to those who do not. In a cross-sectional study across three cities, men who paid for sex were more likely to report sex with men and women (versus sex with

women only), and report more lifetime female sex partners and male anal sex partners [3]. A follow-up study of 6000 participants from Britain found that men who paid for sex were more likely to report sexual relations with 10 or more partners in the five years prior to interview, have a history of an STI, and were less likely to report having had an HIV test, compared to men who never paid for sex [4].

FSWs have been researched and targeted for interventions more often than their male clients [5]. Literature has traditionally focused on the role of FSWs in expanding epidemics, but the role of male clients in the proliferation of HIV is often overlooked [6-7]. However, male clients' risky behaviors before, during, and after transactional sex may play an even greater role in transmission of HIV/STIs than FSWs' behaviors [8]. This is due to their position in networks as a 'bridge' between one core group and another, whereupon high-risk 'bridgers' potentially transmit HIV and STIs between higher risk FSWs and the lower risk general public [9-13]. Male clients of FSWs are important drivers of the HIV epidemic in some regions, especially when the HIV prevalence in FSWs is considerably higher than in the non-FSW adult population [14-17]. In a study of 404 male clients of FSWs by Lowndes et al. in Benin, 8.4% of clients were infected with HIV – a prevalence several times higher than that in the adult population [17]. Lowndes et al. concluded that male clients, who often report multiple sexual partners, represented a bridge between FSWs and the general population of women, especially to male clients' significant others [17].

Sexual risk behaviors may contribute to HIV/STI transmission in male clients of FSWs. In addition to unprotected sex with FSWs, other risky behaviors reported by male clients include sex with a male partner [18]. A cross-sectional study from London found that among men who reported sex with FSWs, 36% also reported sex with men [7]. In an Australian study of men attending a sexual health clinic, male clients of FSWs reported more sexual partners and more past STIs than non-clients [19]. These behaviors may represent sources of HIV transmission risk between high risk groups of clients, FSWs and the lower risk community.

Nevertheless, the act of unprotected sex remains the most common route of transmission of HIV and other STIs among male client and FSWs [13]. Therefore, measures of unprotected sex are useful tools for detection of potential HIV transmission and for assessing the efficacy of HIV prevention interventions among male clients and FSWs. Many studies examine unprotected sex as a dichotomous dependent measure (e.g., reporting any unprotected sex versus reporting no unprotected sex during a specified time frame) [20], while other studies use a count dependent variable measuring the total number of unprotected sex acts over a period of time [21]. An important difference between dichotomous dependent variables and count dependent variables is that the former can examine differences in those who report *some* unprotected sex versus those report *none*; meanwhile count variables can compare those who report a higher rate of unprotected sex to those who report a lower rate. Given these analytical differences, each approach may identify unique correlates of

unprotected sex. The first aim of this dissertation was to examine differences in the correlates identified using either a dichotomous outcome variable or a count outcome variable measuring unprotected sex among male clients of FSWs (Aim 1).

An extensive literature search found no papers that have compared the results of a logistic regression approach to any other approach (e.g., linear regression, negative binomial regression) using two differently constructed dependent variables. Several studies have examined the differences between logistic and linear regression approaches using identical dependent variables [22-24]. In all cases, these papers did not compare the correlates of each regression approach. Instead, using an identical dependent variable for both analyses, they compared the accuracy of each approach to estimate the observed and predicted values in the data. Although both approaches used in Aim 1 use the maximum likelihood ratio to estimate parameters, the results of two different approaches cannot be directly compared since each approach uses different regression coefficient metrics for the given dependent variable [25-26].

According to the lack of similar studies in the published literature, the analysis in Aim 1 is unique. While this large gap in the literature surrounding this type of comparison of results of analytic approaches may provide useful information about analytic approaches examining unprotected sex, the lack of literature renders hypothesis generation difficult. Rather than being derived from the literature, the hypothesis for Aim 1, that differences in the results of the two analytic approaches will be observed, is derived from the fact that dichotomous

dependent variables can be used to compare “higher risk” versus “lower risk” groups, while count dependent variables reveal which factors are associated with a relatively higher rate of exposure to unprotected sex [27]. Given the difference in the type of research questions each approach is best suited to answer and the differences in variable construction, a logical conclusion is that each approach might identify a different set of correlates, given the same data set.

The results and interpretations from a comparison of these two dependent variables measuring unprotected sex are useful in various situations. For example, dichotomous measures can be used to compare individuals who consistently use condoms from those who do not. This information could be useful in examining condom use as a tendency or habit, permitting the comparison of groups that may have very different levels of risk groups [27]. This approach is more commonly used than the count approach than in studies examining the correlates of condom use [28]. On the other hand, if the primary concern of the research is the number of exposures to unprotected sex rather than the differences between those who do and do not use condoms, researchers may find it preferable to use a count dependent variable, as it may be the best indicator of the actual degree of exposure to sexual risk [29]. Many safer sex interventions aim to decrease the total exposure to unprotected sex. Perhaps for this reason, count data are significantly more likely to be used in the analysis of intervention studies than dichotomous data are [27].

Investigating the results of these two approaches to measuring unprotected sex has implications for HIV/STI prevention among male clients of

FSWs in Tijuana. If it is determined that the dichotomous approach identifies a correlate that is not identified by the count approach, this finding could inform policies that aim to increase condom use within this higher risk subgroup. For example, if certain policing behaviors, such as the arrest of FSWs, were found to be associated with unprotected sex among male clients and FSWs, decreasing arrests of FSWs could possibly be implemented to increase condom use. On the other hand, correlates identified through the count approach may be useful in designing safer sex interventions. For instance, if it is found that drug use is associated with the number of unprotected sex acts, then the efficacy of safer sex interventions may be improved by including a component that is directed towards substance use treatment.

### **Factors associated with unprotected sex in male clients of FSWs**

Global literature shows that factors associated with sexual risk behaviors (such as unprotected sex among male clients of FSWs) include drug and alcohol use [30] and psychosocial and psychosexual characteristics [19]. Substance use during sex commonly occurs among male clients and FSWs [30-31]. Several studies, including a literature review have found that substance use in male clients of FSWs is associated with unprotected sex and HIV/STI transmission worldwide [32-34]. Client and FSW drug-using behaviors, such as injection drug use, are also associated with unprotected sex [35] and HIV/STI transmission [36]. A retrospective study of the behavioral characteristics of Thai men who visited FSWs concluded that drug use was associated with lifetime sex with FSWs [34]. A cross-sectional study of 300 truckers in Brazil found that 21%

reported sex with commercial sex workers, and that use of a stimulant was associated with a positive serologic test for syphilis [37]. A qualitative study of truckers in Brazil found that the use of alcohol and amphetamine were common and appeared to influence unsafe sex practices with FSWs [38].

With regard to alcohol use, a study of migrant workers in Thailand found that men were more likely to use alcohol during sex when they were unfamiliar with the FSWs whom they were paying for sex [39]. Several studies report that clients used alcohol during transactional sex as a way to detach from emotion [40], and as a suppressor of shame [41]. Other studies found that clients in the Philippines were frequently intoxicated during sex [42] and that alcohol use was associated with frequent sex with FSWs in Thai male clients [43].

Psychosexual characteristics, such as misogyny [44], sexual compulsivity [21, 44], social-sexual effectiveness [45], sexual sensation seeking [46], and negative attitudes toward condoms and FSWs [47] have been found to be associated with unprotected sex in male clients of FSWs in past research (see Chapter 3 for descriptions of these characteristics). Psychosocial characteristics such as lack of social support may also be associated with unprotected sex [48]. These characteristics may be important direct or indirect predictors of HIV transmission. They may also be useful in the development of HIV prevention interventions because they represent cognitive mechanisms that can influence sexual risk behaviors. Identification of those who engage in sexual risk behaviors could lead to the development of targeted interventions for specific groups or



individuals who may disproportionately contribute to the transmission of HIV/STIs.

Self-efficacy can be defined as the perceived ability of an individual to perform a behavior [49]. Thus, self-efficacy for condom use is an individual's perceived ability to use condoms. Self-efficacy for condom use may represent an important psychosexual factor [50] in understanding condom use in male clients of FSWs. It may directly affect condom use in heterosexual adults, including in male clients of FSWs [21]. When considering HIV prevention, self-efficacy for condom use is believed to be important in enacting condom-using behaviors [51-54] because individuals who are confident in their ability to use condoms are more likely to use them.

Other psychosocial and psychosexual factors may also be directly or indirectly associated with self-efficacy for condom use in male clients of FSWs. One of these factors is sexual sensation seeking, which is a personality trait characterized by the continued pursuit of novel sexual experiences [55]. Sexual sensation seeking may predict HIV transmission risk due to the fact that high sexual sensation seekers may maintain high risk sexual behaviors despite the threat of HIV possible infection [56]. The study of many psychosocial and psychosexual factors such as sexual sensation seeking has been largely ignored within the context of behavioral change theories that could be applied to safer sex interventions [57-58].

Many health behavioral theories consider self-efficacy for condom use an important concept in understanding safer sex behaviors. Therefore, identifying

factors associated with self-efficacy for condom use may be prerequisite to increasing self-efficacy for condom use, and ultimately, increasing condom use [53, 59]. The second aim of this dissertation was to examine factors associated with self-efficacy for condom use in a sample of 400 male clients of FSWs (Aim 2).

### **The prevalence of drugs and violence and their possible association**

Drug availability and associated risky drug-using behaviors, can contribute to a community's potential adverse health outcomes, such as interpersonal violence and harms related to drug dependence, including HIV infection [60]. For example, when risky behaviours such as unsafe sex and sharing of injection equipment increase as a consequence of greater access to drugs in communities, infectious diseases transmission associated with high risk sex and substance abuse, including HIV, STIs and viral hepatitis, often follow.

Violence is associated with drug availability, drug use, and drug trafficking in literature from a number of regions globally. For example, Clarke found "gangs, guns, and ganja" linked in Jamaica, and that the increase in the cocaine trade by drug gangs in Jamaica during the 1980s and 1990s was connected to gang violence [61]. In South Africa, urban communities and schools are subject to an interrelated trio of afflictions consisting of violence, gangs, and drugs [62]. Likewise, elevated levels of violence in communities in the vicinity of Cali, Colombia during the 1980s were coupled with a high concentration of drugs and gangs [63]. The drug market for methamphetamine in Japan is partially controlled by the Yakuza gang, which uses selective violence to maintain its

dominance over the market [64]. In all of these examples, when both violence and drugs are present in a community, they may self-perpetuate to the extent that negative public health outcomes, such as violence-related morbidity and mortality and HIV, emerge at epidemic levels [65-67].

Researchers have examined the association between drugs and gang violence in many countries. In Brazil and other Latin American countries, for example, Rodgers found that gangs involved in drug trafficking tended toward more violent behavior than gangs that were not involved with drugs [68]. Corroborating the evidence from Brazil, Zaluar asserts that the increased rates of violent crime and murder in Brazilian cities cannot be understood without considering the link to drug trafficking by cartels [69]. A 2008 article comparing youth gangs in Germany, Russia, and Brazil noted that disadvantaged neighborhoods in Russia under the control of drug factions faced high rates of protracted violence [70]. Violence may be used by gangs to control drug distribution and markets [71]. Because gang violence and drugs are often intertwined [72], individuals in communities where gangs and high availability of drugs are present may be adversely affected by both gang member violence and high community drug availability.

According to the UN Office of Drugs and Crime, there has been a shift in drug trafficking corridors from the Caribbean corridors to the Mexico-Central America Corridor, through which US demand for drugs is now primarily supplied [73]. Throughout Mexico, drug cartels control the majority of the illegal drug trade in the country. Current drug trafficking routes in western Mexico, including

those in Baja California, have been identified as areas where an elevated risk of drug-related violence exists compared to other areas, due to cartels and street-level gangs [74]. Violence initiated by drug gangs increased drastically in Tijuana and other parts of Baja, California, beginning in 2006 [75], where more than 500 people were killed during three months of drug- and gang-related violence in 2008 [76]. Once limited to the border region, cartel- and street-level gang violence and related drug supply surpluses now affect non-border areas along the coastal drug corridor in Baja California [77]. In addition to the harms resulting from increased drug use, there is a risk in rural areas for drug- and gang-related morbidity and mortality due to violence perpetrated by cartels or street-level gangs in Baja California.

To date, the majority of the research examining the association between drugs and violence has focused on drug gangs operating in urban areas, or smaller street gangs operating at the local level [62, 69]. The literature has largely ignored rural communities, despite evidence that drug activity and violence can spread to rural areas [77]. In order to characterize possible drug use and gang violence in a rural setting, the third aim of this dissertation is to examine the association between drug-scene familiarity and exposure to gang violence among residents in a rural farming community in southern Baja California (Aim 3).

## **THEORETICAL AND CONCEPTUAL FRAMEWORKS**

## **Social Cognitive Theory and related theories**

In the second aim of this dissertation, constructs of health behavioral theories, including Social Cognitive Theory (SCT), are applied to the examination of HIV prevention and to the possible formation of safer sex interventions among male clients of FSWs in Tijuana. SCT posits that individual behavioral change comes from social interactions and experiences and that an individual's knowledge acquisition can be directly related to observing others within the context of social interactions [78]. SCT aims to impart social and self-regulatory skills to individuals so that they can practice safer behaviors [54]. SCT has been applied to health domains, including HIV prevention.

Of the constructs of SCT, perhaps one of the most important is self-efficacy [49]. Self-efficacy, as defined previously, can be understood as the perceived ability of an individual to perform a behavior [49]. Self-efficacy for condom use is one application of self-efficacy [79]. SCT hypothesizes that without self-efficacy, safer sex behaviors (e.g., condom use) are very difficult to practice, even if individuals possesses relevant knowledge and skills [54]. Understanding self-efficacy for condom use is therefore prerequisite to increasing condom use [53, 59].

Outcome expectancies, which are a person's assessments that given behaviors will lead to certain results [78], are causally related to self-efficacy [79], and may directly influence it [80]. Other constructs thought to influence behavior indirectly via self-efficacy are knowledge, skills for self-regulation and risk reduction, and social support [81]. Social support has been theoretically

incorporated into SCT and other models in an effort to change condom using behaviors [80, 82]. It is believed that successful behavioral interventions using SCT must include all the components that influence self-efficacy, including knowledge and social support [54]. Increasing self-efficacy for condom use could be important in decreasing transmission of HIV/STIs among male clients of FSWs in Tijuana. The second aim of this dissertation examines self-efficacy for condom use using constructs that are central to SCT and other health behavioral theories.

Figure 1.1 displays the theoretical framework used for the study which makes up Chapter 3 of this dissertation. This framework is informed by constructs from SCT and other health behavioral theories and is adapted from a theoretical conceptualization of SCT developed by Fisher & Fisher [54], who note that the relationships between constructs of SCT are left unspecified by Bandura. Some of the associations between constructs, however, have been empirically tested in the literature, and these associations are represented in the current theoretical framework. With regard to health behavioral models in instituting changes in HIV risk behaviors, it should be noted that other health behavioral models, such as the Health Belief Model, the AIDS Risk Reduction Model, The Transtheoretical Model, and the Theory of Planned Behavior also theorize that self-efficacy and other constructs from this theoretical framework are important in HIV risk behavioral change [54]. Therefore, although the guiding theoretical framework of Chapter 3 relies heavily on a conceptualization of SCT, the application of the results within theory-based interventions can be expanded to

include alternative theories with similar constructs, among other constructs.

These interventions will be discussed in Chapter 5.

As specified in the figure, the top three blue boxes on the left side are considered indispensable constructs of socio-cognitive interventions affecting HIV risk behavior, as they are known to influence self-efficacy for condom use [54] and condom use. These constructs are included in the framework to represent possible constructs that could be used in the development of safer sex interventions for male clients of FSWs in Tijuana [54]. They include a knowledge component, self-regulatory- and risk-reduction skill-building and maintenance, and social support. Of these constructs, only social support was hypothesized as a possible correlate of self-efficacy for condom use. Measures of self-regulatory and risk-reduction skill-building and maintenance were not collected. HIV knowledge was examined as a possible correlate, but no hypothesis was made concerning the association between HIV knowledge and self-efficacy for condom use. This is because the HIV knowledge scale used in this study contained only two questions out of a total of 19 concerning the usage of condoms and safer sex practices [83]. Since the knowledge and skill building components shown in the framework were not hypothesized to be associated with self-efficacy for condom use in Chapter 3, the lines showing these associations in Figure 1.1 are shown as solid arrows. The association between condom use self-efficacy and safer sex was not tested in this analysis, and this relationship is also indicated by a solid arrow.

The three bottom boxes on the left include social support, outcome expectancies, and sexual sensation seeking. Social support is included in the framework both as a hypothesized correlate of self-efficacy for condom use and as a necessary construct of safer sex interventions. With respect to its placement as a construct as a tool for intervention, if it is shown that social support is a correlate of self-efficacy for condom use, it may indicate that social support would be a useful construct to include in safer sex interventions for male clients of FSWs in Tijuana. Outcome expectancies and sexual sensation seeking are other factors that are hypothesized to be associated with self-efficacy for condom use and are tested in Chapter 3 (see Chapter 3 for more detail). The hypothesized associations are shown as dashed lines. Only direct relationships between self-efficacy for condom use and other constructs of the theoretical framework are specified, though indirect associations may also exist.

### **Concept of “exposure opportunities”**

Although it does not guide the hypotheses, the concept of “exposure opportunities” is used in Chapter 4 of this dissertation to illustrate how drug use initiation can proceed in communities. Exposure opportunities can be defined as an occasion when an individual is introduced to a ‘harder’ drug, (e.g., cocaine), when they have previously used only ‘softer drugs’ (e.g., tobacco, alcohol, marijuana). This concept arose from the lack of a clear mechanistic explanation for the “stepping stone” or “gateway” theory, which came to prominence during the 1980s and 1990s. Briefly, gateway theory hypothesizes that the use of softer



drugs could lead individuals to the future use of harder drugs (for more, see Kandel, et al.) [84].

The exposure opportunities concept was developed by Wagner and Anthony and informed by previous work by Frost, an infectious disease epidemiologist [85]. The concept hypothesizes that someone who uses alcohol may be more likely to be offered cocaine via an “exposure opportunity” within a peer-based setting [86]. Subsequently, someone who has been exposed to the opportunity to try cocaine may be more likely to try it. The findings by Wagner & Anthony showed that the association between use of a softer drug followed by use of a harder drug was not necessarily a result of users actively seeking out drug using opportunities [86]. Instead, the more community exposure opportunities to use hard drugs or to the black market could explain more drug use initiation by individuals in the community [87]. Contrary to the concept of exposure opportunities, which suggests that drug initiation occurs due to the availability of drugs during social interactions, it has been argued in the literature that individual-level factors are also likely responsible for initiation of hard drugs (e.g., heroin, cocaine). For example, curiosity and genetic predisposition may also factor into the decision to use a hard drug for the first time [88]. Therefore, it is likely that a constellation of factors, including environmental factors such as drug availability through the black market, social factors, and individual factors, contribute to initiation of hard drugs [89].

The study in Chapter 4 is very preliminary; due to safety and sensitivity issues, direct questions involving personal drug use could not be asked.

Moreover, the study was cross-sectional, so drug use initiation could not be examined. Therefore, the concept of exposure opportunities does not guide the hypothesis for Aim 3. Instead, the concept is introduced to illustrate that the prevalence of hard drug use could possibly increase in communities in rural population in Baja California whose individuals have previously taken only soft drugs and are newly exposed to harder drugs. For example, if cocaine was never available in Lomas de San Ramón, but its prevalence is increased due to drug trafficking in the area, the exposure opportunities for initiation of cocaine could lead to epidemic drug use. Recent research has shown that Mexican migrating populations may face an increasing prevalence of drug use, and this drug use may be due to exposure opportunities [90].

### **The Drugs-Violence Nexus Theory**

Similar to the concept of exposure opportunities, the Drugs-Violence Nexus Theory does not guide the hypothesis in Chapter 4 of this dissertation. Instead it is introduced to illustrate the possible connection to between drugs and gang violence in communities. The Drugs-Violence Nexus Theory was first developed by Goldstein, et al., who used it to classify types of violence and their possible causal association with illegal drug use within communities [91]. Valdez, et al. further developed this theoretical paradigm to clarify the causal connections between drugs and outcomes of violence among adolescent street gang members of Mexican-American descent in south Texas. Findings from this study revealed that drug use was associated with violence among gang members [92]. The scope of this study very narrowly examined the direct

relationship between drug use and interpersonal violence, but did not examine other possible effects, such as community drug availability and violence; or whether those who do not use drugs but live in a community where drug use is common may be more likely to be the victim of violence; or whether those who engage in the drug market but who do not use drugs may still be exposed to violence. These scenarios could be logical extensions of this theory but have not been tested. The association found by Valdez, et al. has also been observed in a population of non-gang-member, inner-city high school students in four US cities, where it was found that high amounts of hard drug use was associated with frequency of violence [93]. Chapter 4 of the current dissertation introduces the Drugs-Violence Nexus Theory to illustrate how the presence of drugs and drug use in a community might be associated with community exposure to gang violence.

## **STUDY SETTING**

The research for this dissertation study took place entirely in the state of Baja California Norte, Mexico, which, along with Baja California Sur, makes up the entire Baja California peninsula in Mexico. Baja California Norte is the most northwestern of Mexico's 32 states. It is generally a rural state, with over half its three million residents living in the area including and surrounding Tijuana. The climate and geography permit abundant agriculture, which draw many migrants from other parts of Mexico, especially southern Mexico, and Central America.

In addition to serving as a route for migrants traveling to and from the United States, Baja California Norte serves as one of the narco-trafficking routes through Mexico to the United States [94]. Since the 1990s, Mexican cartels have become increasingly involved in the trafficking of cocaine, methamphetamine, heroin and marijuana on these prescribed drug-running routes through Mexico into the United States [95]. Aside from a resulting increase in drug availability in Mexico, a further acute result of this lucrative and illicit activity has been the increased power of and competition amongst Mexican cartels, leading to the Mexican Drug War, which has claimed the lives of over 50,000 Mexican citizens since 2007 [96]. Lying on the Pacific coastal drug route, Tijuana had been a major center of violence until 2010, when the Tijuana cartel began losing power [76]. Drug surpluses and gang violence at the cartel level and the street level have recently begun to spread to rural areas of Baja California [77]. This reality could cause adverse public health implications for rural communities, as adverse outcomes may accompany the spillover from Tijuana. The manifestations of drug use and violence in the rural communities may begin to more closely reflect those that had primarily affected larger cities up until now.

Due to factors such as economic disparity, migration, poverty, and the drug trade and its resulting violence, Baja California is home to many types of high risk populations, including highly mobile migrants, IDUs, FSWs and their clients, and gang members. The presence of these diverse high risk populations permits the examination of multiple high risk behaviors that could be associated with public health harms such as interpersonal violence and HIV/STI

transmission. The first and second aims of this dissertation examine samples of a high risk population of male clients of FSWs in Tijuana. The third aim examines a group of primarily migrant, indigenous farmers in a small agricultural community that lies south of the border region in rural Baja California.

### **Tijuana**

Tijuana, Mexico is a border city adjacent to San Diego, California, and is home to the busiest land border crossing between Mexico and the United States [97]. The active border between the two large cities facilitates much international mobility. Economic disparity between the two countries creates a haven for the exchange of both legal and illegal goods and services. Multiple factors, including the high levels of trade, mobility, and transfer of illegal goods and services, contribute to a unique setting from a public health perspective, where risk for transmission of HIV/STI is elevated compared to other urban areas in Mexico.

HIV/STI risk in Tijuana is characterized by the use of substances such as cocaine, heroin, and methamphetamine [98]. Compared to other parts of Mexico, illicit drug use [99] and injection drug use [100] are elevated in Tijuana, where an estimated 10,000 IDUs are thought to reside [101]. One reason that drugs and drug use are so prevalent at the Tijuana-San Diego border is that this area is situated on one of the primary drug smuggling routes between Mexico and the United States. This drug trafficking route, which runs from southern Mexico up the Pacific coast of Baja California to Tijuana, supplies much of the large US demand for illicit drugs. Thus, Tijuana serves as a conduit to the United States for large amounts of cocaine, methamphetamine, heroin, and marijuana,

each of which is produced in various amounts in Mexico [94-95]. The federal government of Mexico partially decriminalized possession of small amounts of drugs in 2010 [102], but it is yet unknown if the local drug market has been affected in terms of drug availability and drug use.

HIV risk in Tijuana is also characterized by a high demand for sex work, especially in the *Zona Roja*, which is a central area of Tijuana that operates as a zone of tolerance for sex work [103]. The local government regulates sex work by requiring that FSWs register for sex work permits and obtain testing and treatment for STIs [104]. There are an estimated 5,000 to 10,000 FSWs in Tijuana [105-106], who attract male clients from both sides of the border [18]. In a study of 400 male clients in Tijuana, half of whom were from the United States, 50% of the sample reported unprotected sex with a Tijuana FSW [36]. Of these male clients, 46% reported often being high during sex with FSWs in the four months prior to interview, suggesting a high risk for HIV transmission through sexual behaviors, which may be exacerbated by substance use [36]. Methamphetamine, cocaine, and heroin were the most commonly used drugs in this sample of male clients, with 64%, 50%, and 36% lifetime usage, respectively [36].

HIV/STI transmission risk due to drug use and unsafe sex is compounded by a clustering of bars in Tijuana's central district that serve alcohol to potential clients of FSWs [107]. The legal age of alcohol consumption is 18 and, but this regulation is rarely enforced, attracting youth from the United States who cannot legally consume alcohol in their home country until they are 21. Alcohol and drug

use restrict cognitive processes such that intoxicated individuals are unable to simultaneously process multiple pieces of information [108]. These substances also decrease inhibitions in those who use them [109]. Disinhibition can be described as a “lack of restraint manifested through disregard for social conventions, impulsivity, and poor risk assessment.” Disinhibition affects motor, cognitive, and perceptual aspects, affecting decision making. Unprotected sex and other risky behaviors may manifest through disinhibited instinctual drives [110].

Due to high mobility in the border region and the drug use and the high level of sexual risk behaviors in the urban areas surrounding the border, transmission of HIV/STIs is a serious concern for those on either side of the border. HIV prevalence is increasing in Tijuana and was estimated at 0.54% in 2009 among adults aged 15-49 [111-112]. This is in contrast to the countrywide adult HIV prevalence of [113-114]. While migration, deportation, and mobility may contribute to transmission of HIV/STIs, the prevalence of HIV/STIs is highest in high risk groups such as IDUs, FSWs, and their clients, whose transmission likely stems from drug use and sexual risk behaviors [94, 115-116]. In a cross-sectional study of male clients of Tijuana FSWs, HIV prevalence was 4.1% [36] while the prevalence in FSWs was similar, at 6.0% [111]. Given the high prevalence of drug use, sex work, and HIV in Tijuana, studies of high risk groups, including among male clients of FSWs in Tijuana and their risky behaviors, are needed to inform interventions that can curb the growing HIV epidemic in the border region.

### **San Quintín Valley**

The study site for Aim 3 was located in the San Quintín Valley, an agricultural region of Baja California, approximately 200 miles south of Tijuana. This rural location places the study outside of the unofficial US-Mexico border region [117]. A group of small communities surrounds the San Quintín Valley, which is a productive farming zone. The small community of San Ramón was estimated to contain 5000 residents in 2009 [118], the majority of whom were migrants from outside of Baja California [119]. Most of the valley's inhabitants belong to indigenous groups from Mexico [119] and are employed by the fruit and vegetable export industry [120]. Many roads in the community of San Ramón are unpaved, and the low level of development in this community means that dwellings are often not equipped with sufficient plumbing or electricity.

Vast differences are readily apparent between the study sites for this dissertation. For example, Tijuana is a large, urban city composed mainly of non-indigenous Mexicans, while the San Quintín Valley region is a rural region primarily inhabited by indigenous migrants from the state of Oaxaca. The two sites also share some common characteristics: They are both located along one of the busiest drug trafficking routes that run from South America through Mexico to the United States [94], increasing drug availability in both study settings. The main highway in Baja California Norte connects these two populations, serving as a migrant corridor for those who are looking for permanent or temporary work in the United States. The similarities and differences between the study settings



provide the opportunity to examine these populations individually, but also permit the integration of results that may apply generally to both populations.

One of the possible consequences of the drug trafficking that occurs in Baja California Norte is that the prevalence of drug use in this state is higher than in other Mexican states. In 2008, the proportion of the population who reported injecting drugs in Baja California Norte, was 4.8%, compared to 0.2% across Mexico [100]. The prevalence of methamphetamine use is highest in Baja California among Mexico's 32 states [121-122]. The majority of this injection drug use likely takes place in Tijuana, where it is extremely prevalent. But given that migrants in Baja California are highly mobile, and that both study settings lie on the drug trafficking corridor, it is highly likely that drugs and risky drug-using behaviors such as injection drug use could spread to the rural areas to the south of Tijuana. One of the implications for examining drugs, drug-using behaviors, and drug-related violence within different regions along this corridor is that the adverse public health outcomes associated with these factors (e.g., HIV transmission, morbidity from interpersonal violence) can be quantified and interventions developed before the adverse outcomes manifest as epidemics. An examination of drug use at different locations along this continuum could also provide information about which behaviors are occurring where, and why.

The vast majority of studies examining drug use in Baja California have taken place in Tijuana. Literature has recognized the potential for harms from drug use to occur among mobile populations in the US-Mexico border region [112, 123-124], but no literature has examined the potential for drug-related

harms to occur in rural areas outside the border region. Given the ability of migrants in Baja California to move between rural and urban environments, studies that examine drug use and drug-related violence in rural areas of Baja California are warranted. These studies could be useful for informing drug- and gang-prevention activities in rural communities.

## **AIMS AND HYPOTHESES**

Based on the theoretical and conceptual frameworks described above and a review of the relevant literature on HIV-related sexual behaviors, drugs, and violence among high risk populations in Baja California, Mexico, this dissertation has the following aims and corresponding hypotheses:

**Aim 1.** To examine the results two methods of measuring unprotected sex among male clients of FSWs in Tijuana, Mexico.

Hypotheses: Modeling recent unprotected sex with FSWs in Tijuana will identify different correlates of risk than modeling the number of unprotected sex acts among male clients.

**Aim 2.** To examine the correlates of self-efficacy for condom use among male clients of FSWs in Tijuana, Mexico.

Hypotheses: Sexual sensation seeking, social support, and outcome expectancies for negotiation of safer sex will be independently associated with self-efficacy for condom use after controlling for sociodemographic characteristics, drug and alcohol-related variables, and sexual behaviors.

**Aim 3.** To examine the association between drug-scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico.

Hypotheses: Community members who are exposed to gang violence will have more familiarity with the drug scene.

## **OVERVIEW OF RESEARCH METHODS**

The three manuscripts in this dissertation utilize data from three separate studies. The survey and laboratory data for Aim 1 (Chapter 2) originate from a cross-sectional study of male clients of FSWs in Tijuana, Mexico. The survey and laboratory data for Aim 2 (Chapter 3) originate from an HIV prevention intervention study in Tijuana involving male clients of FSWs. Aim 3 (Chapter 4) data originate from a cross-sectional study of community drug use and violence in San Ramón, Baja California Norte, Mexico. Volkmann led data collection for Chapter 4, participated in data collection for Chapter 3, and led data analysis for chapters 2, 3, and 4. The research methods included below are abbreviated. Methodological details for each study are included in their relevant chapters. For each of the three studies, pre-approval was obtained from institutional review boards at UCSD and in Mexico prior to the onset of data collection.

### **CHAPTER 2: Two Analytic Approaches to Measuring Unprotected Sex**

In sex research, two commonly used approaches for examining dependent variables measuring unprotected sex are 1) to analyze a dichotomous indicator of any versus no unprotected sex acts during a specified time; and 2) to

analyze the continuous number of unprotected sex acts during a specified time. These two approaches were explored using a dataset of male clients of FSWs in Tijuana, Mexico. It was hypothesized that modeling a dichotomous variable comparing male clients of FSWs who reported unprotected sex with FSWs to those who did not would identify different correlates than modeling a count dependent variable measuring the number of unprotected sex acts.

Data collection: Data were collected as part of the *Sexo Seguro* study (PI: Patterson; R01 DA23877), in which 394 male clients of FSWs underwent a cross-sectional interviewer-administered questionnaire on sexual behaviors and HIV/STI testing Between June and October 2008. Men eligible to participate were aged at least 18 years, lived in Tijuana or San Diego, had paid or traded (e.g., personal property or drugs) for sex with a FSW in Tijuana during the four months prior to enrollment, and agreed to be treated for Chlamydia, gonorrhea, and syphilis if they tested positive. The questionnaire was administered by bilingual interviewers in private offices in central Tijuana.

Data analysis: Using an identical data set and variables, the results of modeling unprotected sex using two approaches were considered. The dichotomous approach used logistic regression to identify factors independently associated with reporting any unprotected sex with FSWs in Tijuana. The count approach used log-link negative binomial regression to identify factors independently associated with the number of unprotected sex acts with Tijuana FSWs. Final multivariate models were compared.

### **CHAPTER 3: Correlates of Self-efficacy for Condom Use**

A high proportion of male clients of FSWs in Tijuana engage in unprotected sex with FSWs [18, 21]. While behavioral change theories posit that self-efficacy predicts condom use, correlates of self-efficacy for condom use remain largely unstudied. These correlates were examined among male clients of FSWs in Tijuana.

Data collection: As part of an intervention aiming to increase condom use among male clients of FSWs in Tijuana, data for this analysis originated from the baseline visit of the *Hombre Seguro* study (PI: Patterson; R01 DA029008). Between September 2010 and March 2012, 393 male clients of FSWs, half of whom lived in San Diego and half of whom lived in Tijuana by design, were recruited in Tijuana. Eligible men were biologically male, aged at least 18 years, lived in Tijuana or San Diego, reported unprotected sex with a FSW from Tijuana at least once in the four months prior to enrollment, and agreed to be treated for Chlamydia, gonorrhea, and syphilis if they tested positive. Participants underwent a computer-assisted interviewer-administered baseline questionnaire that included demographics, drug and alcohol-related variables, psychosocial and psychosexual characteristics, sexual behaviors (see Methods section of Chapter 3 for more information on these measures).

Data analysis: The dependent variable, self-efficacy for condom use was measured using a five-item scale from the EDGE study [125]. Stepwise hierarchical regression was performed to identify factors associated with self-efficacy for condom use among male clients of FSWs. Blocks of variables were entered into a multivariate model in the following steps: sociodemographic

characteristics (step 1), drug and alcohol-related variables (step 2), sexual behaviors (step 3), and psychosocial and psychosexual characteristics (step 4).

#### **CHAPTER 4: Drug Scene Familiarity and Exposure to Gang Violence**

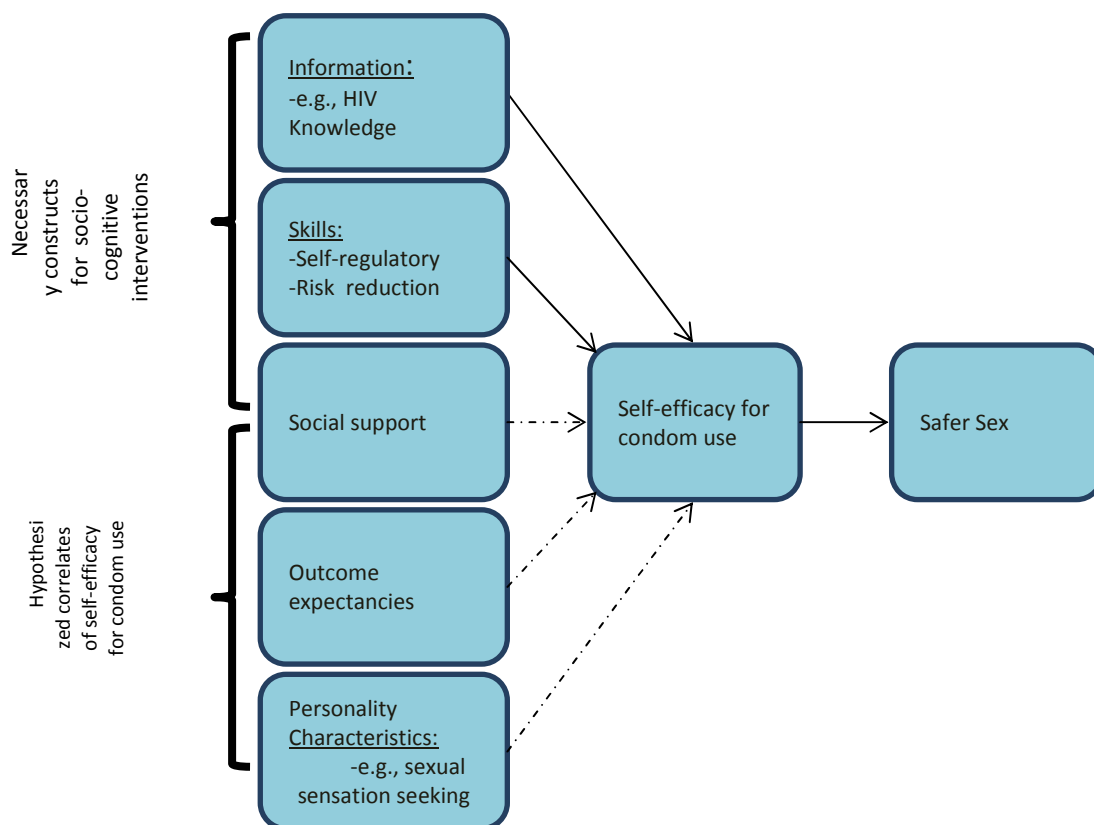
Little is known about the prevalence of drug use, drug scene familiarity, and exposure to gang violence in rural communities in Baja California outside the US-Mexico border region. Drug scene familiarity and exposure to gang violence was examined among residents of a migrant, farming community in rural Baja California.

Data collection: In October 2010, 169 members of a single *colonia* (community) of about 5000 total members underwent an interviewer-administered survey to assess “exposure to gang violence” and “drug scene familiarity”, as well as other health indicators. This cross-sectional study was conducted over a two-day period in October 2010 among residents of a predominately migrant farm worker community in the San-Quintín Valley, Baja California. Study participants were recruited in two ways: (1) all eligible clinic patients were invited to participate after registering for a primary healthcare clinical appointment; and (2) residents of randomly selected households were invited to participate at their homes. For this second strategy, teams of trained interviewers administered surveys within the community, using a map made from a 2008 aerial photograph of the community (see Figure 1.2 for a copy of this map). Teams were randomly assigned to blocks until every block in the community had been sampled. Eligibility criteria included: community residents age 13 years or older, ability to speak English or Spanish, willing and able to

undergo a 30-minute interview, and the ability and willingness to provide informed consent. Participants completed an interviewer-administered questionnaire that included questions about substance use and gangs in their community.

Data analysis: To produce the independent variable “drug scene familiarity”, a summary variable was created composed of the questions “Do you know of a person or of a place in your community where you can get drugs if you wanted them?” and “Do any of your friends use illegal drugs?” The question “Have you or anyone you know ever been hurt by someone in a gang?” was used to measure exposure to gang violence and served as the dependent variable in this analysis. Multiple logistic regression was used to identify correlates of exposure to gang violence.

## FIGURES



**Figure 1.1. Theoretical framework incorporating constructs of Social Cognitive Theory, as applied in Chapter 3**





Figure 1.2. Aerial photograph of *Colonia San Ramón*

## REFERENCES

1. Carael, M., E. Slaymaker, R Lyerla, and S. Sarkar, *Clients of sex workers in different regions of the world: hard to count*. Sex Transm Infect, 2006. **82**: p. iii26-iii33.
2. Ompad, D., D. Bell, S. Amesty, E. Lazcano-Ponce, L. Villa, and A. Giuliano, *U.S. men who purchase sex, who are they?*, in *139th Annual Meeting of the American Public Health Association*. 2011: Washington, DC.
3. Ompad, D., A. Nyitray, D. Bell, S. Amesty, E. Lazcano-Ponce, L. Villa, and A. Giuliano, *Correlates of purchasing sex among men in three cities: An interurban analysis.*, in *10th International Conference on Urban Health*. 2011: Belo Horizonte, Brazil.
4. Ward, H., C. Mercer, and K. Wellings, *Who pays for sex? An analysis of the increasing prevalence of female commercial sex contacts among men in Britain*. Sex Transm Infect 2005. **81**(6): p. 467-471.
5. Foss, A., M. Hossain, P. Vickerman, and C. Watts, *A systematic review of published evidence on intervention impact on condom use in sub-Saharan Africa and Asia*. Sex Transm Infect 2007. **83**(7): p. 510-516.
6. Alary, M. and C. Lowndes, *The central role of clients of female sex workers in the dynamics of heterosexual HIV transmission in sub-Saharan Africa*. AIDS, 2004. **18**: p. 945-947.
7. Day, S., H. Ward, and L. Perrotta, *Prostitution and risk of HIV: male partners of female prostitutes*. BMJ, 1993. **307**(6900): p. 359-361.
8. Côté, A., F. Sobela, A. Dzokoto, K. Nzambi, C. Asamoah-Adu, A. Labbé, B. Mâsse, J. Mensah, E. Frost, and J. Pépin, *Transactional sex is the driving force in the dynamics of HIV in Accra, Ghana*. AIDS, 2004. **18**(6): p. 945-947.
9. Lowndes, C., A. Renton, M. Alary, T. Rhodes, G. Garnett, and G. Stimson, *Conditions for widespread heterosexual spread of HIV in the Russian Federation: implications for research, monitoring and prevention* International Journal of Drug Policy, 2003. **14**(1): p. 45-62.
10. Morris, M., C. Podhisita, M. Wawer, and M. Handcock, *Bridge populations in the spread of HIV/AIDS in Thailand*. AIDS, 1996. **10**(11): p. 1265-1271.
11. Aral, S.O., *Behavioral Aspects of Sexually Transmitted Diseases: Core Groups and Bridge Populations*. Sexually Transmitted Diseases, 2000. **27**(6): p. 327-328.

12. Niccolai, L., I. Shcherbakova, O. Toussova, A. Kozlov, and R. Heimer, *The potential for bridging of HIV transmission in the Russian Federation: sex risk behaviors and HIV prevalence among drug users (DUs) and their non-DU sex partners*. *J Urban Health* 2009. **86**(Supplement 1): p. 131-143.
13. Lowndes, C., M. Alary, H. Meda, C. Gnintoungbe, L. Mukenge-Tshibaka, and C. Adjovi, *Role of core and bridging groups in the transmission dynamics of HIV and STIs in Cotonou, Benin, West Africa*. *Sex Transm Infect* 2002. **78**(Supplement 1): p. i69-i77.
14. Hesketh, T., J. Zhang, and D. Qiang, *HIV knowledge and risk behaviour of female sex workers in Yunnan Province, China: potential as bridging groups to the general population*. *AIDS Care*, 2005. **17**(8): p. 958-966.
15. Thomas, T., L. Urada, D. Morisky, and R. Malow, *Best Practice Example from the Philippines: A Low-Level Prevalence Country and the Male "Bridge" Population*, in *HIV/AIDS: Global Frontiers in Prevention/Intervention*. 2008, Routledge.
16. Ruxrungtham, K., T. Brown, and P. Phanuphak, *HIV/AIDS in Asia*. *Lancet*, 2004. **364**(9428): p. 69-82.
17. Lowndes, C., M. Alary, C. Gnintoungbé, E. Bédard, L. Mukenge, N. Geraldo, P. Jossou, E. Lafia, F. Bernier, E. Baganizi, J. Joly, E. Frost, and S. Anagonou, *Management of sexually transmitted diseases and HIV prevention in men at high risk: targeting clients and nonpaying sexual partners of female sex workers in Benin*. *AIDS*, 2000. **14**(16): p. 2523-2534.
18. Goldenberg, S., M. Gallardo Cruz, S. Strathdee, L. Nguyen, S. Semple, and T. Patterson, *Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico*. *Sex Transmitted Dis*, 2010. **37**(5): p. 319-324.
19. Coughlan, E., Mindel, A., & Estcourt, C.S. , *Male clients of female commercial sex workers: HIV, STDs and risk behaviour*. *International Journal of STD and AIDS*, 2001. **12**: p. 665-669.
20. Leech, N., K. Barrett, and G. Morgan, *SPSS for Intermediate Statistics: Use And Interpretation*. 2005, Mahwah, New Jersey: Routledge Academic.
21. Semple, S., S. Strathdee, M. Cruz, A. Robertson, S. Goldenberg, and T. Patterson, *Psychosexual and social-cognitive correlates of sexual risk behavior among male clients of female sex workers in Tijuana, Mexico*. *AIDS Care*, 2010. **22**(12): p. 1473-1480.

22. Zhao, L., Y. Chen, and D. Schaffner, *Comparison of Logistic Regression and Linear Regression in Modeling Percentage Data*. Appl Environ Microbiol, 2001. **67**(5): p. 2129-2135.
23. Barros, A. and V. Hiraakata, *Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio*. BMC Medical Research Methodology, 2003. **3**(21).
24. Hellevik, O., *Linear versus logistic regression when the dependent variable is a dichotomy*. Quality & Quantity, 2009. **43**(1): p. 59-74.
25. Roesch, S., *Re: Dissertation Student*, T.L. Patterson, Editor. 2012: San Diego, CA.
26. Abramovitz, D., *Re: Unprotected Sex Paper*, T. Volkmann, Editor. 2012: San Diego.
27. Schroder, K., M. Carey, and P. Vanable, *Methodological Challenges in Research on Sexual Risk Behavior: I. Item Content, Scaling, and Data Analytical Options*. Ann Behav Med, 2003. **26**(2): p. 76-103.
28. Fritz, R., *AIDS knowledge, self-esteem, perceived AIDS risk, and condom use among female commercial sex workers*. Journal of Applied Social Psychology, 1998. **28**: p. 888-911.
29. Crosby, R.A., *Condom use as a dependent variable: measurement issues relevant to HIV prevention programs*. AIDS Educ Prev, 1998. **10**(6): p. 548-57.
30. Li, Q., X. Li, and B. Stanton, *Alcohol use among female sex workers and male clients: an integrative review of global literature*. Alcohol Alcohol, 2010. **45**(2): p. 188-99.
31. Plant ML, P.M., Peck DF, Setters J., *The sex industry, alcohol and illicit drugs: implications for the spread of HIV infection*. Br J Addict, 1989. **84**(1): p. 53-59.
32. Wee, S., M. Barrett, and W. Lian, *Determinants of inconsistent condom use with female sex workers among men attending the STD clinic in Singapore*. Sex Transm Infect, 2004. **80**: p. 310-314.
33. Gare, J., T. Lupiwa, and D. Suarkia, *High prevalence of sexually transmitted infections among female sex workers in the eastern highlands province of Papua New Guinea: correlates and recommendations*. Sex Transm Dis, 2005. **32**: p. 466-73.

34. Celentano DD, N.K., Suprasert S, Wright N, Matanasarawoot A, Eiumtrakul S, Romyen S, Tulvatana S, Kuntolbutra S, Sirisopana N, et al., *Behavioral and sociodemographic risks for frequent visits to commercial sex workers among northern Thai men*. AIDS, 1993. **7**(12): p. 1647-52.
35. Kumar, M. *A rapid situation assessment of sexual risk behavior and substance use among sex workers and their clients in Chennai (Madras), South India*. . 2003 [cited 2011 Jan 21]; Available from: [http://www.who.int/entity/mental\\_health/evidence/sexual\\_behaviour\\_assessment\\_chennai.pdf](http://www.who.int/entity/mental_health/evidence/sexual_behaviour_assessment_chennai.pdf).
36. Patterson, T., S. Goldenberg, M. Gallardo, R. Lozada, S. Semple, P. Orozovich, D. Abramovitz, and S. SA, *Correlates of HIV, sexually transmitted infections, and associated high-risk behaviors among male clients of female sex workers in Tijuana, Mexico*. AIDS, 2009. **23**(13): p. 1765-1761.
37. Lacerda, R., N. Gravato, W. McFarland, G. Rutherford, K. Iskrant, R. Stall, and N. Hearst, *Truck drivers in Brazil: prevalence of HIV and other sexually transmitted diseases, risk behavior and potential for spread of infection*. AIDS, 1997. **11**(Suppl 1:S15-9).
38. Malta M, B.F., Pereira-Koller EM, Cunha MD, Marques C, Strathdee SA., *A qualitative assessment of long distance truck drivers' vulnerability to HIV/AIDS in Itajaí, southern Brazil*. AIDS Care 2006. **18**(5): p. 489-496.
39. Ford, K. and A. Chamrathirong, *Migrant seafarers and HIV risk in Thai communities*. AIDS Educ Prev, 2008. **20**: p. 454-63.
40. Sivaram, S., A. Srikrishnan, and C. Latkin, *Development of an opinion leader-led HIV prevention intervention among alcohol users in Chennai, India*. AIDS Educ Prev, (2004). **16**: p. 137-49.
41. De Graaf, R., I. Vanwesenbeeck, G. Van Zessen, C. Straver, and J. Visser, *Alcohol and drug use in heterosexual and homosexual prostitution, and its relation to protection behaviour*. AIDS Care, 1995. **7**(1).
42. Chiao, C., D. Morisky, and R. Rosenberg, *The relationship between HIV/sexually transmitted infection risk and alcohol use during commercial sex episodes: results from the study of female commercial sex workers in the Philippines*. Subst Use Misuse, 2006. **41**: p. 1509-33.
43. Celentano, D., K. Nelson, and S. Suprasert, *Behavioral and sociodemographic risks for frequent visits to commercial sex workers among northern Thai men*. AIDS, 1993. **7**: p. 1647-52.

44. Vanwesenbeeck, I., *Another decade of social scientific work on sex work: A review of research 1990-2000*. Annual Review of Sex Research, 2001. **12**: p. 242-289.
45. Xantidis, L. and M. McCabe, *Personality Characteristics of Male Clients of Female Commercial Sex Workers in Australia*. Archives of Sexual Behavior, 2000. **29**(2): p. 165-176.
46. Gullette, D. and M. Lyons, *Sensation seeking, self-esteem, and unprotected sex in college students*. J Assoc Nurses AIDS Care, 2006. **17**(5): p. 23-31.
47. de Graaf, R., G. van Zessen, I. Vanwesenbeeck, C. Straver, and J. Visser, *Condom use by Dutch men with commercial heterosexual contacts: determinants and considerations*. AIDS Educ Prev, 1997. **9**(5): p. 411-23.
48. Xu JJ, W.N., Lu L, Pu Y, Zhang GL, Wong M, Wu ZL, Zheng XW., *HIV and STIs in clients and female sex workers in mining regions of Gejiu City, China*. 2008.
49. Williams, D., *Outcome Expectancy and Self-Efficacy: Theoretical Implications of an Unresolved Contradiction*. Personality and Social Psychology Review, 2010. **14**(4): p. 417-425.
50. Basen-Engquist, K., *Psychosocial predictors of "safer sex" behaviors in young adults*. AIDS Educ Prev, 1992 **4**(2): p. 120-34.
51. Quatrella, L., *Predictors of condom-use self-efficacy and perceptions of responsibilities of safer sex behaviors among college students*. 2000, Seton Hall University. p. 131.
52. Bandura, A., *A social cognitive approach to the exercise of control over AIDS infection*. , in *Adolescents and AIDS: A generation in jeopardy*, R. DiClemente, Editor. 1992, Sage: Newbury-Park, CA. p. 89-116.
53. Sheeran, P., C. Abraham, and S. Orbell, *Psychosocial correlates of heterosexual condom use: A meta-analysis*. Psychological Bulletin, 1999. **125**(1): p. 90-132.
54. Fisher, J. and W. Fisher, *Theoretical Approaches to Individual-Level Change in HIV Risk Behavior*, in *Handbook of HIV prevention*, J. Peterson and R. DiClemente, Editors. 2000, Kluwer Academic/Plenum.: New York. p. 3-55.
55. Kalichman, S. and D. Rompa, *Sexual sensation seeking and sexual compulsivity scales: Reliability, validity, and predicting HIV risk behavior*. Journal of Personality Assessment, 1995. **65**(3): p. 586-601.

56. Kalichman, S., J. Johnson, V. Adair, D. Rompa, K. Multhauf, and J. Kelly, *Sexual Sensation Seeking: Scale Development and Predicting AIDS-Risk Behavior Among Homosexually Active Men*. *Journal of Personality Assessment*, 1994. **62**(3): p. 385 - 397.
57. Noar, S., R. Zimmerman, P. Palmgreen, M. Lustria, and M. Horosewski, *Integrating personality and psychosocial theoretical approaches to understanding safer sexual behavior: implications for message design*. *Health Commun*, 2006. **19**(2): p. 165-74.
58. Ogden, J., *Some problems with social cognition models: A pragmatic and conceptual analysis*. *J Health Psychology*, 2003. **22**: p. 424-428.
59. O'Leary, A., R. Wolitski, R. Remien, W. Woods, J. Parsons, S. Moss, and C. Lyles, *Psychosocial correlates of transmission risk behavior among HIV-seropositive gay and bisexual men*. *AIDS*, 1992. **19**: p. S67-S75.
60. Blumstein, A. and J. Wallman, *The Crime Drop in America*. 2000, Cambridge: Cambridge University Press.
61. Clarke, C., *Politics, Violence and Drugs in Kingston, Jamaica*. *Bulletin of Latin American Research*, 2006. **25**(3): p. 420-440.
62. Matthews, I., R. Griggs, and G. Caine, *The Experience Review of Interventions and Programmes Dealing with Youth Violence in Urban Schools in South Africa*. 1999, Independent Projects Trust.
63. Moser, C., *Encounters with violence in Latin America: Urban poor perceptions from Columbia and Guatemala*. 2004, New York: Psychology Press.
64. Friman, H., *Drug markets and the selective use of violence*. *Crime, Law and Social Change*, 2009. **52**(3): p. 285-295.
65. Short, J. and L. Hughes, *Studying Youth Gangs*. 2006, Oxford, UK: AltaMira Press. 118.
66. Lanier, M., R. Pack, and T. Akers, *Epidemiological Criminology: Drug Use Among African American Gang Members*. *Journal of Correctional Health Care*, 2010. **16**(1): p. 6-16.
67. M Singer, M., *Dose of Drugs, a Touch of Violence, a Case of AIDS: Conceptualizing the SAVA Syndemic*. *Free Inquiry in Creative Sociology* 1996. **24**(2): p. 99-110.

68. Rodgers, D., *Youth Gangs and Violence in Latin America and the Caribbean: A Literature Survey*, in *Urban Peace Program Series*. 1999, The World Bank.
69. Zaluar, A., *Violence Related to Illegal Drugs, "Easy Money" and Justice in Brazil: 1980-1995*. Management of Social Transformations, 1999. **35**.
70. Zdun, S., *Violence in street culture: Crosscultural comparison of youth groups and criminal gangs*. New Directions for Youth Development, 2008. **119**: p. 39-54.
71. De La Rosa, M., E. Lambert, and B. Gropper, eds. *Drugs and Violence. Causes, Correlates, and Consequences*. 1990, USGPO: Washington, D. C.:
72. Klein, M.W., C.L. Maxson, and L.C. Cunningham, "Crack," *Street Gangs, and Violence*. Crimonology, 1991. **9**(4).
73. Crime, U.N.O.o.D.a., *The Threat of Narco-Trafficking in the Americas 2008*. 2008, United Nations: New York City.
74. State, U.D.o. *Travel Warning - Mexico*. 2010 [cited 2011 February 25]; Available from: [http://travel.state.gov/travel/cis\\_pa\\_tw/tw/tw\\_4755.html](http://travel.state.gov/travel/cis_pa_tw/tw/tw_4755.html).
75. Dudley, S. *Who Controls Tijuana?* 2012 [cited 2012 October 17]; Available from: <http://www.insightcrime.org/investigations/who-controls-tijuana>.
76. Dotinga, R. *The Great Tijuana Drug War Seems Finished*. 2010 [cited 2012 October 17]; Available from: [http://www.voiceofsandiego.org/this\\_just\\_in/](http://www.voiceofsandiego.org/this_just_in/).
77. Intelligence, S.G. *Mexico and the Cartel Wars in 2010*. 2010 [cited 2011 February 24]; Available from: <http://www.stratfor.com/weekly/20101215-mexico-and-cartel-wars-2010>.
78. Bandura, A., *Self-efficacy: Toward a unifying theory of behavioral change*. Psychological Review, 1977. **84**: p. 191-215.
79. Bandura, A., *Reflections on self-efficacy*. Advances in Behaviour Research and Therapy, 1978. **1**: p. 237-269.
80. Wulfert, E. and C. Wan, *Safer Sex Intentions and Condom Use Viewed from a Health Belief, Reasoned Action, and Social Cognitive Perspective*. The Journal of Sex Research, 1995. **32**(4): p. 299-311.



81. Montoya, I., *Social network ties, self-efficacy, and condom use among women who use crack cocaine: a pilot study*. *Subst Use Misuse*, 1998 **33**(10): p. 2049-73.
82. Bandura, A., *Social foundations of thought and action: A social cognitive theory*. 1986, Englewood Cliffs, NJ: Prentice Hall.
83. Carey, M. and K. Schroder, *Development and psychometric evaluation of the brief HIV Knowledge Questionnaire*. *AIDS Education and Prevention*, 2002. **14**.
84. Kandel, D., K. Yamaguchi, and K. Chen, *Stages of progression in drug involvement from adolescence to adulthood: further evidence for the gateway theory*. *J Stud Alcohol* 1992. **53**: p. 447-57.
85. Maxcy KF, e., *Papers of Wade Hampton Frost, M.D.: a contribution to epidemiological method*. 1941, New York, NY: The Commonwealth Fund.
86. Wagner, F.A. and J.C. Anthony, *Into the World of Illegal Drug Use: Exposure Opportunity and Other Mechanisms Linking the Use of Alcohol, Tobacco, Marijuana, and Cocaine*. *American Journal of Epidemiology*, 2002. **155**(10).
87. Reinerman, C., P.D.A. Cohen, and H.L. Kaal, *The Limited Relevance of Drug Policy: Cannabis in Amsterdam and in San Francisco*. *American Journal of Public Health* 2004. **94**(5): p. 836-42.
88. Kenkel, D., A. Mathios, and R. Pacula, *Economics of youth drug use, addiction and gateway effects*. *Addiction* 2001. **96**: p. 151–164.
89. Bretteville-Jensen, A., H. Melberg, and A. Jones, *Sequential Patterns of Drug Use Initiation - Can We Believe In the Gateway Theory?* *The BE Journal of Economic Analysis & Policy*, 2008. **8**(2): p. 1935-1682.
90. Borges, G., C. Rafful, C. Benjet, D. Tancredi, N. Saito, S. Aguilar-Gaxiola, M. Medina-Mora, and J. Breslau, *Mexican immigration to the US and alcohol and drug use opportunities: Does it make a difference in alcohol and/or drug use?* *Drug Alcohol Depend* 2012. **Suppl 1**: p. S4-S11.
91. Goldstein, G., *The Drugs/Violence Nexus: A Tripartite Conceptual Framework*. *Journal of Drug Issues*, 1985. **39**: p. 143-174.
92. Valdez, A., C.D. Kaplan, and A. Cepeda, *The drugs-violence nexus among Mexican-American gang members*. *J Psychoactive Drugs*, 2006. **38**(2): p. 109-21.

93. Fagan, J., J. Weis, and Y. Cheng, *The social organization of drug use and drug dealing among urban gangs*. *Criminology*, 1989. **27**(4): p. 633-67.
94. Rachlis, B., K.C. Brouwer, E.J. Mills, M. Hayes, T. Kerr, and R.S. Hogg, *Migration and transmission of blood-borne infections among injection drug users: understanding the epidemiologic bridge*. *Drug Alcohol Depend*, 2007. **90**(2-3): p. 107-19.
95. Bucardo, J., K.C. Brouwer, C. Magis-Rodríguez, R. Ramos, M. Fraga, S.G. Perez, T.L. Patterson, and S.A. Strathdee, *Historical trends in the production and consumption of illicit drugs in Mexico: implications for the prevention of blood borne infections*. *Drug and Alcohol Dependendancy*, 2005: p. 281-293.
96. Reuters (2012) *Mexico admits mistake in high-profile drug case*. Reuters UK.
97. Transportation, U.S.D.o. *Border Crossing: U.S.-Mexico Border Crossing Data*. [cited 2011 May 5]; Available from: [http://www.bts.gov/programs/international/border\\_crossing\\_entry\\_data/us\\_mexico/pdf/entire.pdf#search='Border%20crossing%20statistics%20US%20Mexico](http://www.bts.gov/programs/international/border_crossing_entry_data/us_mexico/pdf/entire.pdf#search='Border%20crossing%20statistics%20US%20Mexico).
98. Strathdee, S., "Vivo para consumirla y la consumo para vivir" ["I live to inject and inject to live"]: *high-risk injection behaviors in Tijuana, Mexico*. *J Urban Health*, 2005. **82**: p. 58-73.
99. Pollini, R., *Drug Use and Abuse in San Diego County, California*, in *Oral presentation to the National Institute on Drug Abuse's Community Epidemiology Work Group*. 2010: San Diego.
100. Moreno, J., J. Licea, and C. Ajenjo, *Tackling HIV and drug addiction in Mexico*. *Lancet*, 2010. **376**(9740): p. 493-495.
101. Brouwer, K.C., S.A. Strathdee, C. Magis-Rodriguez, E. Bravo-Garcia, C. Gayet, T.L. Patterson, S.M. Bertozzi, and R.S. Hogg, *Estimated numbers of men and women infected with HIV/AIDS in Tijuana, Mexico*. *J Urban Health*, 2006. **83**(2): p. 299-307.
102. Volkman T, S.S., Garfein RS, Patterson TL, Pollini RA, Wagner KD, Artamanova I, Strathdee SA., *Border Crossing to Inject Drugs in Mexico Among Injection Drug Users in San Diego, California*. *J Immigr Minor Health*, 2011.
103. Strathdee, S., R. Lozada, S. Semple, P. Orozovich, M. Pu, H. Staines-Orozco, -V.M. Fraga, H. Amaro, A. Delatorre, C. Magis-Rodríguez, and T.

- Patterson, *Characteristics of female sex workers with US clients in two Mexico-US border cities*. *Sex Transm Dis* 2008. **35**: p. 263-268.
104. Sirotin, N., S. Strathdee, R. Lozada, D. Abramovitz, S. Semple, J. Bucardo, and T. Patterson, *Effects of government registration on unprotected sex amongst female sex workers in Tijuana; Mexico*. *Int J Drug Policy*, 2010. **21**(6): p. 466-70.
  105. Brouwer, K., S. Strathdee, and C. Magis-Rodriguez, *Estimated numbers of men and women infected with HIV/AIDS in Tijuana, Mexico*. *J Urban Health*, 2006. **83**(2): p. 299-307.
  106. Patterson, T.L., S.J. Semple, M. Fraga, J. Bucardo, A. de la Torre, and J. Salazar, *Comparison of sexual and drug use behaviors between female sex workers in Tijuana and Ciudad Juarez, Mexico*. *Substance Use and Misuse*, 2006. **41**(10-12): p. 1535–1549.
  107. Fritz MS, M.D., *Required sample size to detect the mediated effect*. *Psychol Sci*, 2007. **18**(3): p. 233-9.
  108. Olmstead, M., *Animal models of drug addiction: Where do we go from here?* *The Quarterly Journal of Experimental Psychology*, 2006. **59**(4).
  109. Loeber, S. and T. Duka, *Acute alcohol decreases performance of an instrumental response to avoid aversive consequences in social drinkers*. *Psychopharmacology*, 2009. **205**(4): p. 577-87.
  110. Grafman, J., F. Boller, R. Berndt, I. Robertson, and G. Rizzolatti, *Handbook of Neuropsychology*. 2002: Elsevier Health Sciences.
  111. Patterson, T., S. Semple, and H. Staines, *Prevalence and correlates of HIV infection among female sex workers in two Mexico-U.S. border cities*. *J Infect Dis*, 2008. **97**(5): p. 728-732.
  112. Strathdee, S.A., W.D. Fraga, P. Case, M. Firestone, K.C. Brouwer, S.G. Perez, C. Magis, and M.A. Fraga, *"Vivo para consumirla y la consumo para vivir" ["I live to inject and inject to live"]: high-risk injection behaviors in Tijuana, Mexico*. *J Urban Health*, 2005. **82**(3 Suppl 4): p. iv58-73.
  113. Strathdee, S. and C. Magis-Rodriguez, *Mexico's Evolving HIV Epidemic*. *JAMA*, 2008. **300**(5): p. 571–573.
  114. UNAIDS, *Mexico: Epidemiological Fact Sheet on HIV and AIDS, Core data on epidemiology and response*. 2008, UNAIDS/WHO Working Group on Global HIV/AIDS and STI: Geneva.

115. Brouwer, K., R. Lozada, and W. Cornelius, *Deportation along the U.S.-Mexico border: its relation to drug use patterns and accessing care*. J Immigr Minor Health, 2009. **11**(1): p. 1-6.
116. Strathdee, S., R. Lozada, and V. Ojeda, *Differential effects of migration and deportation on HIV infection among male and female injection drug users in Tijuana, Mexico*. PLoS One, 2008. **3**(7): p. e2690.
117. *Border Region*. 2012 [cited 2012 September 25]; Available from: [http://www.borderhealth.org/border\\_region.php](http://www.borderhealth.org/border_region.php).
118. CifrasXII. *Censo General de Población y Vivienda*. [database on the Internet] [cited 2011 February 24]; Available from: [www.conapo.gob.mx/00cifras/proy/localidad.xls](http://www.conapo.gob.mx/00cifras/proy/localidad.xls).
119. Garfein, R.S., J.L. Burgos, A. Rodriguez-Lainz, S. Brodine, A. Pietrucha, A. Rondinelli, R. Laniado-Laborin, E. Ibarra, A. Cañez, and M. Fraga, *Latent Tuberculosis Infection in a Migrant Agricultural Community in Baja California, Mexico*. J Immigr Minor Health, 2010. **July 29**.
120. Gonzalez-Fagoaga, J.E., R. Cruz-Piñero, and M.G. Rangel, *Servicios de salud en migrantes indígenas en San Quintín, Baja California*. Condiciones de salud en la frontera norte de México, ed. M. Rangel and M. Hernandez-Avila. Vol. 1. 2009, Mexico, D.F.: El Colegio de la Frontera Norte.
121. National Council against Addictions, N.I.o.P.R.d.I.F., National Institute on Public Health. , *2008 national household survey on addictions, Mexico. (in Spanish)*. . 2009.
122. Case, P., R. Ramos, K.C. Brouwer, M. Firestone-Cruz, R.A. Pollini, M.A. Fraga, T.L. Patterson, and S.A. Strathdee, *At the borders, on the edge: use of injected methamphetamine in Tijuana and Ciudad Juarez, Mexico*. J Immigr Minor Health, 2008. **10**(1): p. 23-33.
123. Strathdee, S.A., R. Lozada, V.D. Ojeda, R.A. Pollini, K.C. Brouwer, A. Vera, W. Cornelius, L. Nguyen, C. Magis-Rodriguez, and T.L. Patterson, *Differential effects of migration and deportation on HIV infection among male and female injection drug users in Tijuana, Mexico*. PLoS One, 2008. **3**(7): p. e2690.
124. Volkmann, T., S. Shin, R. Garfein, T. Patterson, R. Pollini, K. Wagner, I. Artamanova, and S. Strathdee, *Border Crossing to Inject Drugs in Mexico Among Injection Drug Users in San Diego, California*. J Immigr Minor Health, 2011.

125. Mausbach, B., S. Semple, S. Strathdee, J. Zians, and T. Patterson, *Efficacy of a behavioral intervention for increasing safer sex behaviors in HIV-positive MSM methamphetamine users: results from the EDGE study.* Drug Alcohol Depend, 2007 **87**(2-3): p. 249-57.

## CHAPTER 2: TWO ANALYTIC APPROACHES TO MEASURING UNPROTECTED SEX

**Title:** Measuring Unprotected Sex: A Case Study of Two Analytic Approaches among Male Clients of Female Sex Workers

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### ABSTRACT

**Background:** Two commonly used approaches for examining dependent variables measuring unprotected sex are 1) to analyze a dichotomous indicator of any versus no unprotected sex acts during a specified time and 2) to analyze the continuous number of unprotected sex acts during a specified time. We explored these approaches among male clients of female sex workers (FSWs) in Tijuana, Mexico.

**Methods:** 394 male residents of Tijuana or San Diego, aged  $\geq 18$  years, who reported paying or trading for sex with FSWs in Tijuana during the past four months underwent HIV/STI testing and an interviewer-administered questionnaire. We considered the results of modeling unprotected sex using logistic regression for the dichotomous outcome and log-link negative binomial regression for the count outcome.

**Results:** In the dichotomous analysis, four variables were independently associated with recent unprotected sex with Tijuana FSWs. In the count analysis, five variables were independently associated with a higher number of unprotected sex acts with Tijuana FSWs. The only variable identified by both approaches was being high during sex with a FSW.

**Discussion:** Using identical data and variables, each approach identified unique correlates of unprotected sex. Recommendations are made to researchers about situations in which each approach might be preferred.

**Keywords:** unprotected sex; male clients; female sex workers; methodology; sexual risk

## INTRODUCTION

Many studies examining sexual risk behavior have analyzed unprotected sex as a dichotomous dependent measure, which is a measure of relative frequency reduced to two categories (e.g., reporting any unprotected sex versus reporting no unprotected sex during a specified time frame) [1]. Due to the construction of dichotomous variables, the interpretations of results differ from other approaches such as count variables. For example, the odds ratio obtained from logistic regression with a dichotomous dependent variable enables one to compare the relative odds of reporting unprotected sex versus no unprotected sex for those who report certain characteristics.

In contrast, count dependent variables might measure the total number of acts of unprotected sex occurring over a specific amount of time. In this case, an analysis of this count dependent variable using negative binomial regression provides the ability to estimate unprotected sex through the calculation of a rate, which permits the comparison of a relative rate ratio of unprotected sex within one group versus another (e.g., married versus unmarried men). Thus, in research examining unprotected sex, one of the primary differences between a dichotomous dependent variable and a count dependent variable is that the former can be used to test hypotheses related to which subgroups report any unprotected sex versus those who do not, while the latter can be used to test hypotheses about those who report relatively higher rates of unprotected sex acts.



In Tijuana, Mexico, just south of San Diego, California, HIV prevalence in male clients of FSWs is estimated to be 4.1% [2], which mirrors that of FSWs (6.0%) [3]. Male clients of FSWs and their partners are at high risk of acquiring and transmitting HIV/STIs due to their position in networks as a potential 'bridge' for transmission of HIV between FSWs with a higher burden of HIV/STIs and the lower risk general population [4-8]. In a recent analysis, more than 50% of male clients from San Diego and Tijuana reported unprotected sex with FSWs in Tijuana in the four months prior to interview [2, 9-10]. Of male clients in Tijuana, the number of recent unprotected sex acts with FSWs varied greatly (range: 0-240) [9]. The high proportion of male clients of FSWs reporting unprotected sex and the high variation in the number of unprotected sex acts among clients renders this population ideal for using both the dichotomous and count approaches to analyze unprotected sex.

Three past studies of male clients of FSWs in Tijuana have used dichotomous variables and logistic regression to identify correlates of HIV infection [2] and correlates of unprotected sex using the same dataset [10-11]. In these studies, sociodemographic characteristics, structural factors, psychosocial and psychosexual factors, drug-related variables, and sexual behaviors were identified as correlates of HIV infection and unprotected sex [2, 10-11]. For example, using logistic regression, Goldenberg et al. found that being high during sex with a FSW, being married or in a common law relationship, visiting the same sex worker, and being unemployed were independently associated with unprotected vaginal and anal sex [10]. Since the results of the latter analysis

estimate the odds of reporting unprotected sex versus no unprotected sex among those who report certain characteristics, and the count approach instead estimates the *rate* of unprotected sex among different groups, results of each type of analysis may identify different correlates than the other approach.

The goal of this paper is to examine, using an identical data set and variables as a previous analysis [10], the correlates of a dichotomous variable and a count variable measuring unprotected sex among male clients of FSWs in Tijuana. Further, using the results as examples, we address which types of research questions each approach is well suited to answer. We hypothesized that modeling recent unprotected sex with FSWs in Tijuana would identify different correlates than modeling the number of unprotected sex acts among male clients. In addition to possibly identifying differences in the results of each analytic approach, this analysis will help researchers determine which approach is preferred depending on which types of questions they seek to answer.

## **METHODS**

### **Data Collection**

Between June and October 2008, 400 male clients of FSWs were recruited in Tijuana to complete a cross-sectional questionnaire and to undergo HIV/STI testing, as previously described [2]. Men eligible to participate were aged at least 18 years, lived in Tijuana or San Diego, had paid or traded (e.g., personal property or drugs) for sex with a FSW in Tijuana during the four months prior to enrollment.

After written informed consent, the questionnaire was administered by bilingual interviewers in private offices near the Tijuana's *Zona Roja* (a central district where sex work is tolerated), and men were compensated \$30 USD for their participation. UCSD's Human Research Protections Program and Tijuana General Hospital's Ethics Committee approved the human subjects protocol.

### **Measures**

Surveys elicited information from participants in several categories, including sociodemographic characteristics (e.g., age at interview, race/ethnicity, sexual identity), drug-related variables, and sexual behaviors. In order to examine the results of the two analytic approaches, modeling the dichotomous unprotected sex variable versus modeling the count variable, we selected the same set of variables that were used in a previous analysis by Goldenberg, et al. [10].

### **Drug-related variables**

Past and current substance use was measured by asking participants if they used specific drugs in their lifetime, during the past four months, and during sex with a FSW. The two latter questions were measured using a Likert scale with the following seven responses: never;  $\leq 1$  a month; 2-3 days/month; once a week; 2-3 days/week; 4-6 days/week; every day. In addition, participants were asked whether they injected any drug during the previous four months. The following four responses were available options: never, once in a while, fairly often, very often. All drug use variables were dichotomized to "yes" and "no"

responses, whereby “never” was recoded as 0 and all other responses were recoded as 1.

### **Sexual behaviors**

The survey asked participants whether they engaged in sex with a female sex worker in the last four months (“yes/no”) and “In the past four months, did you trade drugs for sex with a prostitute in Tijuana?” (“yes/no”). The survey asked about visiting the same FSW during the past four months, which was phrased as “In general, how often do you go back to the same prostitute?” Responses categories were: never, once in a while, fairly often, very often and were recoded to “yes/no”. All participants were asked to provide the total number of recent vaginal and anal sex acts with FSWs and the number of those acts in which a condom was used (e.g., “In the past four months, how many times did you have vaginal sex with a female prostitute in Tijuana?” and “In the past four months, how many times did you use a condom for anal sex with a female prostitute in Tijuana?”).

### **Laboratory testing**

Rapid antibody testing for HIV (“Determine”; Abbott Pharmaceuticals, Boston, MA, USA) and *Treponema pallidum* (rapid plasma reagin test; MacroVue, Becton Dickinson, Cockeysville, MD) were conducted using a drop of blood. Reactive HIV samples were confirmed using Western Blot. *Chlamydia trachomatis* and *Neisseria gonorrhoeae* were detected using DNA strand displacement amplification (SDA) on participant urine samples. HIV and syphilis rapid test results were available immediately after the interview, while the C.

*trachomatis* and *N. gonorrhoeae* results were available after one month, whereupon free treatment was provided to those who returned for their results. Those who tested positive for HIV and *Treponema pallidum* were referred to local clinics for free care.

### **Statistical Analysis**

Our analysis assessed whether a previous analysis by Goldenberg et al. using a dichotomous dependent variable to measure any unprotected sex in the past four months (Approach 1) identified different correlates than a current analysis using a count dependent variable to measure the number of unprotected sex acts in the past four months (Approach 2), using the same data set and explanatory variables [10]. In Approach 1, the binary dependent variable was created by dichotomizing clients who reported at least one act of unprotected vaginal or anal sex with a Tijuana FSW during the prior four months versus those who reported no acts of vaginal or anal sex with a Tijuana FSW [10]. In the current analysis (Approach 2), the count dependent variable measured the sum of the total number of unprotected vaginal and anal sex acts with FSWs in Tijuana during the past four months by subtracting the number of times condoms were used for vaginal and anal sex from the total number of vaginal and anal sex acts reported by clients.

### **Descriptive statistics (Approach 2)**

After ensuring the data were identical to the previous analysis and that variables were identically constructed, the frequencies, proportions, medians,

and the interquartile range (IQR) of characteristics of male clients of FSWs included in this analysis were calculated and displayed.

### **Bivariate and Multivariate analyses**

*Dichotomous dependent variable approach from Goldenberg, et al. [10]*

*(Approach 1)*

The following are the bivariate and multivariate methods from Approach 1 [10]. In bivariate analyses, logistic regression was used to identify factors associated with reporting any unprotected sex with a FSW in Tijuana in the four months prior to the survey [10].

In multivariate analyses, logistic regression was used to identify factors independently associated with any unprotected sex acts with Tijuana FSWs in the prior 4 months. Multivariate models were built by adding factors that were found to be significantly associated with the dichotomous dependent variable at the 10% level in bivariate analyses. Variables were added manually, from most to least statistically significant, and were retained if statistical significance at the 5% level was achieved and maintained. All possible two-way interactions were explored among final model variables [10].

*Count dependent variable approach (Approach 2)*

In bivariate analyses, negative binomial regression identified factors associated with the total number of unprotected sex acts with FSWs in Tijuana in the four months prior to the survey.

In multivariate analyses, a Vuong test was performed to determine whether a zero-inflated negative binomial model was preferred to an ordinary negative binomial model [12]. General estimating equations modeling was used to conduct a log-link negative binomial distribution regression using a robust variance estimator to account for overdispersion in the dependent variable. Negative binomial regression identified factors independently associated with the number of recent unprotected sex acts with FSWs in Tijuana. Multivariate models were built by adding factors that were found to be significantly associated with the count dependent variable at the 10% level in bivariate analyses. Model-building proceeded identically to the method described above for Approach 1. In order to keep the two analyses as similar as possible, we did not use an offset term to account for the total number of sex acts in the count variable approach. Model fit was assessed using the likelihood ratio chi-squared test for Approach 1 and the Wald test for Approach 2.

## **RESULTS**

### **Descriptive statistics**

Of the 400 participants who enrolled in the study, six were excluded from analyses because data were missing for one of the variables included in the multivariate models. The remaining 394 clients had a median age of 36 years and a median education level of 11 years. Participants were majority Latino (79.4%), Spanish speaking (87.8%), employed (57.9%), heterosexual (87.5%), and most had at least one child (65.7%). By design, half (52.8%) lived in Tijuana

and half (47.2%) lived in San Diego. A minority of participants reported being in a married or common-law relationship (25.6%) and living with a partner or spouse (25.6%) (Table 1).

Of sexual behaviors, 14.2% reported having a recent male sex partner, 35.9% reported visiting the same FSW (35.9%), and 66.2% reported recently being high during sex with a FSW in Tijuana. Half (50.4%) of the sample reported unprotected vaginal and/or anal sex with a FSW in Tijuana during the past four months. The median number of FSWs clients reported having sex within the past four months was 4 (interquartile range = 2,10). The median proportion of unprotected sex acts with Tijuana FSWs was 39% (median: 0; range: 0-100%).

### **Factors associated with unprotected sex in both Approaches 1 and 2**

In bivariate analyses, factors associated with both the count and dichotomous dependent variables included: reporting bisexual orientation, living with a partner/spouse, ever being victimized by a FSW or pimp, reporting sex with a male partner during the past four months, the number of sex acts with FSWs during the past four months, the number of years visiting FSWs, receptive needle sharing during the past four months, and being high during sex with a FSW during the past four months (Table 2).

### **Factors uniquely associated with reporting recent unprotected sex in**

#### **Approach 1**

The following demographic factors were associated with the dichotomous dependent variable but were not associated with the count dependent variable: older age, fewer years of education, Spanish speaking, having children, being in



a married or common-law relationship, having a significant other who is a FSW, ever being in jail, number of STIs reported, and any STI infection during the past four months.

Of drug-related variables, having injected any drug during the past four months, ever using any drug, ever using methamphetamine or heroin, and ever having been in substance abuse treatment were associated with the dichotomous dependent variable only.

Of sexual behaviors, visiting the same FSW during past four months, age of first contact with a FSW, having a male sex partner during the past four months, and being drunk during sex with a FSW during the past four months were associated with the dichotomous dependent variable only (Table2).

### **Factors uniquely associated with recent unprotected sex in Approach 2**

The following factors were associated with the count dependent variable but were not associated with the dichotomous dependent variable: the number of clients' friends who visit FSWs in Tijuana, current infection with Chlamydia or gonorrhea, and the number of FSWs visited in Tijuana during the past four months (Table 2).

### **Comparison of factors independently associated with recent unprotected sex with FSWs in Approaches 1 and 2**

Table 3 presents the adjusted odds ratios from Approach 1 and the adjusted rate ratios from Approach 2.

In Approach 1, the following factors were independently associated with having had any unprotected sex with a Tijuana FSW during the four months prior

to interview: reporting being high during sex with a FSW during the past four months (adjusted odds ratio (aOR)=3.15; 95% confidence interval (CI) = 2.00-4.96), visiting the same sex worker (aOR=2.26; 95% CI = 1.45-3.53), being married or in a common-law relationship (aOR=1.53; 95% CI = 1.00-2.35), and being unemployed (aOR=1.55; 95% CI = 1.00-2.39) [10] (Table 3).

In Approach 2, factors independently associated with higher number of unprotected sex acts with Tijuana FSWs were: being high during sex with a FSW during the past four months (adjusted rate ratio (aRR)=2.14; 95% confidence interval (CI) = 1.41-3.24), reporting a male sex partner during the past four months (aRR=1.69; 95% CI = 1.22-2.33), living with a partner or spouse (aRR=1.61; 95% CI = 1.13-2.31), the number of FSWs visited in Tijuana during the past four months (aRR=1.03 per unit increase; 95% CI = 1.01-1.04), and the number of sex acts with FSWs in Tijuana (aRR=1.03 per unit increase; 95% CI = 1.03-1.04) (Table 3).

Being high during sex was the only significant correlate identified by both approaches. No two-way interactions between factors included in either multivariate model were significantly associated with the dependent variable (Table 3) [10]. The results of the Vuong z-test were non-significant, indicating that the zero-inflated negative binomial regression model did not confer a better model fit than an ordinary negative binomial regression model. With regard to model fit metrics, the likelihood ratio test indicated a p-value of  $p < 0.0001$  for Approach 1, and the Wald test p-value was  $p < 0.0001$  for Approach 2, indicating very good fit for both models.

## DISCUSSION

In support of our hypothesis, the results of the two modeling approaches - using a dichotomous dependent variable measuring any unprotected sex vs. using a count dependent variable measuring the number of unprotected sex acts - showed that each approach identified several unique correlates that were not identified by the other. Specifically, the dichotomous approach performed by Goldenberg et al. found that being high during sex with a FSW in Tijuana, being married or in a common-law relationship, visiting the same FSW, and being unemployed were independently associated with reporting recent unprotected sex with a FSW in Tijuana. The count approach found that being high during sex with a FSW in Tijuana, sex with a male partner, living with a partner or spouse, the number of FSWs visited, and the number of acts of sex with FSWs were independently associated with the number of unprotected sex acts. Although the two approaches used the identical independent variable construction and data set from a sample of male clients of FSWs in Tijuana, the results of the two different approaches yielded only one common correlate. These findings have implications for researchers in that two similar approaches to measuring unprotected sex may produce different results. Therefore, when designing interventions and studies measuring unprotected sex, researchers should consider which type of dependent variable will provide the most useful answers to particular research questions within the population of interest.

In the case of the previously conducted dichotomous approach, the odds ratio represents the odds of reporting unprotected sex versus no unprotected sex [13] among a subgroup of men, such as those who are in a married/common-law relationship, to use an example from Approach 1. For male clients of FSWs in Tijuana, the odds of reporting unprotected sex with a FSW during the past four months were 2.26 times for those who returned to the same FSW as for those who did not report unprotected sex. In this case, clients who are more likely to revisit the same FSW may represent a riskier group [10] for whom safer sex interventions could be developed to initiate condom-using behavior. One implication for this result is that researchers can examine hypotheses related to why male clients may or may not be exhibiting condom-using behaviors. But since it is not associated with the count approach this variable does not relate to the total amount of unprotected sex.

In contrast to modeling a dichotomous outcome, modeling a count dependent variable using negative binomial regression produces parameter estimates that may be exponentiated to obtain the ratio of two rates, given that the independent variable is binary [14]. In the case of Approach 2, this ratio represents the rate of unprotected sex among clients who report sex with a male partner, versus clients who did not report sex with a male partner. The rate of unprotected sex with FSWs among clients who reported sex with a male partner was 1.69 times as high as the corresponding rate among clients who did not report sex with a male partner. In the current analysis, those who report sex with males may represent a riskier group for whom safer sex interventions could be

developed to decrease the frequency of unprotected sex. One implication for this result is that researchers can examine hypotheses related to the total amount of unprotected sex male clients may be engaging in. But it may not relate to their condom using habits.

Given that the two approaches used to measure unprotected sex produced differing results, there are implications for researchers conducting studies examining unprotected sex, in that each approach has advantages and disadvantages concerning various study types. Dichotomous measures can be used to distinguish individuals who consistently use condoms from those who do not. Therefore, these binary variables are useful in examining condom use as a tendency or habit, whereby those who do not engage in unprotected sex can be compared to those who do engage [15]. If a researcher believes there is something fundamentally different between these two groups in regards to their condom use, this approach may provide insight into these differences. For example, the dichotomous approach shows that male clients who engaged in unprotected sex with FSWs were more likely to be in a married/common-law relationship. A researcher may hypothesize that male clients who are in long-term committed relationships are less accustomed to using condoms, which could explain why they do not use them habitually [11]. The dichotomous approach permits the comparison of the “any” versus “none” risk groups, providing the ability to compare groups which may have very different levels of risk while simplifying the analysis to two groups. This may explain why studies examining correlates of unprotected sex more commonly use a dichotomous [16-

17] or categorical [18-19] dependent variable rather than a count dependent variable. Possibly due to the simplified analyses of dichotomous variables, they have also been preferred in studies examining associations between psychosocial variables and unprotected sex. According to a meta-analysis, dichotomous measures are used much more commonly than count variables to test psychosocial models of theory explaining sexual risk behaviors [20]. An additional advantage of the dichotomous variable is that unlike count variables, a binary variable measuring sexual risk can be easily compared across studies that use the same outcome of *no* unprotected sex versus *any* unprotected sex, facilitating inter-study comparisons and exploratory research.

Situations also exist in which using a count dependent variable may be preferred to answer certain questions in sexual risk research. If the primary concern of the research is the number of exposures to unprotected sex rather than a study of the differences between those who do and do not use condoms, researchers may find that using a count dependent variable is the preferred approach, as it may be the best indicator of the total amount of sexual risk [21-25]. When examining the effects of a prospective intervention, for example, using an outcome variable whose range can vary across a continuous spectrum is particularly useful. From a social and psychological perspective, it may be difficult to reduce the number of unprotected sex acts to zero. However, decreasing the number of acts is a more realistic goal. This number is measurable using a count variable, whose measurement provides more information than measuring whether a participant engaged in condom use every

time (i.e., reports no unprotected sex) [15, 23]. Many examples from the literature illustrate the utility of a count variable as part of interventions to decrease exposure to unprotected sex [26-28]. In a review of 116 studies measuring unprotected sex, Schroder found that count data were significantly more likely to be used in intervention and methodological research studies, while relative frequency data were significantly more likely to be used in correlational studies ( $p < .001$ ) [15].

Each of the two approaches measuring unprotected sex in this study also has disadvantages. For instance, while dichotomous measures are useful in research exploring differences in those who report any versus no unprotected sex and are useful in testing model hypotheses, they do not provide information about the magnitude of unprotected sexual episodes [15]. By nature of their construction, dichotomous variables created from continuous variables or from categorical variables with multiple categories ignore much of the variation contained in the original measurement and are thus subjected to a significant loss of data [29]. This loss of data causes a lack of precision in the measurement [23], which could lead to lack of detection of hypothesized relationships and accepting the null hypothesis when it is false (type II error) [24]. For example, during dichotomization of a variable measuring unprotected sex, someone who reports one act of unprotected sex out of 100 total acts is placed into the same category as someone who reports 100 unprotected acts out of 100 total acts. Due to their different sexual risk profiles, these individuals may not belong in the same category of risk, and they would be treated much differently from each

other when using a count approach. In regards to the count approach, one possible disadvantage of using this type of variable in sexual risk research is that measures of frequency of unprotected sex are not as easily incorporated into theoretical frameworks due to the fact that more complex statistical techniques are required to analyze these variables. Count variables are less likely to be used in the empirical testing of theoretical models [15, 30-31] and most frameworks measure condom use as a dichotomous, categorical, or proportional variable.

Given the advantages and disadvantages to both analytic approaches, researchers must consider which approach is most appropriate to answer the research question that has been posed. Studies considering the correlation between count measures of unprotected sex and relative frequency measures of unprotected sex, the latter which include dichotomous measures, have found inconsistent and weak associations between the two measures [20, 32], suggesting that one measure may not substitute for another. As witnessed by the divergence in the results of the two analytical approaches we compared (see Table 3), the use of one approach may identify potential indicators of sexual risk that are not associated with the other approach. Assuming that these differing results were not due to type I (“false positive”) or type II (“false negative”) errors, identifying one set of correlates versus another could have implications for intervention strategies.

In the case of male clients of FSWs, past research suggests that male clients of FSWs are important drivers of the HIV epidemic [33-36]. The influence of these results for resource allocation to groups that are potentially at more risk



for HIV transmission is therefore very important. As the research question dictates which analytical approach will be used, there are no steadfast conventions to determining which approach to analyzing unprotected sex data is conclusively better than another under any set of conditions. For example, most interventions involving sexual risk have used count dependent variables during analysis. However, dichotomous dependent variables have also been successfully used to analyze the results of behavioral interventions [37-38]. Given the lack of unanimity on statistical approaches and the variety of analytical approaches available to statisticians, it may not benefit researchers to utilize more than one approach when conducting research on unprotected sex. Using multiple techniques may provide answers to a broad spectrum of questions, but these answers can produce more than one set of results that may not be reconcilable. It is also recommended to use caution when comparing results of various analytical approaches, since each approach is based on different assumptions and may identify unique correlates.

Some study limitations should be noted. In order to minimize incorrect recall of sexual behavior, some researchers prefer diary or timeline feedback methods for collecting event-level unprotected sex behavior data. Our survey did not collect this information. Since the number of unprotected sex acts was not controlled for in the dichotomous model, we did not use an offset term to account for the total number of sex acts in the count variable analysis. While this would have standardized the total number of unprotected sex acts among clients, excluding the offset term kept the analyses as similar as possible. When this

offset term was added to the count model, the variable measuring the number of FSWs visited fell out of the model, but there was no additional agreement between the results of the two analyses in terms of final model variables. Self-report and recall can be flawed, especially in populations of drug users [23, 39]. These potential biases could underestimate or overestimate the associations found in both approaches undertaken in our study. Finally, we recognize that due to factors such as limited programmatic staff and survey length, not all studies of sexual behaviors collect sexual event data at the level of detail that was collected in the current analysis. Given the differences in results that may be obtained from the analysis of slightly different measures of unprotected sex, if the true interest of a study is to examine sexual behavior as an outcome, it may be worthwhile for researchers to think about the intended uses of their data and the nature of their analytic approaches during study design. That way, even with constrained resources, the appropriate level of detail obtained from the study measurements (e.g., highly variable event level data) will be available for an analyses that will provide nuanced results.

These limitations notwithstanding, the current results demonstrate that among male clients of FSWs in Tijuana, in modeling two types of dependent variables measuring unprotected sex, each approach identified unique correlates compared to the other approach. In planning sexual risk research and the related data analyses, investigators must take into account that each approach offers advantages and disadvantages. Researchers who are interested in targeting subgroups who experience one level of exposure to unprotected sex versus

another may wish to utilize the dichotomous approach in understanding condom use as a behavior, and for allocating prevention resources to certain groups. The count approach to measuring unprotected sex may help policy makers and researchers target, through safer sex interventions, individuals who are exposed to highest frequency of unprotected sex. With these differences in mind, investigators designing studies to examine unprotected sex should consider which approach is most appropriate to address their research question in order to gain a clearer understanding of sexual risk due to unprotected sex.

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Chapter 2, in full, is a reprint of the material as it was submitted to *The Journal of Sex Research*: Volkmann T, Wagner KD, Semple SJ, Strathdee SA, Goldenberg S, Patterson TL. Measuring Unprotected Sex: A Case Study of Two

Analytical Approaches among Male Clients of Female Sex Workers. Tyson  
Volkmann was the primary investigator and author of this paper.

## TABLES

Table 2.1. Characteristics of male clients of FSWs in Tijuana, Mexico

Variable	n (%)
Median Age (IQR)~	36 (28, 44)
Median years of education (IQR)	11 (9, 12)
Latino	313 (79.40)
Spanish speaker	346 (87.80)
Married/common-law	166 (42.10)
Living with partner/spouse	101 (25.60)
Unemployed	155 (39.30)
Bisexual (vs. heterosexual)	49 (12.50)
Has children	259 (65.70)
Median annual income, in thousands of Mexican Pesos (IQR)	57 (15.53)
Lives in Tijuana	209 (52.78)
Unprotected sex with a FSW^	198 (50.4)
Median number of FSWs visited in Tijuana^ (IQR)	4 (2,10)
Median number of sex acts with FSWs^ (IQR)	10 (4, 25)
Male sex partner^	56 (14.20)
Visits the same FSW^	141 (35.90)
High during sex with a FSW in Tijuana^	260 (66.20)
^During the four months prior to interview	
~IQR indicates interquartile range	

**Table 2.2. Comparison of factors associated with (i) recent unprotected sex with FSWs in Tijuana and (ii) the number of recent unprotected vaginal and anal sex acts, male clients of FSWs in Tijuana, Mexico**

Variable	(i) Dichotomous dependent variable approach (Goldenberg, et al.): Unprotected sex with Tijuana FSWs*		(ii) Count dependent variable approach: Number of unprotected sex acts with Tijuana FSWs*	
	Crude Odds Ratio	95% Confidence Interval	Crude Rate Ratio	95% Confidence Interval
<b>Sociodemographic characteristics</b>				
Born in the United States	~	~	0.65	0.34-1.24
Born in Mexico	~	~	1.37	0.70-2.66
Latino	~	~	0.92	0.43-1.98
Age	1.02	1.00-1.04	0.99	0.97-1.02
Years of education	0.93	0.87-0.93	0.94	0.79-1.11
Spanish speaker	2.22	1.17-4.19	1.88	0.84-4.21
Has children	1.88	1.23-2.87	1.11	0.54-2.28
Married/common-law	1.56	1.04-2.33	1.00	0.49-2.04
Bisexual (vs. heterosexual)	1.86	1.00-3.45	2.27	1.04-4.94
Living with partner/spouse	1.56	1.04-2.33	1.81	1.00-3.72
Unemployed	1.48	0.98-2.22	0.79	0.41-1.53
Significant other a FSW	4.76	1.99-10.99	1.61	0.76-3.42
<b>Drug-related variables</b>				
Injected any drug^	2.33	1.45-3.74	1.49	0.77-2.90

Table 2.2, continued

Variable	(i) Dichotomous dependent variable approach (Goldenberg, et al.): Unprotected sex with Tijuana FSWs*		(ii) Count dependent variable approach: Number of unprotected sex acts with Tijuana FSWs*	
	Crude Odds Ratio	95% Confidence Interval	Variable	Crude Odds Ratio
Ever used any drug	2.14	1.13-4.05	1.95	0.87-4.38
Ever used methamphetamine	2.43	1.59-3.71	1.93	0.95-3.91
Ever used heroin	1.83	1.21-2.77	1.58	0.75-3.34
Ever used cocaine	1.44	0.97-2.15	0.91	0.43-1.91
Ever attended substance abuse treatment	1.84	1.11-3.07	1.08	0.55-2.12
Receptive syringe sharing^	3.26	1.86-5.68	1.62	0.83-3.17
<b>Sexual Behaviors</b>				
Number of FSWs visited in Tijuana* (per-unit increase)	1.01	0.99-1.02	1.09	1.08-1.11
Visits the same FSW^	2.25	1.47-3.43	1.68	0.79-3.60
Casual partner other than FSW^	1.47	0.97-2.23	1.00	0.51-1.96
Age of first contact with FSW (per-unit increase)	0.96	0.94-0.99	0.96	0.91-1.02
Number of years visiting FSWs (per-unit increase)	1.03	1.01-1.05	1.02	1.00-1.05
Number of sex acts with FSWs*(per-unit increase)	1.01	1.00-1.01	1.05	1.05-1.06
Male sex partner^	3.50	1.84-6.65	2.04	1.03-4.29
High during sex with a FSW in Tijuana^	3.20	2.06-4.97	3.57	1.76-7.24
Drunk during sex with a FSW in Tijuana^	1.79	1.19-2.68	1.76	0.86-3.59
^During the four months prior to interview ~ Not significant in bivariate analysis in Goldenberg, et al and odds ratio not reported therein.				

**Table 2.3. Comparison of factors independently associated with (i) recent unprotected sex with FSWs in Tijuana and (ii) factors associated with the number of recent unprotected vaginal and anal sex acts, male clients of FSWs in Tijuana, Mexico**

Variable	(i) Dichotomous dependent variable (Goldenberg, et al.): Unprotected sex with Tijuana FSWs*		(ii) Count dependent variable: Number of unprotected sex acts with Tijuana FSWs*	
	Adjusted Odds Ratio	95% CI	Adjusted Rate Ratio	95% CI
High during sex with a FSW in Tijuana <sup>^</sup>	3.15	2.00-4.96	2.14	1.41-3.24
Male sex partner <sup>^</sup>	--	--	1.69	1.22-2.33
Visits the same FSW <sup>^</sup>	2.26	1.45-3.53	--	--
Living with partner/spouse	--	--	1.61	1.13-2.31
Married/common-law	1.53	1.00-2.35	--	--
Unemployed	1.55	1.00-2.39	--	--
Number of FSWs visited in Tijuana <sup>^</sup> (per-unit increase)	--	--	1.03	1.01-1.04
Number of sex acts with FSWs <sup>^</sup> (per-unit increase)	--	--	1.03	1.03-1.04
-- Variable not significant in final model <sup>^</sup> During the last four months				



## REFERENCES

1. Leech, N., K. Barrett, and G. Morgan, *SPSS for Intermediate Statistics: Use And Interpretation*. 2005, Mahwah, New Jersey: Routledge Academic.
2. Patterson, T., S. Goldenberg, M. Gallardo, R. Lozada, S. Semple, P. Orozovich, D. Abramovitz, and S. SA, *Correlates of HIV, sexually transmitted infections, and associated high-risk behaviors among male clients of female sex workers in Tijuana, Mexico*. *AIDS*, 2009. **23**(13): p. 1765-1761.
3. Strathdee, S.A., R. Lozada, R.A. Pollini, K.C. Brouwer, A. Mantsios, D.A. Abramovitz, T. Rhodes, C.A. Latkin, O. Loza, J. Alvelais, C. Magis-Rodriguez, T.L. Patterson, and P.E. Cuete, *Individual, Social, and Environmental Influences Associated With HIV Infection Among Injection Drug Users in Tijuana, Mexico*. *Journal of Acquired Immune Deficiency Syndrome*, 2008. **47**(3): p. 369-376.
4. Lowndes, C., A. Renton, M. Alary, T. Rhodes, G. Garnett, and G. Stimson, *Conditions for widespread heterosexual spread of HIV in the Russian Federation: implications for research, monitoring and prevention* *International Journal of Drug Policy*, 2003. **14**(1): p. 45-62.
5. Morris, M., C. Podhisita, M. Wawer, and M. Handcock, *Bridge populations in the spread of HIV/AIDS in Thailand*. *AIDS*, 1996. **10**(11): p. 1265-1271.
6. Aral, S.O., *Behavioral Aspects of Sexually Transmitted Diseases: Core Groups and Bridge Populations*. *Sexually Transmitted Diseases*, 2000. **27**(6): p. 327-328.
7. Niccolai, L., I. Shcherbakova, O. Toussova, A. Kozlov, and R. Heimer, *The potential for bridging of HIV transmission in the Russian Federation: sex risk behaviors and HIV prevalence among drug users (DUs) and their non-DU sex partners*. *J Urban Health* 2009. **86**(Supplement 1): p. 131-143.
8. Lowndes, C., M. Alary, H. Meda, C. Gnintoungbe, L. Mukenge-Tshibaka, and C. Adjovi, *Role of core and bridging groups in the transmission dynamics of HIV and STIs in Cotonou, Benin, West Africa*. *Sex Transm Infect* 2002. **78**(Supplement 1): p. i69-i77.
9. Semple, S., S. Strathdee, M. Cruz, A. Robertson, S. Goldenberg, and T. Patterson, *Psychosexual and social-cognitive correlates of sexual risk behavior among male clients of female sex workers in Tijuana, Mexico*. *AIDS Care*, 2010. **22**(12): p. 1473-1480.

10. Goldenberg, S., M. Gallardo Cruz, S. Strathdee, L. Nguyen, S. Semple, and T. Patterson, *Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico*. *Sex Transmitted Dis*, 2010. **37**(5): p. 319-324.
11. Patterson, T., T. Volkman, M. Gallardo, G. S. Goldenberg, R. Lozada, S. Semple, C. Anderson, and S. Strathdee, *Identifying the HIV Transmission Bridge: Which Men Are Having Unsafe Sex with Female Sex Workers and with Their Own Wives or Steady Partners?* *JAIDS*, 2012. **E-published only**.
12. Shankar, V., J. Milton, and F. Mannerin, *Modeling accident frequencies as zero-altered probability processes: An empirical inquiry*. *Accident Analysis & Prevention*, 1997. **29**(6): p. 829-837.
13. Arminger, G., C. Clogg, and M. Sobel, *Handbook of statistical modeling for the social and behavioral sciences*. 1995, New York: Plenum Press.
14. Sirotin, N., S. Strathdee, R. Lozada, D. Abramovitz, S. Semple, J. Bucardo, and T. Patterson, *Effects of government registration on unprotected sex amongst female sex workers in Tijuana; Mexico*. *International Journal of Drug Policy*, 2010. **21** p. 466-470.
15. Schroder, K., M. Carey, and P. Venable, *Methodological Challenges in Research on Sexual Risk Behavior: I. Item Content, Scaling, and Data Analytical Options*. *Ann Behav Med*, 2003. **26**(2): p. 76-103.
16. Fritz, R., *AIDS knowledge, self-esteem, perceived AIDS risk, and condom use among female commercial sex workers*. *Journal of Applied Social Psychology*, 1998. **28**: p. 888-911.
17. Sanderson, C. and E. Maibach, *Predicting condom use in African American STD patients: The role of two types of outcome expectancies*. *Journal of Applied Social Psychology* 1996. **26**: p. 1495-1509.
18. Morrison, D., G. Rogers, and S. Baker, *Determinants of condom use among high-risk heterosexual adults: A test of the Theory of Reasoned Action*. *Journal of Applied Social Psychology*, 1995. **25**: p. 651-676.
19. Norris, A. and K. Ford, *Condom use by low-income African American and Hispanic Youth with a well-known partner: Integrating the Health Belief Model, Theory of Reasoned Action, and the Construct Accessibility Model*. *Journal of Applied Social Psychology*, 1995. **25**: p. 1801-1830.

20. Sheeran, P., C. Abraham, and S. Orbell, *Psychosocial correlates of heterosexual condom use: A meta-analysis*. *Psychological Bulletin*, 1999. **125**: p. 90-132.
21. Jaccard, J., R. McDonald, and C. Wan, *The accuracy of self-reports of condom use and sexual behavior*. *Journal of Applied Social Psychology*, 2002. **32**(9): p. 1863-1905.
22. Jemmott, J. and L. Jemmott, *HIV risk reduction behavioral interventions with heterosexual adolescents*. *AIDS*, 2000. **14**: p. S40-S52.
23. Fishbein, M. and W. Pequegnat, *Evaluating AIDS prevention interventions using behavioral and biological outcome measures*. *Sexually Transmitted Diseases*, 2000. **27**: p. 101-110.
24. Crosby, R., *Condom use as a dependent variable: Measurement issues relevant to hiv prevention programs*. *AIDS Educ Prev*, 1998. **10**(6): p. 548-557.
25. Exner, T., D. Seal, and A. Ehrhardt, *A review of HIV interventions for at-risk women*. *AIDS and Behavior*, 1997. **1**: p. 93-124.
26. Carey, M., S. Maisto, S. Kalichman, A. Forsyth, E. Wright, and B. Johnson, *Enhancing motivation to reduce the risk of HIV infection for economically disadvantaged urban women*. *Journal of Consulting and Clinical Psychology*, 1997. **65**: p. 531-541.
27. Kalichman, S., D. Rompa, and B. Coley, *Lack of positive outcomes from a cognitive-behavioral HIV and AIDS prevention intervention for inner-city men: lessons from a controlled pilot study*. *AIDS Education and Prevention*, 1997. **9**: p. 299-313.
28. St. Lawrence, J., T. Brasfield, K. Jefferson, E. Alleyne, R. O'Bannon, and A. Shirley, *Cognitive-behavioral intervention to reduce African American adolescents' risk for HIV infection*. *Journal of Consulting and Clinical Psychology & Health*, 1995. **63**: p. 221-237.
29. McCaffrey, D. and M. Elliott, *Power of Tests for a Dichotomous Independent Variable Measured with Error*. *Health Serv Res*, 2008 **43**(3): p. 1085–1101.
30. Abraham, C., P. Sheeran, D. Abrams, and S. Spears, *Health beliefs and teenage condom use: A prospective study*. *Psychology and Health* 1996. **11**: p. 641-655.
31. Diaz-Loving, R. and G. Villangran-Vaquez, *The Theory of Reasoned Action applied to condom use and request of condom use in Mexican*

- government workers*. *Applied Psychology: An International Review*, 1999. **48**: p. 139–151.
32. O'Leary, A., T. Ambrose, M. Raffaelli, E. Maibach, L. Jemmott, J. Jemmott, E. Labouvie, and D. Celentano, *Effects of an HIV risk reduction project on sexual risk behavior of low-income STD patients*. *AIDS Educ Prev*, 1998 **10**(6): p. 483-92.
  33. Hesketh, T., J. Zhang, and D. Qiang, *HIV knowledge and risk behaviour of female sex workers in Yunnan Province, China: potential as bridging groups to the general population*. *AIDS Care*, 2005. **17**(8): p. 958-966.
  34. Thomas, T., L. Urada, D. Morisky, and R. Malow, *Best Practice Example from the Philippines: A Low-Level Prevalence Country and the Male "Bridge" Population*, in *HIV/AIDS: Global Frontiers in Prevention/Intervention*. 2008, Routledge.
  35. Ruxrungtham, K., T. Brown, and P. Phanuphak, *HIV/AIDS in Asia*. *Lancet*, 2004. **364**(9428): p. 69-82.
  36. Lowndes, C., M. Alary, C. Gnintoungbé, E. Bédard, L. Mukenge, N. Geraldo, P. Jossou, E. Lafia, F. Bernier, E. Baganizi, J. Joly, E. Frost, and S. Anagonou, *Management of sexually transmitted diseases and HIV prevention in men at high risk: targeting clients and nonpaying sexual partners of female sex workers in Benin*. *AIDS*, 2000. **14**(16): p. 2523-2534.
  37. Reinecke, J., P. Schmidt, and I. Ajzen, *Application of the Theory of Planned Behavior to adolescents' condom use: A panel study*. *Journal of Applied Social Psychology*, 1996. **29**: p. 749-772.
  38. Kegeles, S., R. Hays, and T. Coates, *The Mpowerment Project: a community-level HIV prevention intervention for young gay men*. *Am J Public Health*, 1996 **86**(8): p. 1129-36.
  39. Brewer, D., S. Garrett, and S. Kulasingam, *Forgetting as a cause of incomplete reporting of sexual and drug injection partners*. *Sex Transm Dis*, 1999. **26**(3): p. 166-176.

## CHAPTER 3: CORRELATES OF SELF-EFFICACY FOR CONDOM USE

**Title:** Correlates of Self-efficacy for Condom Use among Male Clients of Female Sex Workers

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### ABSTRACT

**Introduction:** Male clients of female sex workers (FSWs) in Tijuana, Mexico engage in high levels of unprotected sex. While behavioral change theories posit that self-efficacy predicts condom use, correlates of self-efficacy for condom use

remain largely unstudied. We examined these correlates among male clients of FSWs in Tijuana.

**Methods:** Eligible male clients were  $\geq 18$  years of age, HIV-negative, lived in Tijuana or San Diego, CA, reported unprotected sex with a Tijuana FSW  $\geq$  once in the past four months, and agreed to be treated for sexually transmitted infections (STIs). Participants completed an interviewer-administered questionnaire including demographics, substance use, psychosocial/psychosexual characteristics (e.g., outcome expectancies for negotiation of safer sex, social support, and sexual sensation seeking), and sexual behaviors. Participants also underwent HIV/STI testing. A stepwise hierarchical multiple regression analysis identified correlates of self-efficacy for condom use.

**Results:** Of 393 male clients, median age was 37 years. Participants were mostly Spanish speaking (92.4%), and employed (61.6%). Factors independently associated with higher self-efficacy for condom use were higher positive outcome expectancies for negotiation of safer sex ( $\beta=0.41$ ;  $p<0.001$ ), lower sexual sensation seeking scores ( $\beta=-0.15$ ;  $p<0.018$ ), and higher social support scores ( $\beta=0.17$ ;  $p=0.001$ ).

**Discussion:** Both psychosocial and psychosexual factors may influence self-efficacy for condom use among male clients of FSWs. These factors represent central constructs in socio-cognitive models that explain behavioral change and could be intervention targets for improving self-efficacy for condom use, and ultimately, safer sex behavior.

**Keywords:** Condom Use, Self-efficacy, HIV Prevention, Male Clients, Female Sex Workers

## INTRODUCTION

In Tijuana, a city situated on the US-Mexican border south of San Diego, California, HIV prevalence among male clients of FSWs is estimated to be 4.1% [1], parallel that of Tijuana FSWs (6.0%) [2]. Male clients of FSWs may be central in HIV epidemics because of their high levels of sexual risk behaviors and their position as a 'bridge' connecting other high risk sexual networks such as FSWs to lower risk sexual networks, which may include significant others and non-FSW casual partners [3-7]. Our research group recently found that married male clients from the United States and Mexico were more likely to report unprotected sex with FSWs than those who were not married [8]. Male clients who reported recent unprotected sex with both a FSW and a wife or steady partner were also more likely to report paying more for unprotected sex with FSWs [9]. Within the same study, engaging in more unprotected sex was associated with lower self-efficacy for condom use [10].

Self-efficacy can be defined as the perceived ability of an individual to perform a behavior [11]. Self-efficacy for condom use is one application of self-efficacy [12], which is an indispensable component to Bandura's Social Cognitive Theory of behavioral change (SCT) [13]. When SCT is applied to HIV prevention, self-efficacy for condom use is considered a major construct [14-17], because individuals who are confident in their ability to use condoms are more likely to use them. Accordingly, self-efficacy for condom use is an important predictor of condom use [16]. SCT further hypothesizes that without self-efficacy, safer sex behaviors (e.g., condom use) are very difficult to practice, even if



individuals possesses relevant knowledge and skills [17]. Understanding factors associated with self-efficacy for condom use is a prerequisite to increasing self-efficacy for condom use, and ultimately, increasing condom use [16, 18]. Increasing self-efficacy for condom use could aid in decreasing transmission of HIV/sexually transmitted infections (STIs) among male clients of FSWs in Tijuana.

SCT is comprised of several other constructs that are thought to influence sexual risk behavior directly or indirectly. One of these constructs vis à vis condom use are outcome expectancies, which are a person's assessments that given behaviors will lead to certain results [13]. Outcome expectancies are causally related to self-efficacy [12], and may directly influence it [19]. Other constructs thought to influence behavior indirectly via self-efficacy are knowledge, skills for self-regulation and risk reduction, and social support [20]. Social support has been theoretically and empirically incorporated into SCT models in an effort to change condom use behaviors [19, 21]. It is believed that successful behavioral interventions using SCT must include all the components that influence self-efficacy, including knowledge and social support [17].

Variables not included in the theoretical constructs of SCT have rarely been examined within SCT despite evidence that these variables could inform behavioral change theories [22-23]. Empirical support exists for examining the association between psychosexual factors and components of SCT, as they could be associated with self-efficacy for condom use. Sexual compulsivity, for example, is defined by a constant and unwanted insistence to attend to sexual

urge [24], and has been associated with self-efficacy for condom use in HIV-positive gay and bisexual men in the United States [25]. Attitudes about condoms were also associated with self-efficacy for condom use in a sample of young adults [26]. Sexual sensation seeking is a personality trait characterized by the continued pursuit of novel sexual experiences [27], and has recently been incorporated into empirical socio-cognitive models for use in behavioral interventions [28]. In these models, sexual sensation seeking has been consistently shown to be directly associated with self-efficacy for condom use [22, 28]. While sexual sensation seeking has been shown to be independently associated with risky sexual behaviors [24, 29-30], evidence is mixed concerning the association between sexual sensation seeking and condom use [22, 28, 31]. Sexual sensation seeking is strongly correlated with sexual self-control [30], which is important in the perceived ability to prevent HIV through condom use [32].

Psychosocial characteristics such as HIV knowledge are theoretically posited to influence self-efficacy for condom use in SCT models. A knowledge component is considered necessary but not sufficient for change in HIV behavioral interventions [17]. HIV knowledge is low in some parts of urban Mexico [33], including among FSWs in the US-Mexico border region [34], suggesting that increasing knowledge could be integral to self-efficacy change in interventions. SCT further specifies that social support is pivotal in the maintenance of health behavior [17]. People may feel more confident about using condoms when they are in a positive social environment in which peers provide

cues for acceptable behavior. Social support may also promote the opportunity for learning correct condom use, which could influence the perceived ability to practice safer sex. This suggests that social support could be included in the design of tailored safer-sex interventions. While studies to date have examined the role of social support on self-efficacy for condom use among youth [35] and young adults [26], this association among high-risk, heterosexual adult males has not yet been established. Differential effects of social support by gender have been found [35], indicating that interventions tailored specifically to men should be developed.

Previous investigations have shown that drug use [36] and alcohol use [37] is prevalent among male clients of FSWs and may be associated with sexual risk behaviors [38-40]. Among male clients of FSWs in Tijuana, studies have shown that methamphetamine use was associated with HIV infection [1]; greater use of illicit drugs was associated with more unprotected sex acts [10]; and using drugs was associated with reporting sex with both a FSW and a steady partner [9]. The association between self-efficacy for condom use and substance use among male clients remains unclear.

The goal of the current study was to examine factors associated with self-efficacy for condom use in a sample of 400 male clients of FSWs in Tijuana, Mexico. We hypothesized that sexual sensation seeking, social support, and outcome expectancies for negotiation of safer sex would be independently associated with self-efficacy for condom use after controlling for sociodemographic characteristics, and sexual behaviors. Since substance use

could confound the association between self-efficacy psychosocial and psychosexual correlates, this analysis examined correlates of self-efficacy for condom use while controlling for drug and alcohol-related variables.

## **METHODS**

### **Data Collection**

Data were drawn from the baseline visit of the *Hombre Seguro* study, an intervention aiming to increase condom use among male clients of FSWs in Tijuana. Between September 2010 and March 2012, 400 male clients of FSWs, half of whom lived in San Diego and half of whom lived in Tijuana by design, were recruited in Tijuana. Eligible men were biologically male, aged at least 18 years, lived in Tijuana or San Diego, reported unprotected vaginal or anal sex with a FSW from Tijuana at least once in the four months prior to enrollment, and agreed to be treated for Chlamydia, gonorrhea, and syphilis if they tested positive. Participants completed a baseline questionnaire that included demographics, drug and alcohol-related variables, psychosocial and psychosexual characteristics, sexual behaviors. Participants underwent HIV/STI testing.

Convenience sampling was used to recruit participants. In central Tijuana, outreach workers and *jaladores* (touts) approached potential participants in the street, and referred potential participants to the study's storefront office. Potential participants were compensated \$5 USD to participate in the eligibility screening process, which asked whether clients paid for sex and the dates of their most

recent sexual acts. To verify that participants were clients of FSWs, men were asked questions relevant to sex work (e.g., the name of a venue where they paid for sex). Men who were interested and eligible for the study were given a card and referred to the study office in central Tijuana. There, eligible men provided written informed consent. Those who were deemed too drunk or high to provide consent were asked to return the next day. As HIV-positive men were ineligible, rapid HIV/STI testing with pre- and post-test counseling was performed upon enrollment. Those who tested positive for Chlamydia, gonorrhea, or syphilis were provided free treatment. Those who tested positive for HIV were directed to the Tijuana Health Department.

The questionnaire was interviewer-administered in private offices, where men were compensated \$20 USD for participation. Computer-assisted personal interviews (CAPI; NOVA Software, MD, USA), were conducted by trained personnel in either English or Spanish depending on the participant's preference. UCSD's Human Research Protections Program and Tijuana General Hospital's and Colegio de la Frontera Norte's Ethics Committees approved the study protocol.

### **Measures**

Surveys consisted of sociodemographic characteristics, drug and alcohol-related variables, sexual behaviors, and psychosocial and psychosexual characteristics. With respect to sociodemographic characteristics, participants were asked about their age, citizenship, languages spoken, whether they had

ever been deported from the United States, city of residence, education, sexual orientation (i.e., heterosexual or gay/bisexual), employment, and marital status.

### **Drug and alcohol-related variables**

Drug use questions asked participants how frequently they had used specific drugs (i.e., heroin, methamphetamine, and cocaine) in the past four months and during sex with a FSW or a male sex worker (MSW). Frequency was measured using a seven-point scale with the following response options: never;  $\leq 1$  a month; 2-3 days/month; once a week; 2-3 days/week; 4-6 days/week; or every day. Variables included in the current analysis were behaviors reflecting substances used at the highest prevalence in this population: heroin, cocaine, and methamphetamine use during the past four months and the use of drugs or alcohol during sex during the past four months.

Due to high reported prevalence of alcohol use among male clients of FSWs [41], the Alcohol Use Disorders Test (AUDIT) was used to assess hazardous drinking [42]. AUDIT scores range from 0 to 40 and were dichotomized at the score of  $\leq 7$  (i.e., little to no alcohol problem) versus  $\geq 8$  (medium or high level of alcohol problems and possible or probable alcohol dependence) for inclusion in the current analysis.

### **Sexual behaviors**

Participants were asked about the number of past STIs since sexual debut, whether they had sex with men in the past four months, and whether they preferred to have sex with men or women. All participants were asked to provide

the total number of times they had vaginal and anal sex with FSWs in the past four months and the number of times they used condoms during these acts.

### **Psychosocial measures**

HIV knowledge was measured using an 18-item true/false scale developed by Carey and Schroder (range: 0-100%; Cronbach's alpha [ $\alpha$ ]=0.89 in the current sample), whereby total number of correct responses were divided by the total number of questions answered to determine a percentage score [43].

Social support was measured by Pearlin's Emotional Support Scale, a seven-item scale (range for mean score: 1-4;  $\alpha$ =0.89 for the current sample; response categories: 1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). Higher mean scores represented a higher level of perceived social support [44].

### **Psychosexual variables**

A seven-item scale measured condom use attitudes (range for mean score: 1-4;  $\alpha$ =0.72), wherein higher mean scores represented more negative attitudes toward condoms [10]. Outcome expectancies for negotiation of safer sex were measured by three items (e.g., "I believe that my partner(s) will still trust me if I suggest safer sex practices") using a four-point scale ranging from 1 (Strongly Disagree) to 4 (Strongly Agree) [45], where higher mean scores (range for mean score: 1-4;  $\alpha$ =0.76 for the current sample) represented higher positive outcome expectancies. The 10-item Sexual Compulsivity scale assessed "insistive, repetitive, intrusive, and unwanted urge to perform sex acts, often in ritualized or routine fashions" [24] (range for mean score: 1-4;  $\alpha$ =0.87 for the current sample). The Sexual Sensation Seeking Scale is a one-dimensional, 11-

item measure developed by Kalichman to capture the constant seeking of unique sexual experiences [24]. The range for mean score was 1-4 and the alpha was 0.76 for the current sample [30].

Our dependent variable, self-efficacy for condom use was measured using a five-item scale that included the following questions from the EDGE study [46]: “I can use a condom properly;” “I can use a condom every time I have penetrative sex;” “I can use a condom in any situation (e.g., with different partners or in different places);” “I can use a condom for penetrative sex while under the influence of drugs or alcohol;” and “I can delay penetrative sex if a condom is not available.” Mean scores were calculated for the scale, which used Likert-scoring with the following four responses: 1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree (range: 1-4;  $\alpha=0.75$  for this study sample).

### **Statistical Analysis**

For examination of differences in male clients’ characteristics by level of self-efficacy for condom use, self-efficacy was dichotomized at the median score. Sociodemographic characteristics were compared between those with higher self-efficacy for condom use and those lower self-efficacy for condom use using chi-square tests for dichotomous variables and t-tests and Wilcoxon rank sum tests for normally and non-normally distributed continuous variables, respectively.

We performed a stepwise hierarchical regression to identify factors associated with self-efficacy for condom use among male clients of FSWs. This analytic strategy permitted us to examine independent associations between



our variables of interest (i.e. psychosocial and psychosexual variables) and self-efficacy for condom use while controlling for groups of variables that were not included in the theoretical framework (i.e., sociodemographic characteristics, drug and alcohol-related characteristics, and sexual behaviors). We entered blocks of variables into a multivariate model in the following steps:

sociodemographic characteristics (step 1), drug and alcohol-related variables (step 2), sexual behaviors (step 3), and psychosocial and psychosexual characteristics (step 4). Psychosocial and psychosexual characteristics that achieved and maintained a 5% level of statistical significance were retained in the final model. Multiple R (the model correlation coefficient) measured the correlation between the model's observed and predicted values. R-squared (the coefficient of multiple determination) measured the combined percent of the variance in the dependent variable explained by the independent variables. The squared semipartial correlation coefficient ( $sr^2$ ) measured the amount of variance in the dependent variable explained by each particular variable. The increase in R-squared was used to evaluate the extent to which the addition of variables from step 4 explained the increase in variance in the dependent variable.

Multicollinearity was assessed by calculating the variance inflation factor (VIF) [47].

## **RESULTS**

### **Descriptive statistics**

Of the 400 participants who enrolled in the study, seven were excluded because data were missing for variables of interest. Of the 393 men who were retained, the median age was 37 years (inter-quartile range [IQR]: 30-45) and the median number of years of education was nine (IQR: 7-12). Most participants were Spanish speaking (92.4%) and employed (61.6%). One-third (34.6%) had ever been deported from the United States. Approximately 12% identified as gay or bisexual and 94.7% preferred sex with a woman. By design, half (51.1%) of the sample reported living in Tijuana and half (48.9%) reported living in San Diego (Table 1).

The median score for self-efficacy was 2.8. Those who scored below the median were classified as having “lower self-efficacy for condom use,” and those who scored at or above the median were classified as having “higher self-efficacy or condom use.” Compared to men with lower self-efficacy for condom use, those with higher self-efficacy were significantly more likely to be Mexican citizens ( $p=0.02$ ), to have ever been deported from the United States ( $p=0.01$ ) and to have higher perceived social support ( $p=0.02$ ), lower sexual sensation seeking ( $p<0.001$ ), and higher positive outcome expectancies for safer sex negotiation ( $p<0.001$ ) (Table 1).

### **Factors associated with higher self-efficacy for condom use among male clients of FSWs**

Table 2 presents the stepwise hierarchical regression models for the correlates of self-efficacy for condom use among male clients of FSWs. Among the sociodemographic characteristics considered in step 1, living in Tijuana was

significantly associated with higher self-efficacy for condom use, while being a Spanish speaker was associated with lower self-efficacy.

None of the alcohol and drug use variables added in step 2 were associated with self-efficacy for condom use when controlling for the sociodemographic characteristics. Similarly, none of the sexual characteristics variables added in step 3 were associated with self-efficacy for condom use when controlling for the sociodemographic, drug use, and alcohol use variables.

Of the psychosocial and psychosexual characteristics added in step 4, higher positive outcome expectancies for negotiation of safer sex ( $sr^2=0.185$ ), higher social support ( $sr^2=0.039$ ), and lower sexual sensation seeking ( $sr^2=0.019$ ) were associated with self-efficacy for condom use. The multiple R for step 4 was 0.637 and the increase in R-squared from step 3 was 0.283, which was significant ( $p<0.001$ ). The F-test p-value for the entire model was  $<0.001$  (Table 2).

***Factors independently associated with higher self-efficacy for condom use among male clients of FSWs***

Factors independently associated with higher self-efficacy for condom use were higher outcome expectancies for negotiation of safer sex ( $\beta=0.41$ ;  $p<0.001$ ), lower sexual sensation seeking ( $\beta=-0.15$ ;  $p=<0.018$ ), and higher social support ( $\beta=0.17$ ;  $p=0.001$ ) (Table 2). Multicollinearity was not problematic, as no VIF value was larger than 5 [48].

**DISCUSSION**

In the current study of male clients of FSWs in Tijuana, factors independently associated with higher self-efficacy for condom use included lower sexual sensation seeking scores, higher social support scores, and higher outcome expectancies for negotiation of safer sex. These results highlight important psychosocial and psychosexual factors that may be directly associated with self-efficacy for condom use.

We found that lower sexual sensation seeking scores were independently associated with higher self-efficacy for condom use among male clients. This result is similar to those from a study among young adults in the United States, which found a direct association between sexual sensation seeking and self-efficacy for condom use [22]. Since both sexual sensation seeking and self-efficacy for condom use may influence condom use, both personality and psychosexual variables should be used concurrently to gain a better theoretical understanding of condom use [22]. However, since previous studies have found limited evidence for a direct association between sexual sensation seeking and condom use [31], the relationships between sexual sensation seeking, self-efficacy for condom use, and sexual behaviors might best be understood through theoretically constructed multivariate models, which have up to this point been underutilized in studies examining these variables and constructs [22]. One analytical approach that could be used to examine the direct and indirect relationships in these multivariate models is structural equation modeling. As structural equation models permit testing of multiple direct and indirect relationships in theoretical models, it might also be useful to include additional

explanatory variables into theoretical frameworks in order to improve their conceptual basis [23]. In addition, understanding the relationships between sexual sensation seeking and other variables within health behavior theoretical models could provide a better understanding to guide the development of successful intervention strategies. Evidence of efficacy in a targeted behavioral intervention including socio-cognitive elements has been shown among high sensation seekers [28]. This suggests that moderation analyses could identify specific groups (e.g., high sensation seekers) that might benefit from interventions. Given that male clients of FSWs may be more likely to be sexual sensation seekers than non-clients [49], targeted socio-cognitive interventions that take into account characteristics such as gender and the propensity to seek novel sexual experiences that may influence self-efficacy for condom use, are recommended [31].

Social support was positively associated with self-efficacy for condom use. To our knowledge, this is a unique finding among male clients of FSWs; however, the association between social support and self-efficacy for condom use has been observed among other populations. A study of youth aged 15-24 in Cameroon found that parental support for condom use was associated with condom use self-efficacy [35]. In Bangladesh, more support from peer educators was associated with high condom use self-efficacy among sex workers [50]. Self-efficacy for condom use was directly related to social support in a sample of 275 undergraduate students in the United States [26]. Although the examples mentioned from the supporting literature represent specific kinds of social

support rather than general social support, these variables still involve the supporting influence of family members or peers; and this support is associated with self-efficacy for condom use. One possible avenue for creating interventions to increase self-efficacy for condom use is to integrate a social-cognitive approach that includes a positive social environment that provides cues about acceptable behavior. This tactic could be included in an approach that emphasizes observational learning and skill building [51], and should be incorporated in interventions with other components necessary for self-efficacy building [17].

Outcome expectancies for safer sex negotiation had the strongest association with condom use self-efficacy in our analysis, which is postulated by SCT [12-13]. This finding is consistent with a previous research examining sexual risk among US college students, where 53% of the variance in self-efficacy was explained by outcome expectancies [52]. Although we could not determine temporality in this study, SCT posits that self-efficacy causally influences outcome expectancies [12], and empirical evidence exists for this premise [53]. However, there are also indications that outcome expectancies causally influence self-efficacy [52]. This distinction is important because if outcome expectancies cognitively and causally precede self-efficacy, then interventions attempting to increase self-efficacy could be designed to improve outcome expectancies in order to influence self-efficacy, and ultimately, behavior [11]. For example, in order to improve self-efficacy, a cognitive intervention could aim to overcome the negative expectancies associated with negotiating condom use with partners

among high sexually sensation seeking male clients by practicing condom negotiation dialogues. If self-efficacy influences outcome expectancies, then traditional SCT safer-sex intervention approaches, such as skill building [17] (e.g., increasing condom using skills), could be utilized. Given the importance of the placement of these constructs within SCT, longitudinal studies should be conducted to determine the temporality of these relationships. Regardless of temporality, given that many studies have demonstrated a strong association between outcome expectancies and self-efficacy and their subsequent associations with condom use, it is clear that they are important to take into account in the development and implementation of safer sex interventions. In fact, it has been suggested that three of the most important factors in condom use behavior are outcome expectancies, self-efficacy, and social support for condom use [19]. Successful social cognitive interventions have shown that peer- and motivational-modeling is an effective way to shape outcome expectancies and self-efficacy [19, 21, 45, 54].

Some limitations should be taken into account when considering the results of the current analysis. Due to errors in participant memory, self-report of sexual risk behavior may be less accurate than other methods. For this reason, participants were only asked about recent sexual behavior within the four months prior to interview. Use of cross-sectional data in this study limited our ability to assess causality. The alpha for negative attitudes toward condoms was marginally acceptable ( $\alpha=0.72$ ), which may have limited their ability to measure constructs properly and could lead to an underestimation of associations.

Caution should be used generalizing our results to other populations due to the specific characteristics of male clients of Tijuana.

Despite these limitations, we identified three factors that were independently associated with higher self-efficacy for condom use among male clients of FSWs in Tijuana: higher outcome expectancies for negotiation of safer sex, lower sexual sensation seeking, and higher social support. These factors represent important upstream variables in socio-cognitive models and are necessary components for change in self-efficacy for condom use in empirical socio-cognitive frameworks. These factors could be used as modifiable components in targeted behavioral interventions designed to improve self-efficacy for condom use, and ultimately, safer sex behavior among individuals at high risk for HIV/STI transmission.

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## TABLES

**Table 3.1. Characteristics of clients with high versus low self-efficacy for condom use, male clients of female sex workers in Tijuana, Mexico.**

	<b>Lower self-efficacy for condom use (&lt;2.8; N=179)</b>	<b>Higher self-efficacy for condom use (≥2.8; N=214)</b>	<b>Total (N=393)</b>	<b>p-value</b>
<b>Characteristic</b>				
Median age (IQR)	37 (29, 44)	38 (30, 46)	37 (30, 45)	0.16
Mexican citizenship	133 (74.3%)	166 (77.6%)	299(76.1%)	0.04
Born in Mexico	130 (72.6%)	173 (80.8%)	303 (77.1%)	0.15
Live in Tijuana	84 (46.9%)	117 (54.7%)	201 (51.2%)	0.13
Spanish speaker	170 (95.0%)	193 (90.2%)	363 (92.4%)	0.08
Ever deported from the United States	49 (27.4%)	87 (40.7%)	136 (34.6%)	0.01
Median years lived in current city (IQR)	11 (5, 22)	12.5 (5, 25)	12 (5, 24)	0.53
Married/common-law	38 (21.2%)	60 (28.0%)	98 (24.9%)	0.12
Median years of education completed (IQR)	9 (7, 12)	9 (6, 12)	9 (7, 12)	0.70
Have children	119 (66.5%)	150 (70.1%)	269 (68.5%)	0.44
Employed	117 (65.4%)	125 (58.4%)	242 (61.6%)	0.16
Median hours worked per week (IQR)	35 (0, 40)	24.5 (0, 42)	30 (0, 40)	0.16
Median current annual income in thousands of US dollars (IQR)	7.2 (3.4, 19.2)	5.0 (1.7, 10.0)	5.9 (2.4, 15.0)	0.60
Gay or bisexual (versus heterosexual)	25 (14.0%)	23 (10.8%)	48 (12.2%)	0.33
Prefer to have sex with women	167 (93.3%)	205 (95.8%)	372 (94.7%)	0.27
Wife / steady partner / girlfriend a FSW	20 (11.2%)	24 (11.2%)	44 (11.2%)	0.99
Been in jail or a prison <sup>a</sup>	32 (17.9%)	45 (21.0%)	77 (19.6%)	0.43
Currently on probation or parole	7 (4.0%)	15 (7.0%)	22 (5.6%)	0.18
Median number of STIs since sexual	0 (0, 1)	0 (0, 1)	0 (0, 1)	0.51

Table 3.1, continued

	<b>Lower self- efficacy for condom use (&lt;2.8; N=179)</b>	<b>Higher self- efficacy for condom use (≥2.8; N=214)</b>	<b>Total (N=393)</b>	<b>p-value</b>
Median Social Support (IQR)	3 (2.7, 3.1)	3 (2.9, 3.3)	3 (2.9, 3.1)	0.02
Median Sexual Sensation Seeking (IQR)	2.7 (2.5, 2.9)	2.6 (2.4, 2.8)	2.6 (2.5, 2.8)	<0.001
Median Outcome expectancies for negotiation of safer sex (IQR)	2.7 (2.3, 2.7)	2.7 (2.7, 3.0)	2.7 (2.3, 3.0)	<0.001

<sup>a</sup> Past four months

IQR=Inter-quartile range

**Table 3.2. Self efficacy for condom use regressed on sociodemographic characteristics (Step 1), drug and alcohol-related variables (Step 2), sexual characteristic variables (step 3) and psychosocial and psychosexual factors (Step 4).**

Variable	Step 1		Step 2		Step 3		Step 4	
	$\beta$	$sr^2$	$\beta$	$sr^2$	$\beta$	$sr^2$	$\beta$	$sr^2$
<b>Sociodemographic characteristics</b>								
Age	0.011	<0.001	0.004	<0.001	0.006	<0.001	0.013	<0.001
Mexican citizenship	-0.011	<0.001	-0.006	<0.001	-0.013	0.000	0.003	<0.001
Spanish speaker	<b>-0.178<sub>c</sub></b>	0.025	<b>-0.177<sub>c</sub></b>	0.024	<b>-0.178<sub>c</sub></b>	0.020	<b>-0.149<sub>c</sub></b>	0.025
Live in Tijuana	<b>0.146<sub>c</sub></b>	0.015	<b>0.149<sub>b</sub></b>	0.015	<b>0.156<sub>b</sub></b>	0.016	0.048	0.02
Ever deported from the United States	0.079	0.005	0.078	<0.001	0.072	0.004	0.079	0.007
Married/common-law	0.023	0.001	0.022	<0.001	0.028	<0.001	0.064	0.005
Years of education completed	0.032	0.001	0.031	0.001	0.041	0.001	0.042	0.002
Employed	0.002	<0.001	0.007	<0.001	0.021	<0.001	-0.002	<0.001
Gay or bisexual (versus heterosexual)	-0.043	0.002	-0.038	0.001	0.044	0.001	-0.003	<0.001
<b>Drug and alcohol-related variables</b>								
Used heroin <sup>a</sup>	--	--	-0.013	<0.001	-0.013	<0.001	0.014	<0.001



Table 3.2, continued

Variable	Step 1		Step 2		Step 3		Step 4	
	$\beta$	$sr^2$	$\beta$	$sr^2$	$\beta$	$sr^2$	$\beta$	$sr^2$
Negative attitudes toward condoms	--	--	--	--	--	--	0.003	<0.001
HIV knowledge	--	--	--	--	--	--	-0.047	0.003
Outcome expectancies for negotiation of safer sex	--	--	--	--	--	--	<b>0.408<sub>d</sub></b>	0.185
Sexual Compulsivity	--	--	--	--	--	--	<b>-0.083</b>	0.006
Sexual Sensation Seeking	--	--	--	--	--	--	<b>-0.146<sub>b</sub></b>	0.019
Social Support	--	--	--	--	--	--	<b>0.168<sub>c</sub></b>	0.039
Multiple R	0.243		0.266		0.321		0.637	
R <sup>2</sup>	0.059		0.071		0.103		0.386	
Change in R <sup>2</sup> (p-value of change)	--		0.012 (0.533)		0.032 (0.043)		0.283 (<0.001)	
F (df)	2.75 (8, 384)		1.95 (14, 378)		1.83 (20, 372)		6.56 (27, 365)	
p-value of model	0.006		0.021		0.007		<0.001	

<sup>a</sup> Past four months

<sup>b</sup> p<0.05; <sup>c</sup> p<0.01; <sup>d</sup> p<0.001

## REFERENCES

1. Patterson, T., S. Goldenberg, M. Gallardo, R. Lozada, S. Semple, P. Orozovich, D. Abramovitz, and S. SA, *Correlates of HIV, sexually transmitted infections, and associated high-risk behaviors among male clients of female sex workers in Tijuana, Mexico*. *AIDS*, 2009. **23**(13): p. 1765-1761.
2. Patterson, T., S. Semple, and H. Staines, *Prevalence and correlates of HIV infection among female sex workers in two Mexico-U.S. border cities*. *J Infect Dis*, 2008. **97**(5): p. 728-732.
3. Lowndes, C., A. Renton, M. Alary, T. Rhodes, G. Garnett, and G. Stimson, *Conditions for widespread heterosexual spread of HIV in the Russian Federation: implications for research, monitoring and prevention* *International Journal of Drug Policy*, 2003. **14**(1): p. 45-62.
4. Morris, M., C. Podhisita, M. Wawer, and M. Handcock, *Bridge populations in the spread of HIV/AIDS in Thailand*. *AIDS*, 1996. **10**(11): p. 1265-1271.
5. Aral, S.O., *Behavioral Aspects of Sexually Transmitted Diseases: Core Groups and Bridge Populations*. *Sexually Transmitted Diseases*, 2000. **27**(6): p. 327-328.
6. Niccolai, L., I. Shcherbakova, O. Toussova, A. Kozlov, and R. Heimer, *The potential for bridging of HIV transmission in the Russian Federation: sex risk behaviors and HIV prevalence among drug users (DUs) and their non-DU sex partners*. *J Urban Health* 2009. **86**(Supplement 1): p. 131-143.
7. Lowndes, C., M. Alary, H. Meda, C. Gnintoungbe, L. Mukenge-Tshibaka, and C. Adjovi, *Role of core and bridging groups in the transmission dynamics of HIV and STIs in Cotonou, Benin, West Africa*. *Sex Transm Infect* 2002. **78**(Supplement 1): p. i69-i77.
8. Goldenberg, S., M. Gallardo Cruz, S. Strathdee, L. Nguyen, S. Semple, and T. Patterson, *Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico*. *Sex Transmitted Dis*, 2010. **37**(5): p. 319-324.
9. Patterson, T., T. Volkmann, M. Gallardo, S. Goldenberg, R. Lozada, S. Semple, C. Anderson, and S. Strathdee, *Identifying the HIV Transmission Bridge: Which Men Are Having Unsafe Sex with Female Sex Workers and with Their Own Wives or Steady Partners?* *J Acquir Immune Defic Syndr*, 2012 **60**(4): p. 414-20.

10. Semple, S., S. Strathdee, M. Cruz, A. Robertson, S. Goldenberg, and T. Patterson, *Psychosexual and social-cognitive correlates of sexual risk behavior among male clients of female sex workers in Tijuana, Mexico*. *AIDS Care*, 2010. **22**(12): p. 1473-1480.
11. Williams, D., *Outcome Expectancy and Self-Efficacy: Theoretical Implications of an Unresolved Contradiction*. *Personality and Social Psychology Review*, 2010. **14**(4): p. 417-425.
12. Bandura, A., *Reflections on self-efficacy*. *Advances in Behaviour Research and Therapy*, 1978. **1**: p. 237-269.
13. Bandura, A., *Self-efficacy: Toward a unifying theory of behavioral change*. *Psychological Review*, 1977. **84**: p. 191-215.
14. Quatrella, L., *Predictors of condom-use self-efficacy and perceptions of responsibilities of safer sex behaviors among college students*. 2000, Seton Hall University. p. 131.
15. Bandura, A., *A social cognitive approach to the exercise of control over AIDS infection*. , in *Adolescents and AIDS: A generation in jeopardy*, R. DiClemente, Editor. 1992, Sage: Newbury-Park, CA. p. 89-116.
16. Sheeran, P., C. Abraham, and S. Orbell, *Psychosocial correlates of heterosexual condom use: A meta-analysis*. *Psychological Bulletin*, 1999. **125**(1): p. 90-132.
17. Fisher, J. and W. Fisher, *Theoretical Approaches to Individual-Level Change in HIV Risk Behavior*, in *Handbook of HIV prevention*, J. Peterson and R. DiClemente, Editors. 2000, Kluwer Academic/Plenum.: New York. p. 3-55.
18. O'Leary, A., R. Wolitski, R. Remien, W. Woods, J. Parsons, S. Moss, and C. Lyles, *Psychosocial correlates of transmission risk behavior among HIV-seropositive gay and bisexual men*. *AIDS*, 1992. **19**: p. S67-S75.
19. Wulfert, E. and C. Wan, *Safer Sex Intentions and Condom Use Viewed from a Health Belief, Reasoned Action, and Social Cognitive Perspective*. *The Journal of Sex Research*, 1995. **32**(4): p. 299-311.
20. Montoya, I., *Social network ties, self-efficacy, and condom use among women who use crack cocaine: a pilot study*. *Subst Use Misuse*, 1998 **33**(10): p. 2049-73.
21. Bandura, A., *Social foundations of thought and action: A social cognitive theory*. 1986, Englewood Cliffs, NJ: Prentice Hall.



22. Noar, S., R. Zimmerman, P. Palmgreen, M. Lustria, and M. Horosewski, *Integrating personality and psychosocial theoretical approaches to understanding safer sexual behavior: implications for message design*. Health Commun, 2006. **19**(2): p. 165-74.
23. Ogden, J., *Some problems with social cognition models: A pragmatic and conceptual analysis*. J Health Psychology, 2003. **22**: p. 424-428.
24. Kalichman, S. and D. Rompa, *Sexual sensation seeking and sexual compulsivity scales: Reliability, validity, and predicting HIV risk behavior*. Journal of Personality Assessment, 1995. **65**(3): p. 586-601.
25. O'Leary, A., R. Wolitski, R. Remien, W. Woods, J. Parsons, S. Moss, and C. Lyles, *Psychosocial correlates of transmission risk behavior among HIV-seropositive gay and bisexual men*. AIDS, 2005 **Suppl 1**: p. S67-75.
26. Basen-Engquist, K., *Psychosocial predictors of "safer sex" behaviors in young adults*. AIDS Educ Prev, 1992 **4**(2): p. 120-34.
27. Kalichman, S., n.T. Heckma, and J. Kelly, *Sensation seeking as an explanation for the association between substance use and HIV-related risky sexual behavior*. 1996.
28. Zimmerman, R., P. Palmgreen, S. Noar, M. Lustria, H. Lu, and M. Horosewski, *Effects of a Televised Two-City Safer Sex Mass Media Campaign Targeting High-Sensation-Seeking and Impulsive-Decision-Making Young Adults*. Health Educ Behav, 2007. **34**(5): p. 810-826.
29. Mashegoane, S., K.P. Moalusi, M.A. Ngoepe, and K. Peltzer, *Sexual Sensation Seeking and Risky Sexual Behavior Among South African University Students*. Social Behavior and Personality: an international journal 2002. **30**(5): p. 475-483.
30. Kalichman, S., J. Johnson, V. Adair, D. Rompa, K. Multhauf, and J. Kelly, *Sexual Sensation Seeking: Scale Development and Predicting AIDS-Risk Behavior Among Homosexually Active Men*. Journal of Personality Assessment, 1994. **62**(3): p. 385 - 397.
31. Donohew, L., R. Zimmerman, P. Cupp, S. Novak, S. Colon, and R. Abell, *Sensation seeking, impulsive decision-making, and risky sex: implications for risk-taking and design of interventions*. Personality and Individual Differences, 2000. **28** p. 1079±1091.
32. Bandura, A., *Perceived Self-Efficacy in the Exercise of Control over AIDS Infection*. Evaluation and Program Planning 1990. **13**: p. 9-17.

33. Moyer, L., K. Brouwer, S. Brodine, R. Ramos, R. Lozada, M. Cruz, C. Magis-Rodriguez, and S. Strathdee, *Barriers and missed opportunities to HIV testing among injection drug users in two Mexico--US border cities*. Drug Alcohol Rev, 2008 **27**(1): p. 39-45.
34. Robertson, A.M., V.D. Ojeda, L. Nguyen, R. Lozada, G.A. Martínez, S.A. Strathdee, and T.L. Patterson, *Reducing harm from HIV/AIDS misconceptions among female sex workers in Tijuana and Ciudad Juarez, Mexico: A cross sectional analysis*. Harm Reduction Journal 2012. **9**(35).
35. Meekers, D. and M. Klein, *Understanding gender differences in condom use self-efficacy among youth in urban Cameroon*. AIDS Educ Prev, 2002. **14**(1): p. 62-72.
36. Day, S., H. Ward, and L. Perrotta, *Prostitution and risk of HIV: male partners of female prostitutes*. BMJ, 1993. **307**(6900): p. 359-361.
37. de Graaf, R., I. Vanwesenbeeck, and G. van Zessen, *Alcohol and drug use in heterosexual and homosexual prostitution, and its relation to protection behaviour*. AIDS Care, 1995. **7**: p. 35-47.
38. Wee, S., M. Barrett, and W. Lian, *Determinants of inconsistent condom use with female sex workers among men attending the STD clinic in Singapore*. Sex Transm Infect, 2004. **80**: p. 310-314.
39. Li, Q., X. Li, and B. Stanton, *Alcohol use among female sex workers and male clients: an integrative review of global literature*. Alcohol Alcohol, 2010. **45**(2): p. 188-99.
40. Plant ML, P.M., Peck DF, Setters J., *The sex industry, alcohol and illicit drugs: implications for the spread of HIV infection*. Br J Addict, 1989. **84**(1): p. 53-59.
41. Wee, S., M. Barrett, and W. Lian, *Determinants of inconsistent condom use with female sex workers among men attending the STD clinic in Singapore*. . Sex Transm Infect, 2004. **80**: p. 310 -314.
42. W.H.O. *AUDIT: The Alcohol Use Disorders Test*. 2001 [cited 2011 June 26]; Available from: [http://whqlibdoc.who.int/hq/2001/who\\_msd\\_msb\\_01.6a.pdf](http://whqlibdoc.who.int/hq/2001/who_msd_msb_01.6a.pdf).
43. Carey, M. and K. Schroder, *Development and psychometric evaluation of the brief HIV Knowledge Questionnaire*. AIDS Education and Prevention, 2002. **14**.

44. Pearlin, L., J. Mullan, S. Semple, and M. Skaff, *Caregiving and the Stress Process: An Overview of Concepts and Their Measures*. The Gerontologist, 1990. **30**(5): p. 583-594.
45. Semple, S.J., T.L. Patterson, and I. Grant, *Psychosocial characteristics and sexual risk behavior of HIV+ men who have anonymous sex partners*. Psychology & Health, 2004. **19**(1): p. 71-87.
46. Mausbach, B., S. Semple, S. Strathdee, J. Zians, and T. Patterson, *Efficacy of a behavioral intervention for increasing safer sex behaviors in HIV-positive MSM methamphetamine users: results from the EDGE study*. Drug Alcohol Depend, 2007 **87**(2-3): p. 249-57.
47. Hair, J., A. R, R. Tatham, and W. Black, *Multivariate Data Analysis*. 2006, Upper Saddle River, N.J.: Prentice Hall.
48. Kutner, M., C. Nachtsheim, and J. Neter, *Applied Linear Regression Models*. 4th ed. 2004: McGraw-Hill Irwin.
49. Xantidis, L. and M. McCabe, *Personality characteristics of male clients of female commercial sex workers in Australia*. Arch Sex Behav, 2000 **29**(2): p. 165-76.
50. Sarafian, I., *Process assessment of a peer education programme for HIV prevention among sex workers in Dhaka, Bangladesh : A social support framework*. Soc Sci Med, 2011 [**Epub ahead of print**].
51. Yang, X., G. Xia, X. Li, C. Latkin, and D. Celentano, *Social influence and individual risk factors of HIV unsafe sex among female entertainment workers in China*. AIDS Educ Prev, 2010. **22**(1): p. 69-86.
52. Wulfert, E. and C.K. Wan, *Condom use: A self-efficacy model*. Health Psychology 1993. **12**(5): p. 346-353.
53. Dilorio, C., W. Dudley, J. Soet, J. Watkins, and E. Maibach, *A social cognitive-based model for condom use among college students*. Nurs Res, 2000 **49**(4): p. 208-14.
54. Abraham, C. and P. Sheeran, *Modelling and modifying young heterosexuals' HIV-preventive behaviour; a review of theories, findings and educational implications*. Patient Educ Couns, 1994. **23**(3): p. 173-86.

## CHAPTER 4: DRUG SCENE FAMILIARITY AND EXPOSURE TO GANG VIOLENCE

**Title:** Drug scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico

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### ABSTRACT

We examined drug scene familiarity and exposure to gang violence among residents of a migrant, farming community in rural Baja California, Mexico. In October 2010, 169 members of a single *colonia* (community) underwent an

interviewer-administered survey to assess “exposure to gang violence” and “drug scene familiarity”, as well as other health indicators. Logistic regression was used to identify correlates of exposure to gang violence. Overall, 20% of participants were male, median age was 27 years, 24% spoke an indigenous language, 42% reported exposure to gang violence, and 39% reported drug scene familiarity. Factors independently associated with exposure to gang violence included being younger (AOR=0.80 per 5-year-increase;95%CI=0.67-0.96), living in the community longer (AOR=1.47 per 5-year-increase;95%CI=1.11-1.72), higher educational attainment (AOR=1.70 per 5-year-increase;95%CI=1.07-1.12) and drug scene familiarity (AOR=5.10;95%CI=2.39-10.89). Exposure to gang violence was very common in this community and was associated with drug scene familiarity, suggesting a close relationship between drugs and gang violence in this rural community. In a region characterized by mass migration from poorer parts of Mexico, where drugs and gangs have not been previously reported, emerging social harms may affect these communities unless interventions are implemented.

**Keywords:** Drugs, Gangs, Violence, Mexico, Migration

## INTRODUCTION

Drug availability and the associated rise in risky drug-using behaviours, contribute to the community's potential adverse health outcomes, such as interpersonal violence and harms related to drug dependence, including HIV infection [1]. In Mexico, drug gangs, or cartels, control the major illegal drug trade in the country. At the street-level, gangs, or *pandillas*, are localized entities that engage in illegal activities such as drug distribution, intimidation, and violence. Street-level gangs are defined by peers with mutual interests, identifiable leadership, and internal organization, who act to achieve specific purposes, including conducting illegal activities [2]. According to the UN Office of Drugs and Crime, there has been a dramatic shift in drug trafficking corridors from the preferred Caribbean corridors to the Mexico-Central America Corridor [3]. This trend is especially true for the trafficking of cocaine, which is not produced in Mexico, but is transported to Mexico by land or sea and follows pre-established trafficking patterns through Western, Central, and Eastern Mexico to the United States. In addition to third-party trafficking, hundreds of tons of opium poppies and thousands of tons of marijuana are produced in Mexico and trafficked to the United States by the cartels [3]. Related, distinct patterns have been documented in the initiation of drug use epidemics in other countries that range from no history of drug use, to becoming transit points, trafficking areas and ultimately consuming countries [4].

Drug trafficking routes in western Mexico have been identified as coinciding with the routes traveled by migrants [5], where an elevated risk of drug-related violence exists along drug trafficking routes compared to other areas [6]. Specifically, Baja California has been identified as a zone of transition for migrants from poorer regions of Southern Mexico, who aim to obtain seasonal agricultural work in Baja California or the United States [7]. Once limited to the border region, drug gang violence and related drug supply surpluses now affect non-border areas along the coastal drug corridor in Baja California [8]. If risky behaviours such as unsafe sex and sharing of injection equipment increase as a consequence of greater access to drugs in these communities, it is likely that infectious diseases associated with substance abuse, including HIV and hepatitis C, will follow.

In addition to drug use increasing along trafficking routes, the increased availability of drugs in these areas can contribute to drug use in non-trafficking communities. The concept of “exposure opportunities” may influence drug use in communities where drugs are available, in that it explains why individuals who have previously tried illegal drugs are more likely to initiate drug use with new drugs when they are exposed to them [9-10]. For example, opportunities to try cocaine might be more regular to an individual whose social interactions include those with whom the individual previously used ‘softer’ drugs, such as alcohol. Multiple studies from urban settings in the United States found that availability of illegal drugs increased opportunities for exposure, and was associated with elevated drug use among community members [11-12]. While data have shown

that drug availability and prevalence of drug use have increased in the US-Mexico border region [13], there is scant literature from rural Mexico outside the border region on current drug and violence trends. However, some published studies report the existence of drug use among gang members in Mexico. For example, a qualitative study in Nuevo Leon, Mexico, found that, due to the focus on drug trafficking, drug use within gangs has been understudied, but that drug use is a common cultural practice among Mexican gang members [14].

Drug gang violence, which we define broadly as any violence perpetrated by groups or individuals affiliated with a gang involved in drug trafficking or distribution upon individuals affiliated or unaffiliated with gangs, is associated with drug use, availability, and trafficking in literature examining data from a number of regions globally. For example, Clarke (2006) found “gangs, guns, and ganja” inextricably linked in Jamaica, and that the increase in the cocaine trade by drug gangs in Jamaica during the 1980s and 1990s was connected to gang violence [15]. In South Africa, urban communities and schools are subject to an interrelated trio of afflictions consisting of violence, gangs, and drugs [16]. Likewise, elevated levels of violence in communities in the vicinity of Cali, Colombia during the 1980s were coupled with a high concentration of drugs and gangs [17]. The drug market for methamphetamine in Japan is partially controlled by the Yakuza gang, which uses selective violence to maintain its dominance over the market [18]. In all of these examples, when both violence and drugs are present in a community, they may self-perpetuate to the extent that negative public health outcomes emerge at epidemic levels [19-21].



The Drugs-Violence Nexus Theory emerged as a framework to understand the relationship between illegal drugs and violence in communities [22]. Recently, researchers have used this theoretical paradigm to clarify the causal connections between drugs and outcomes of violence among adolescent street gang members [23]. Findings reveal that drug use increases the propensity of gang members to commit violent acts, with examples in the literature demonstrating a relationship between drugs and gang member violence [24-25]. Three different mechanisms of violence have been proposed within this paradigm: pharmacological, economic-compulsive, and systemic; each of which may presuppose a different manifestation of interpersonal violence [23]. A follow-up study of 300 adolescent youth from the United States found that gang involvement was a highly significant predictor of violent behaviour and substance use [26].

To our knowledge, the Drug-Violence Nexus Theory remains unexplored in the global literature outside of the United States and Mexico. However, researchers have examined the association between drugs and gang violence in many countries. In Brazil and other Latin American countries, for example, Rodgers (1999) found that gangs involved in drug trafficking tended toward more violent behaviour than gangs which were not involved with drugs [27]. Corroborating the evidence from Brazil, Zaluar (1999) asserts that the increased rates of violent crime and murder in Brazilian cities cannot be understood without considering the link to drug trafficking by cartels [28]. A 2008 article comparing youth gangs in Germany, Russia, and Brazil noted that disadvantaged

neighborhoods in Russia under the control of drug factions face high rates of protracted violence [29]. Violence may be used by gangs to control drug distribution and markets [30]. Because gang violence and drugs are often intertwined [31], individuals in communities where gangs and high availability of drugs are present may be adversely affected by both gang member violence and high community drug availability.

As industrial farming and migration cause communities in Baja California to grow in number and size, new drug markets may emerge. To date, little is known about the prevalence of drug use, drug scene familiarity, and exposure to gang violence in rural communities in Baja California outside the US-Mexico border region. Therefore, we conducted a survey to estimate the prevalence of drug scene familiarity and exposure to gang violence in a rural farming community in northern Baja California. We hypothesized that those exposed to gang violence would have an increased familiarity with the drug scene.

## **METHODS**

A cross-sectional study was conducted over a two-day period in March 2010 among a planned sample of 175 residents of a predominately migrant farmworker community in San-Quintín Valley, Baja California. We invited participants to complete an interviewer-administered questionnaire that included questions about substance use and gangs in their community. Institutional review boards at the University of California, San Diego and the *Universidad Autónoma de Baja California* (UABC) in Tijuana, Mexico approved all study procedures.

### **Study setting**

The study site is located in the San-Quintín agricultural region of Baja California, approximately 200 miles south of the US-Mexico border. In 2009, an estimated 5000 residents lived in this community [32], the majority of whom were migrants from outside of Baja California [7] employed by the fruit and vegetable export industry [33]. Most roads in the colonia are unpaved, and dwellings range from having plumbing and electricity to having no plumbing and outdoor pit toilets.

### **Sampling**

We recruited study participants in two ways: (1) all eligible clinic patients were invited to participate after registering for a clinic appointment; and (2) residents of randomly selected households were invited to participate at their homes. In both settings, trained bilingual interviewers explained the study to potential participants and invited them to complete the survey. Eligibility criteria included: community residents age 13 years or older, ability to speak English or Spanish, willing and able to undergo a 30-minute interview, ability to provide informed consent. Adolescents were included because some lifestyle factors assessed, such as substance abuse and sexual behaviours, often begin at an early age. All participants provided written informed consent prior to any involvement in study procedures. Before adolescents enrolled in the study their parents provided informed consent and the minor gave their written assent. While only one adult per household was included in the study, all minors in the household could participate to increase adolescent enrollment. Interviewers

administered questionnaires in private areas in the language of the participants' choice (English or Spanish), and trained recorders marked participants' responses on a paper instrument. Participants received personal hygiene products as compensation for their time.

### **Recruitment**

Within the community, teams of three trained interviewers administered surveys door-to-door. Using a map made from a 2008 aerial photograph of the community, we randomly assigned teams to blocks within the community, whereby each block would either be picked or skipped based on a coin toss, until every block in the community had an opportunity to be sampled. Starting on the eastern side of the street and traveling clockwise around the block, interview teams approached each house on the circumference of the block. If the residents of a house were not home or refused to participate, the team continued to the next house. At the clinic, interviewers assessed patients' eligibility to participate while they waited to see a clinician; if eligible, they were invited to participate in the study. To avoid enrolling the same person at the clinic and in the community, we asked individuals during the screening process if they had already participated in the survey.

### **Survey instrument**

Graduate students trained in research methods and ethics conducted interviews in the open, but out of earshot of others. Interviews lasted approximately 30 minutes. Surveys were written in English and translated into Spanish by a fluently bilingual physician. Mexican co-investigators checked the

instrument for cultural sensitivity and appropriate language. A second bilingual investigator translated the instrument back into English and discrepancies were resolved on both versions. Surveys assessed sociodemographic characteristics; migration; tuberculosis (TB) knowledge; tobacco, alcohol, and illegal drug use by participants, friends, and family members; exercise, leisure time activity, diet, and nutrition; knowledge and perceptions of gangs; sexual behavior; and health history. Interviewers kept basic ethnographic notes during the study to capture observations and comments that were not included in the questionnaire. To protect confidentiality, and since survey responses were not linked to health outcomes, personal identifiers (i.e., names or addresses,) were not collected. Adolescents who reported behaviours that appeared to be dangerous to himself or herself or to the community were encouraged to talk with a trained counselor at the clinic.

Sociodemographic variables collected included age, gender, level of education, occupation, primary language spoken, marital status, and number of children. Migration questions included place of birth, length of time lived in the community, and history of border crossing into the United States. Knowledge of community and personal use of alcohol, tobacco, and illegal drugs were the variables of primary interest for this analysis. Questions varied from less-sensitive (e.g., “Is it easy to get cigarettes in your community?”) to more sensitive questions (e.g., “Have you ever injected any illegal drug?”). To produce our independent variable “drug scene familiarity”, we created a summary variable composed of the questions “Do you know of a person or of a place in your

community where you can get drugs if you wanted them?” and “Do any of your friends use illegal drugs?” We believe this combination of questions is a good measure for drug scene familiarity because participants might answer them more honestly than questions about personal drug use, since social desirability might lead a drug user to answer falsely and introduce bias [34]. To prevent unwanted attention from gang members to our study, we did not directly ask participants if they were in gangs or had committed violent acts. Instead, the indirect question “Have you or anyone you know ever been hurt by someone in a gang?” was used to measure exposure to gang violence and served as the dependent variable in this analysis. We used the word “pandillas” to describe gangs, which is understood in this community to indicate street-level gangs, rather than larger criminally organized adult drug gangs, or “cartels”.

### **Statistical analysis**

After examining continuous variables for normality, we compared those with exposure to gang violence to those with no exposure using the chi-square tests for categorical variables, Fisher’s exact test for dichotomous variables, and Wilcoxon rank-sum tests for continuous variables. We used multivariate logistic regression to identify correlates of exposure to gang violence. Variables that were significant at the  $p < 0.20$  level in univariate analysis were selected for potential inclusion in multivariate models. Only variables that maintained significance at  $p < 0.05$  were retained in the final model. Sixteen (10%) of the 164 individuals included in bivariate analyses were excluded from multivariate

analysis due to missing data for at least one variable contained in our final model.

Model building proceeded via manual backward stepwise selection, whereby likelihood-ratio testing was used to compare nested models. To control for confounding, we removed variables from the model individually and examined changes in associations among the remaining variables. We included interaction terms in the model to see if they were statistically significant and altered the odds ratios for other variables in the model. We used Pearson's residuals to identify outliers within the variables used in the final model; tolerance values tested the variables that were included in the final model for multicollinearity. Hosmer and Lemeshow's Goodness-of-Fit Test assessed whether the final multivariate model was a good fit. We used SAS 9.2 for all statistical analyses.

## **RESULTS**

### **Participant characteristics**

A total of 169 of 175 individuals completed the survey; over one-half (58.3%) were recruited at the clinic. Most participants (79.6%) were female. The median age was 27 years (range: 13-60), and 11.8% were under 18 years old. The median educational attainment was 6 years (inter-quartile range [IQR]: 3-8) and the median time living in the community was 13.1 years (IQR: 9-18). Nearly one-half (46.4%) reported farm work as their principal occupation. A majority (76.9%) of participants were born outside the state of Baja California (55.0% in Oaxaca State) and 24.0% spoke an indigenous language primarily. These

demographic characteristics were similar to past studies conducted in this community [7]. Almost one-quarter (24.2%) reported having a friend who uses illegal drugs, 29.8% knew of a person or place in the community where they could get drugs, and 38.5% reported drug scene familiarity. Twenty-two percent reported gangs to be a big/medium problem in the community and 42.1% reported exposure to gang violence.

### **Factors associated with exposure to gang violence**

Those who reported exposure to gang violence were younger, had a higher level of educational achievement, and were more likely to speak Spanish as their first language rather than an indigenous language compared to those who did not report being hurt by gang violence (Table 1). Compared to participants who were not exposed to gang violence, those who reported exposure to gang violence were more likely to report the following: having ever drunk alcohol; perceiving that they could get illegal drugs in the community; knowing a local place to get drugs; drug scene familiarity; knowing an acquaintance, person, friend, or family member who uses illegal drugs; knowing someone who has used, snorted, or injected drugs; or used marijuana or methamphetamine. Those who reported exposure to gang violence were also more likely to know someone who is in a gang.

### **Multivariate analysis of exposure to gang violence**

In multivariate analysis, factors independently associated with exposure to gang violence included being younger, having lived longer in the community,



having a higher level of educational attainment, and drug scene familiarity (Table 2).

Interview site, gender, employment type, primary language spoken, and place of birth were considered for entry into the multivariate model. However, none was significantly associated with the outcome and their inclusion failed to significantly influence the relationship between the independent and dependent variables, so they were excluded. The inclusion of interaction terms (e.g., language/gender; age/gender) also failed to influence the relationship between the dependent and independent variables. Thus, these terms were not included in the final model. We found no evidence of outliers, multicollinearity, or confounding within our final model, and the goodness-of-fit test provided no evidence to reject the null hypothesis that the final model was a good fit. The R-squared was 0.2077 for the final multivariate model.

## **DISCUSSION**

This study found a high prevalence of exposure to gang violence that was strongly associated with drug scene familiarity among residents of a rural farming community. Thirty-nine percent of participants reported drug scene familiarity, and over 40% reported exposure to gang violence, suggesting a serious concern for this community. The pervasiveness of gangs was apparent in that 83% of those surveyed reported that gangs were active in the community. For example, some community members commented that “*cholos*” (gang members) occupy certain areas of the community, and that residents avoid these areas out of fear

of being attacked. We found no statistically significant difference in perception of gangs being a medium or large problem among those who had been hurt by gangs versus those who had not. As gang violence proliferates throughout Mexico [8], gang membership and associated violence may be increasing in small, non-border communities [14]. Monitoring of behavioral precursors to gang membership (e.g., deviant criminal behavior) [35] could be used to inform interventions to prevent gang membership.

As hypothesized, those who reported exposure to gang violence also reported more familiarity with the illegal drug scene in the community than those with no history of exposure to gang violence. Participants who were hurt by gang violence were more than five times as likely to report drug scene familiarity as those who were not exposed to gang violence. These results suggest a community link between the presence of drugs and gang violence. This relationship is supported by other studies outside of Mexico. For example, Klein (1991) found that gang members in the United States were involved in the distribution of crack cocaine during its emergence, and that violence was associated with crack's presence [31, 36]. Studies from countries as diverse as Trinidad and Tobago [37], South Africa [16], Brazil [38], and Russia [29] have described associations between violence, gangs, and drugs. In Mexico, the nexus between drugs and gang violence at the cartel level is clear; the Mexican Drug War between rival drug gangs was responsible for over 11,000 deaths in Mexico in 2010 alone – mostly in the US-Mexican border region [8]. At the street-level, in a study of notoriously violent gangs in Nuevo Laredo, 60% of

those studied admitted to illegal drug use, suggesting a marriage of drug use and violence in Mexican gangs in the US-Mexico border region [14]. Literature describing the relationship between drugs and gang violence in Mexico outside of the border region is rare. However, the drugs-violence nexus described by Valdez (2006) may provide a framework for future interventions in small Mexican communities where a high availability of drugs and gang violence are concomitant.

Somewhat surprising was that those who reported exposure to gang violence had a significantly higher level of educational attainment, contradicting previous work associating gang involvement with low achievement [35]. It is possible that in the present study educational attainment is a proxy for a greater exposure to social settings where gang recruitment and other activities take place. Past studies have found that gangs are common within school systems [39]. A survey of 4,131 adolescent students in schools in the United States found that gang members were more likely to be involved in drug use, drug selling, and violent activities than non-gang members [40]. In Durban, South Africa, impoverished schools foster gang activity on school grounds, causing increases in violence and providing an environment for recruiting new members [16, 41]. Gangs in this community may be drawn to the school setting, where residents with more years of education would subsequently experience an increased exposure to gangs compared to those who have spent time working in agriculture. In order to inform gang membership prevention, future studies could investigate the role of gangs in San Quintín Valley schools.

In the present study, younger age was independently associated with exposure to gang violence. Gangs generally consist of adolescents and young adults [27, 35]. Formation of youth gangs in communities involves myriad complicated intrapersonal and social factors. Many of these factors may be community-specific, while others may be common among gangs throughout regions of the world where gangs are common. For example, predictors of gang membership among youth globally include factors such as facing social rejection [42] and exposure to urban poverty during childhood, as is the case in the majority of Latin American and Caribbean gangs [27]. Future research could seek to identify societal factors that are common to both the San Quintín Valley and other regions of the world where gang violence is problematic. If gang recruitment is targeting youth in this present study's community, gang prevention interventions in schools could be essential to prevent the harms associated with gang violence and drug use.

Those who reported exposure to gang violence were significantly more likely to have lived in the community longer. These residents were also more likely to be primary Spanish speakers, although this result did not persist in multivariate analysis. Many community residents have recently migrated from Southern Mexico and often speak indigenous languages. Being a Spanish speaker and living in the community longer may be proxies for being a non-migrant member of the community. Compared to long-term residents who may be more involved in the community, migrants are often more isolated and less integrated in the communities to which they have migrated [43]. Increased

community involvement may provide more opportunity for exposure to gang violence and drugs in the present study's community (e.g., in the school system). Migration is associated with gang violence in other settings. For example, youth from El Salvador who emigrated from home to the United States and subsequently returned to El Salvador have often been documented joining the gang *Maras*. These youth were commonly exposed to extremely violent gang behaviours in the United States, and they return to El Salvador having adopted similar behaviours [27]. Researchers conducting further studies in the San Quintín Valley could consider examining the social networks within the community as a means of deducing levels of social isolation, community integration, and other potential correlates for gang exposure.

Our findings indicate that increased familiarity with the drug scene and exposure to gang violence may be creating a specific "habitus" in this community whereby individuals and groups develop subjective strategies that are compatible with the existing objective conditions [44]. That is, in this context of the US–Mexico border as an area where exposure to criminogenic structural conditions is creating an environment of comparatively greater tolerance and participation in these activities among the general public [45]. Our findings are particularly timely given similarly documented phenomenon across other regions of the world, in which trafficking of drugs by criminal organizations contributes to increases in drug availability and use in communities along drug distribution routes [5, 38, 46–47]. In our context, the drug distribution corridor of Mexico's west coast is contributing to a spillover effect of drugs in the US-Mexico border region [48].

Our research provides initial evidence of how drug use is extending from more urban border areas to more rural communities.

Certain limitations should be considered in interpreting these findings. Due to the study's cross-sectional design, we could make no causal inferences about drug scene familiarity and exposure to gang violence. Social desirability may have decreased the reported frequency of some of the personal drug-use responses, and concerns about confidentiality may have led some participants to under report exposure to gang activity. We recognize that second-hand reports of others' behaviours may be less accurate than self-reporting, but safety concerns prevented our team from asking about personal gang involvement. Therefore, we used proxies to obtain a suitable understanding of behaviours and perceptions in this community to motivate and inform future study designs. Additionally, because some participants may not have felt safe admitting to illegal behaviours, the use of variables that characterized participants' familiarity of the drug scene may have given a more accurate representation of community drug use prevalence than questions about participants' own behaviors. Due to safety concerns, we did not ask about drug cartels or the possible relationship between local gangs (*pandillas*) and cartels. Future studies could consider collecting qualitative data to elucidate the possible relationships between the larger cartels and the local street-level gangs. The Drugs-Violence Nexus outlines three typologies of violence that can emerge within the paradigm. However, our survey did not specifically ask about the mechanism or type of violence being reported within the community. Although our study may have limited

generalizability outside of the San Quintín valley, it does characterize the high availability of drugs in this community, which may be symptomatic of areas lying on the drug trafficking route in Mexico. Males were underrepresented in this study because they were more likely than women to be working in the fields when we conducted our survey. However, controlling for gender did not affect the associations for any of the variables in our final model. Qualitative data were not collected in this study; a mixed methods approach is recommended for future studies. The potential for site differences was possible since we recruited from both the community and the clinic. However, differences persisted on less than 7% of our variables by location, which could easily be explained by chance variation.

## **CONCLUSIONS**

Despite these limitations, our study found that exposure to gang violence was common among members of this community, and that it was independently associated with familiarity with the local drug scene. These findings suggest a close relationship between drugs and gang violence in this rural community. In a region where drugs and gangs have not been previously reported, which is characterized by mass migration from poorer parts of Mexico, interventions are needed to prevent the impact of social harms that are manifesting in non-border communities from worsening.

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Chapter 4, in full, is a reprint of the material as it appears in *Global Public Health*: Volkmann T, Fraga MA, Brodine SK, Iñiguez-Stevens E, Cepeda A, Elder JP, Garfein RS; for the VIIDAI team. Drug scene familiarity and exposure to gang violence among residents in a small community in Baja California, Mexico. *Glob Public Health* 2012 Oct 16. Published online 2012 October 16. DOI: 10.1080/17441692.2012.729220. The final publication is available at <http://www.tandfonline.com/doi/full/10.1080/17441692.2012.729220>. Tyson Volkmann was the primary investigator and author of this paper.



## TABLES

**Table 4.1. Univariate analysis of participant characteristics and perceptions by exposure to gang violence<sup>a</sup> among residents of a rural farm-worker community in Baja California, Mexico, 2010.**

	<b>Ever Exposed to Gang Violence n=69 n (%)<sup>b</sup></b>	<b>Never Exposed to Gang Violence n=95 n (%)<sup>b</sup></b>	<b>Univariate OR (95% CI)</b>	<b>p-value</b>
<b>Demographics</b>				
Median age (IQR)	25 (21,32)	29 (23,39)	0.96 (0.93-0.99)	<b>0.01</b>
Interviewed at clinic	42 (60.9%)	53 (55.8%)	0.83 (0.44-1.56)	0.68
Male	16 (23.2%)	17 (17.9%)	0.70 (0.32-1.50)	0.46
Median years of education (IQR)	6 (3.5,9.0)	5 (2.5,6.0)	1.09 (1.01-1.18)	<b>0.04</b>
Have mobile phone	32 (46.4%)	50 (52.6%)	0.76 (0.41-1.42)	0.49
Occupation	--	--	--	
Homemaker	29 (42.0%)	27 (28.4%)	--	Ref.
Farm worker	28 (40.6%)	49 (51.6%)	1.62 (0.66-3.96)	0.30
Other	12 (17.4%)	18 (18.9%)	0.86 (0.36-2.04)	0.72
Spanish primary language	60 (87.0%)	64 (67.4%)	3.52 (1.50-8.27)	<b>&lt;0.01</b>
Married	56 (81.2%)	78 (82.1%)	0.94 (0.42-2.09)	0.96
Born in vicinity	14 (20.3%)	14 (14.7%)	1.47 (0.65-3.35)	0.48
Born outside Baja	50 (72.5%)	78 (82.1%)	0.57 (0.27-1.21)	0.14
Median years lived in community (IQR)	15 (9.6,19.0)	13 (7.0,17.3)	1.04 (0.99-1.08)	0.14
Median household size (IQR)	5 (4,7)	5 (4,7)	0.97 (0.85-1.12)	0.71
Median number children (IQR)	2 (1,3)	2 (1,4)	0.870 (0.74-1.02)	0.08
Ever crossed the border to USA	12 (17.4%)	18 (18.9%)	0.90 (0.40-2.02)	0.96
<b>Drug Use</b>				
Easy to get cigarettes in community	57 (82.6%)	64 (67.4%)	2.23 (0.91-5.45)	0.08
Current smoker	15 (21.7%)	20 (21.1%)	1.00 (0.99-1.00)	0.97
Ever drank alcohol	30 (43.5%)	24 (25.3%)	2.28 (1.17-4.42)	<b>0.02</b>
Could get illegal drugs in community	31 (44.9%)	24 (25.3%)	2.38 (1.10-5.15)	<b>0.04</b>
Ever been offered illegal drugs	15 (21.7%)	10 (10.5%)	2.28 (0.95-5.44)	0.10

Table 4.1., continued

	Ever Exposed to Gang Violence n=69 n (%) <sup>b</sup>	Never Exposed to Gang Violence n=95 n (%) <sup>b</sup>	Univariate OR (95% CI)	p-value
Ever been offered drugs by a peer	8 (11.6%)	9 (9.5%)	1.22 (0.45-3.35)	0.44
Know someone who has used drugs	54 (78.3%)	42 (44.2%)	4.37 (2.17-8.83)	<0.001
Know a place to get drugs	29 (42.0%)	19 (20.0%)	3.18 (1.57-6.44)	0.001
Friend(s) who uses illegal drugs	26 (37.7%)	12 (12.6%)	4.13 (1.89-9.00)	<0.001
Drug scene familiarity <sup>c</sup>	41 (59.4%)	24 (25.5%)	4.27 (2.19-8.33)	<0.001
Family member(s) have used drugs	22 (31.9%)	15 (15.8%)	2.52 (1.19-5.33)	0.02
Know someone who has snorted drugs	30 (43.5%)	24 (25.3%)	2.36 (1.21-4.62)	0.02
Know someone who has injected drugs	15 (21.7%)	6 (6.3%)	4.06 (1.48-11.10)	<0.001
Know someone who has used marijuana	51 (73.9%)	50 (52.6%)	3.06 (1.49-6.29)	<0.001
Know someone used methamphetamine	10 (14.5%)	4 (4.2%)	3.88 (1.16-12.99)	0.04
Know someone who has used cocaine	10 (14.5%)	10 (10.5%)	1.25 (0.50-3.15)	0.81
Know someone who has used heroin	9 (13.0%)	6 (6.3%)	2.28 (0.77-6.75)	0.14
Ever used illegal drug	7 (10.1%)	4 (4.2%)	2.46 (0.69-8.75)	0.17
Ever used cocaine	3 (4.3%)	1 (1.1%)	5.25 (0.40-68.95)	0.47
Ever used marijuana	5 (7.3%)	1 (1.0%)	17.50 (1.22-250.4)	0.08
<b>Gangs and Violence</b>				
Much violence in the community	29 (42.0%)	47 (49.5%)	1.58 (0.83-3.00)	0.16
Gangs present in community	64 (92.8%)	77 (81.1%)	1.50 (0.48-4.69)	0.68
Gang problem big/medium	14 (20.3%)	22 (23.2%)	1.39 (0.65-2.99)	0.51
Know someone in a gang	44 (63.7%)	30 (31.6%)	3.79 (1.96-7.34)	<0.001

**Table 4.1., continued**

**Abbreviations:** **STI** = Sexually transmitted infection; **IQR** = Inter-quartile range; **OR** = Odds ratio; **CI** = Confidence interval  
<sup>a</sup>**Exposure to gang violence** = “Have you or anyone you know ever been hurt by someone in a gang?” <sup>b</sup>All values represent the n and % unless otherwise stated. <sup>c</sup>**Drug scene familiarity** = “yes” if participant answered “yes” to either question: “Know a place to get drugs” and “Friend(s) who uses illegal drugs”; otherwise the variable = “no”.

**Table 4.2. Multivariate analysis of factors independently associated with exposure to gang violence among residents of a rural farm-worker community in Baja California, Mexico, 2010.**

<b>Variable</b>	<b>Adjusted OR (95% CI)</b>
Age (per 5-year increase)	0.80 (0.67-0.96)
Time living in community (per 5-year increase)	1.47 (1.11-1.72)
Education (per 5-year increase)	1.70 (1.07-1.12)
Drug scene familiarity	5.10 (2.39-10.89)

**Abbreviations:** OR = Odds ratio; CI = Confidence interval

## REFERENCES

1. Blumstein, A. and J. Wallman, *The Crime Drop in America*. 2000, Cambridge: Cambridge University Press.
2. Miller, W.B., *Crime by Youth Gangs and Groups in the United States*. 1992, U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.: Washington, DC.
3. Crime, U.N.O.o.D.a., *The Threat of Narco-Trafficking in the Americas 2008*. 2008, United Nations: New York City.
4. Programme, U.N.I.D.C., *International Drug control Programme: Facing the Challenge*. 1997.
5. Rachlis, B., K.C. Brouwer, E.J. Mills, M. Hayes, T. Kerr, and R.S. Hogg, *Migration and transmission of blood-borne infections among injection drug users: understanding the epidemiologic bridge*. *Drug Alcohol Depend*, 2007. **90**(2-3): p. 107-19.
6. State, U.D.o. *Travel Warning - Mexico*. 2010 [cited 2011 February 25]; Available from: [http://travel.state.gov/travel/cis\\_pa\\_tw/tw/tw\\_4755.html](http://travel.state.gov/travel/cis_pa_tw/tw/tw_4755.html).
7. Garfein, R.S., J.L. Burgos, A. Rodriguez-Lainz, S. Brodine, A. Pietrucha, A. Rondinelli, R. Laniado-Laborin, E. Ibarra, A. Cañez, and M. Fraga, *Latent Tuberculosis Infection in a Migrant Agricultural Community in Baja California, Mexico*. *J Immigr Minor Health*, 2010. **July 29**.
8. Intelligence, S.G. *Mexico and the Cartel Wars in 2010*. 2010 [cited 2011 February 24]; Available from: <http://www.stratfor.com/weekly/20101215-mexico-and-cartel-wars-2010>.
9. Wagner, F.A. and J.C. Anthony, *Into the World of Illegal Drug Use: Exposure Opportunity and Other Mechanisms Linking the Use of Alcohol, Tobacco, Marijuana, and Cocaine*. *American Journal of Epidemiology*, 2002. **155**(10).
10. Maxcy KF, e., *Papers of Wade Hampton Frost, M.D.: a contribution to epidemiological method*. 1941, New York, NY: The Commonwealth Fund.
11. Crum, R.M., M. Lillie-Blanton, and J.C. Anthony, *Neighborhood environment and opportunity to use cocaine and other drugs in late childhood and early adolescence*. *Drug Alcohol Depend*, 1996. **43**(3): p. 155-61.

12. Dembo, R., N. Allen, D. Farrow, J. Schmeidler, and W. Burgos, *A causal analysis of early drug involvement in three inner-city neighborhood settings*. *Int J Addict*, 1985. **20**(8): p. 1213-37.
13. Brouwer, K.C., S.A. Strathdee, C. Magis-Rodriguez, E. Bravo-Garcia, C. Gayet, T.L. Patterson, S.M. Bertozzi, and R.S. Hogg, *Estimated numbers of men and women infected with HIV/AIDS in Tijuana, Mexico*. *J Urban Health*, 2006. **83**(2): p. 299-307.
14. Guzmán-Facundo, F.R., L.J. Pedrão, K.S. Lopez-García, M.M. Alonso-Castillo, and S.E. Esparza-Almanza, *[Drugs use as a cultural practice within gangs]*. *Rev Lat Am Enfermagem*, 2011. **19**: p. 839-47.
15. Clarke, C., *Politics, Violence and Drugs in Kingston, Jamaica*. *Bulletin of Latin American Research*, 2006. **25**(3): p. 420-440.
16. Matthews, I., R. Griggs, and G. Caine, *The Experience Review of Interventions and Programmes Dealing with Youth Violence in Urban Schools in South Africa*. 1999, Independent Projects Trust.
17. Moser, C., *Encounters with violence in Latin America: Urban poor perceptions from Columbia and Guatemala*. 2004, New York: Psychology Press.
18. Friman, H., *Drug markets and the selective use of violence*. *Crime, Law and Social Change*, 2009. **52**(3): p. 285-295.
19. Short, J. and L. Hughes, *Studying Youth Gangs*. 2006, Oxford, UK: AltaMira Press. 118.
20. Lanier, M., R. Pack, and T. Akers, *Epidemiological Criminology: Drug Use Among African American Gang Members*. *Journal of Correctional Health Care*, 2010. **16**(1): p. 6-16.
21. M Singer, M., *Dose of Drugs, a Touch of Violence, a Case of AIDS: Conceptualizing the SAVA Syndemic*. *Free Inquiry in Creative Sociology* 1996. **24**(2): p. 99-110.
22. Goldstein, G., *The Drugs/Violence Nexus: A Tripartite Conceptual Framework*. *Journal of Drug Issues*, 1985. **39**: p. 143-174.
23. Valdez, A., C.D. Kaplan, and A. Cepeda, *The drugs-violence nexus among Mexican-American gang members*. *J Psychoactive Drugs*, 2006. **38**(2): p. 109-21.
24. Valdez, A. and S. Sifaneck, *"Getting high and getting by". Dimensions of drug selling behaviors among American Mexican gang members in South*

- Texas. *Journal of Research in Crime and Delinquency*, 2004. **41**(1): p. 82-105.
25. Fagan, J., J. Weis, and Y. Cheng, *The social organization of drug use and drug dealing among urban gangs*. *Criminology*, 1989. **27**(4): p. 633-67.
  26. Walker-Barnes, C.J. and C.A. Mason, *Delinquency and Substance Use among Gang-Involved Youth: The Moderating Role of Parenting Practices*. *American Journal of Community Psychology*, 2004. **34**(3-4): p. 235-250.
  27. Rodgers, D., *Youth Gangs and Violence in Latin America and the Caribbean: A Literature Survey*, in *Urban Peace Program Series*. 1999, The World Bank.
  28. Zaluar, A., *Violence Related to Illegal Drugs, "Easy Money" and Justice in Brazil: 1980-1995*. *Management of Social Transformations*, 1999. **35**.
  29. Zdun, S., *Violence in street culture: Crosscultural comparison of youth groups and criminal gangs*. *New Directions for Youth Development*, 2008. **119**: p. 39-54.
  30. De La Rosa, M., E. Lambert, and B. Gropper, eds. *Drugs and Violence. Causes, Correlates, and Consequences*. 1990, USGPO: Washington, D. C.:
  31. Klein, M.W., C.L. Maxson, and L.C. Cunningham, "*Crack,*" *Street Gangs, and Violence*. *Criminology*, 1991. **9**(4).
  32. CifrasXII. *Censo General de Población y Vivienda*. [database on the Internet] [cited 2011 February 24]; Available from: [www.conapo.gob.mx/00cifras/proy/localidad.xls](http://www.conapo.gob.mx/00cifras/proy/localidad.xls).
  33. Gonzalez-Fagoaga, J.E., R. Cruz-Piñero, and M.G. Rangel, *Servicios de salud en migrantes indígenas en San Quintín, Baja California*. *Condiciones de salud en la frontera norte de México*, ed. M. Rangel and M. Hernandez-Avila. Vol. 1. 2009, Mexico, D.F.: El Colegio de la Frontera Norte.
  34. van de Morte, T.F., *Faking it: social desirability response bias in self-report research*. *Australina Journal of Advanced Nursing* 2008. **25**(4): p. 40-48.
  35. Hill, K.G., C. Lui, and J.D. Hawkins. *Early Precursors of Gang Membership: A Study of Seattle Youth*. *Juvenile Justice Bulletin* 2001 [cited 2011 March 3]; Available from: <http://strategicliving.org/190106.pdf>.

36. Howell, J.C. and S.H. Decker. *The Youth Gangs, Drugs, and Violence Connection*. Juvenile Justice Bulletin 1999 [cited 2011 February 25]; Available from: <http://www.ncjrs.gov/pdffiles1/93920.pdf>.
37. Katz, C.M. and A.M. Fox, *Risk and protective factors associated with gang-involved youth in Trinidad and Tobago*. Rev Panam Salud Publica, 2010. **27**(3): p. 187-202.
38. McLennan, J., I. Bordin, K. Bennett, F. Rigato, and M. Brinkerhoff, *Trafficking among youth in conflict with the law in São Paulo, Brazil*. Soc Psychiatry Psychiatr Epidemiol, 2008. **43**(10): p. 81-23.
39. Goldstein, A.P. and D.W. Kodluboy, *Gangs in Schools: Signs, Symbols, and Solutions*. 1998, Champaign: Research Press.
40. Swahn, M.H., R.M. Bossarte, B. West, and V. Topalli, *Alcohol and drug use among gang members: experiences of adolescents who attend school*. J Sch Health, 2010. **80**(7): p. 353-60.
41. Griggs, R., *Children at Risk: The Security Situation in Durban Schools*, in *Public Information Briefing 3*. 1997, Independent Projects Trust: Durban.
42. Dishion, T., S. Nelson, and M. Yasui, *Predicting Early Adolescent Gang Involvement from Middle School Adaptation*. Journal of Clinical Child and Adolescent Psychology, 2005. **34**(1): p. 62-73.
43. Hack-Pola, D., *Migrant Integration: Case for a Necessary Shift of Paradigm*. Journal of Identity and Migration Studies, 2008. **2**(1): p. 37-56.
44. Bourdieu, P., *'Structures, habitus, practices'*, in *The Logic of Practice*. 1990, Cambridge: Polity.
45. Valdez, A. and C. Kaplan, *Conditions That Increase Drug Market Involvement: The Invitational Edge and The Case Of Mexicans In South Texas*. Journal of Drug Issues, 2007. **37**(4): p. 893-917.
46. Beyrer, C., M. Razak, K. Lisam, J. Chen, W. Lui, and X. Yu, *Overland heroin trafficking routes and HIV-1 spread in south and south-east Asia*. AIDS Care, 2000. **14**: p. 75-83.
47. Renton, A., D. Gzirishvili, G. Gotsadze, and J. Godinho, *Epidemics of HIV and sexually transmitted infections in Central Asia. Trends, drivers and priorities for control*. Int J Drug Policy, 2006. **17**: p. 494-503.
48. Bucardo, J., K.C. Brouwer, C. Magis-Rodríguez, R. Ramos, M. Fraga, S.G. Perez, T.L. Patterson, and S.A. Strathdee, *Historical trends in the production and consumption of illicit drugs in Mexico: implications for the*

*prevention of blood borne infections.* Drug and Alcohol Dependendancy, 2005: p. 281-293.



## CHAPTER 5: DISCUSSION

The results of this dissertation contain a number of findings among high risk populations in Baja California Norte, Mexico, including among male clients of female sex workers (FSWs) in Tijuana and among members of an agricultural, non-border community in the rural San Quintín Valley. In Chapter 2, the analysis examining two methods of measuring unprotected sex among male clients of FSWs found that, using the same data set and variable construction, each method identified unique correlates of unprotected sex compared to the other method. This suggests that researchers must be conscientious of using the analytic approach that is most valid to answer their particular research question, since the wrong approach could lead to the identification of correlates or subgroups for interventions, or lead researchers to conclusions that are difficult to reconcile (Chapter 2). There are also implications for understanding correlates of each approach to modeling unprotected sex, as different correlates have different interpretations based on which approach they are associated with.

Among male clients of FSWs in Tijuana, it was found that both psychosocial and psychosexual factors that are central constructs of Social Cognitive Theory (SCT) and other health behavioral theories were associated with higher self-efficacy for condom use, which may in turn influence condom use (Chapter 3). These factors represent both traditional constructs in social-cognitive models (e.g., social support) and non-traditional correlates (e.g., sexual sensation seeking) that may explain behavioral change and could be intervention

targets for improving self-efficacy for condom use, and ultimately, safer sex behavior.

It was also found that, in a small community in the San Quintín Valley, exposure to gang violence was common and was associated with drug scene familiarity, suggesting a close relationship between drugs and gang violence in this community. These findings are the first of their kind in a rural community and provide a starting point for understanding the possible spread of drugs and violence into rural areas of Mexico, while highlighting the need for gang- and drug- prevention interventions (Chapter 4) [1].

All of the current findings relate to risky behaviors in Baja California Norte, Mexico among populations at high risk for negative health outcomes related to sexual behaviors, drug use, and violence. While each individual chapter makes a unique contribution to the literature, the synthesis of their results makes a collective contribution as well. For example, combining the results of Chapters 2 and 3, it is clear that regardless of which analytical approach is used, drug use plays an important role in unprotected sex in male clients in Tijuana. Safer sex interventions to improve self-efficacy for condom use could be targeted to drug using clients. In order to be more efficacious, these interventions could include a drug education or a drug treatment component. To synthesize the results for the two populations studied in the current dissertation, the mobile population of primarily migrants from the San Quintín Valley lives along the same drug trafficking route and migration corridor as the male clients in Tijuana. There may be a continuum of drugs and migration between these two communities. This

suggests that drug-using behaviors, drug availability, and drug-related violence may be very likely to occur both communities, and that the associated adverse public health outcomes that are common in Tijuana could spill into rural communities in Baja California.

The results reported in Chapters 2-4 are summarized in the following section within the context of the supporting theoretical framework and literature. The remaining sections of this chapter address the public health implications and strengths and limitations of the current research, recommended interventions based on results, and directions for future research.

## **SUMMARY OF STUDIES AND MAJOR FINDINGS**

In this section, the results from Chapters 2, 3, and 4 are first summarized in their own chapter subsections. A final subsection that further interprets and synthesizes the findings follows the chapter subsections.

### **Two Analytic Approaches to Measuring Unprotected Sex**

Chapter 2 of this dissertation used quantitative methods to contrast the results of two approaches (i.e. a dichotomous dependent variable and a count dependent variable) to analyzing unprotected sex among male clients of FSWs. The results of the two modeling approaches showed that each approach identified several unique correlates that were not identified by the other. For example, factors independently associated with recent unprotected sex with a FSW in Tijuana using the dichotomous approach were being high during sex with a FSW in Tijuana, being married or in a common-law relationship, visiting the

same FSW, and being unemployed [2]. In contrast, the approach employing the count dependent variable identified the following variables as correlates of a higher number sex acts with FSWs: being high during sex with a FSW in Tijuana, sex with a male partner, living with a partner or spouse, and a higher number of FSWs visited. The only correlate identified by both approaches was being high during sex with a FSW in Tijuana, indicating that the two approaches to measuring unprotected sex can provide very different results. It was concluded that, when measuring unprotected sex, it is important for researchers to consider which type of dependent variable is better suited to answer the particular research question that is being investigated.

The differences in our results stem from the different constructions and interpretations inherent in the use of each of these two types of variables. For instance, while an odds ratio represents the odds of reporting unprotected sex versus no unprotected sex [3] among a subgroup of men (e.g., married/common-law men), modeling a count dependent variable produces a relative comparison of two rates, given that the independent variable is binary [4]. In our modeling exercise, this ratio represents the rate of unprotected sex among one group another versus another.

To expand upon the differences in the correlates of each approach of this analysis, specific examples from the final model results will be shown. First, both approaches identified being high during sex as a correlate. This means that being high during sex is associated with the having any unprotected sex *and* with the total number of unprotected sex acts with FSWs. This indicates that being

high during sex may be influencing both the habit of condom use and the total amount of sexual risk male clients are exposed to with FSWs in Tijuana. Other studies of male clients in Tijuana have found that drug use is associated with unprotected sex and HIV infection [2, 5-7]. Drug using behaviors are important to account for in further analyses in this population and in interventions, as will be discussed further in the Recommended Interventions section. In the count approach, both reporting sex with a higher number of FSWs and a higher number of total sexual acts were associated with the total number of unprotected sex acts. This is a fairly intuitive result, as it follows that, on average, the higher number of exposures to FSWs and sex acts, the higher total number of unprotected sex acts would be reported, when holding other variables steady. This result was also found within a sample of male clients in Singapore, where inconsistent condom use was associated with more visits to FSWs [8]. In our analysis, these correlates were not associated with the dichotomous approach. This means that neither the total number of sex acts nor the total number of FSWs partially explained a difference in whether male clients used condoms every time or not. Effectively, this indicates that regardless of how many exposures to sex male clients reported, they still maintained their condom-using habits, whether they engaged in any unprotected sex or no unprotected sex. Being unemployed was associated only with the dichotomous approach. This result could be viewed as a socioeconomic factor [2], and it could be that those who were unemployed did not have access to condoms, which influenced their condom-using behaviors insofar as they were significantly less likely to use

condoms every time, even if they had desired to use them. This variable may not be associated with the count outcome because the rate of unprotected sex may be less likely to reflect the lack of economic choice to consistently use condoms. Finally, being married/common-law was associated only with the dichotomous approach, whereas living with a partner or spouse was associated only with the count approach. It should be noted that while the variables living with a partner or spouse and being in a married/common-law relationship appear to be similar, these variables were only moderately correlated (60%). A possible explanation for the difference in the results of these correlates of the two approaches is provided below.

Each of the two approaches has advantages in its application to sexual behavioral research. Dichotomous variables, as shown above, are useful in examining condom use as a habit, because those who report the custom of *never* engaging in unprotected sex during the specified time frame can be compared to those who engaged in any unprotected sex during the same time frame, and their differences can be compared to gain useful information about the condom-using habits of specific groups [9]. This approach is ideal for program planners who are trying to determine which subgroups to target for interventions. Based on our results, men who are married/common-law may be more likely to report unprotected sex with FSWs. This may be because they are unaccustomed to using condoms in their primary relationships, and therefore do not use condoms with FSWs either [6, 10]. However, male clients who live with a partner or spouse report a higher rate of unprotected sex with

FSWs than those who do not. This may be due to the fact that those who live with a partner or spouse are significantly more likely to report that their spouse is a FSW or ex-FSW than those who do not live with a partner or spouse. These men, therefore, may be having more unprotected sex with the FSW who is their live-in partner.

Another advantage of the dichotomous approach is that, by creating a binary variable, dichotomization simplifies analyses. This may explain why studies examining the correlates of unprotected sex use a dichotomous [11-12] or a categorical [13-14] dependent variable more often than a count dependent variable. Dichotomous measures are also used more often than count variables to test psychosocial theoretical models explaining sexual risk behaviors [15]. On the other hand, when the main focus of sexual risk research is the number of exposures to unprotected sex, investigators may find that using a count dependent variable is the best indicator of the total amount of unprotected sex or the magnitude of sexual risk undertaken by participants compared to other participants [16-18]. This approach is ideal for researchers who are examining the impact of safer sex interventions. Indeed, count dependent variables have been used more often than dichotomous variables to measure the outcome of unprotected sex in examining the efficacy of sexual risk interventions [19-21].

The results of this research have implications both for researchers and for high risk populations of male clients of FSWs, such as those in Baja California. First, sexual behavioral researchers investigating unprotected sex should be aware that two similar approaches of measuring unprotected sex may produce

different results including disparate correlates of unprotected sex. Therefore, when designing interventions and studies measuring unprotected sex, researchers should consider which type of dependent variable(s) provide the most useful answers to particular research questions within the population of interest. With regard to male clients of FSWs in Tijuana, targeted interventions may be effective in decreasing transmission of HIV/STIs through reducing unprotected sex within this risky population. These interventions could be designed and measured more successfully following the recommendations for researchers outlined in Chapter 2. It is recommended that researchers precisely match their quantitative analytic approach to the research question that they intend to answer. The results produced could determine the destination for resource allocation; they may also affect intervention development, and could potentially influence the success of safer sex interventions designed to decrease HIV transmission in Tijuana.

Specific to the results from the two approaches analyzed in Chapter 2, intervention design could proceed according to a number of factors, including the aim of the intervention and the subgroup of interest. For example, using the dichotomous approach it was found that those who reported unprotected sex were more likely to be unemployed. If it was hypothesized that those who were unemployed actually desired to use condoms, but were less likely to use condoms due to their economic situation preventing them from obtaining condoms, a condom promotion intervention could be designed to examine this hypothesis. Condoms and financial incentives could be given to those who are



unemployed. The analysis of this intervention could entail the examination of whether those who were unemployed and took part in the intervention were more likely to become part of the group who reported no unprotected sex, post-intervention. This would provide information about whether socioeconomic conditions affect condom-using habits among male clients of FSWs. Using the count approach in Chapter 2, male clients who reported sex with a male partner also reported a higher rate of unprotected sex with FSWs in Tijuana. As these male clients may have an average riskier profile than other male clients, a safer sex intervention could attempt to decrease the total amount of unprotected sex by male clients who report sex with male partners. The analysis of this intervention would compare the rate of unprotected sex by intervention participants before and after the intervention. This type of intervention could have the most efficacious and cost-effective outcome on transmission of HIV among male clients of FSWs in Tijuana because it draws its aims from the identification of a subgroup that reports more overall sexual risk. Other possible safer sex interventions among male clients of FSWs will be discussed in more detail in a later section presenting recommended interventions.

### **Correlates of Self-efficacy for Condom Use**

Chapter 3 of this dissertation used a hierarchical regression analysis to determine the correlates of self-efficacy for condom use among male clients of FSWs in Tijuana. Identifying correlates of self-efficacy for condom use may provide insight into modifiable factors that can be used to design tailored interventions for this high risk group. The results of this analysis revealed that

several factors were associated with the outcome variable, which was the mean score of a five-item Likert-scale scored measure of the perceived ability of the participant to use condoms. The following factors were found to be independently associated with higher self-efficacy scores: lower sexual sensation seeking scores, higher social support scores and higher outcome expectancies for negotiation of safer sex.

These results highlight psychosocial and psychosexual factors from SCT that may be directly associated with self-efficacy for condom use. Theoretical models such as SCT permit testing multiple direct and indirect relationships between variables which might explain condom use within this high risk group of male clients. However, researchers have not traditionally included personality variables such as sexual sensation seeking into SCT models. In order to achieve a broader understanding of the factors that directly or indirectly influence self-efficacy for condom use and condom use itself, it might be useful to examine additional psychosexual and psychosocial explanatory variables as part of theoretical frameworks in order to improve their conceptual basis [22]. To that end, Figure 1.1, which represents the guiding theoretical framework for Chapter 3 of this dissertation, incorporates sexual sensation seeking as an example of personality characteristics that could be included in theoretical models or empirical examinations of the correlates of self-efficacy for condom use. Understanding the relationships between sexual sensation seeking and other variables within health behavior theoretical models could guide the development of intervention strategies to increase safer sex behavior.

The finding that sexual sensation seeking was independently associated with self-efficacy for condom use is consistent with findings from a study of 746 young adults in the United States [23], which found, using structural equation modeling, that sexual sensation seeking was directly associated with self-efficacy for condom use. This result was unique in that no previous study has explored this relationship in male clients of FSWs. Other studies have found limited evidence for a direct association between sexual sensation seeking and condom use [24], indicating the need to explore the relationships between sexual personality variables, self-efficacy for condom use, and sexual behaviors through theoretically-informed multivariate models.

The association that was found between higher social support and self-efficacy for condom use are also unique to male clients. However, research in Cameroon among youth aged 15-24 [25], in Bangladesh among FSWs [26], and in a study of students in the United States [27], showed similar results. As social support is an indispensable construct of SCT [28-29], interventions promoting social support may guide successful safer sex interventions among male clients of FSWs in Tijuana.

The strongest association in our final model was between outcome expectancies for safer sex negotiation with condom use self-efficacy. This finding corroborates the construction of SCT, which asserts that outcome expectancies are causally associated with self-efficacy [30-31]. Empirical findings also support this result. Previous research examining unprotected sex among university students in the United States showed that 53% of the variance

in self-efficacy was explained via outcome expectancies [32]. With regards to these results, implications for intervention implementation are discussed in more detail below.

### **Drug Scene Familiarity and Exposure to Gang Violence**

Chapter 4 of this dissertation used a survey and quantitative methods to determine the prevalence of drug scene familiarity and exposure to gang violence among residents in a rural community in the San Quintín Valley, Baja, Mexico. The study used logistic regression to examine the association between drug scene familiarity and exposure to gang violence in this same population. Drug scene familiarity was measured by a summary variable combining the questions “do you know of a person or of a place in your community where you can get drugs if you wanted them?” and “do any of your friends use illegal drugs?” Exposure to gang violence was measured using the question “Have you or anyone you know ever been hurt by someone in a gang?” Results indicate that drug familiarity and exposure to gang violence may be a serious concern in this community, as 39% percent of participants reported drug scene familiarity, and over 40% reported exposure to gang violence. In multivariate logistic regression modeling, exposure to gang violence was independently associated with being younger, having lived longer in the community, having a higher level of educational attainment, and drug scene familiarity.

These findings suggest a close association between drugs and gang violence in this small community. This study drew from the concept of exposure opportunities, which posits that increased availability of illegal drugs predicts drug

use initiation among some of those who have previously tried illegal drugs [33-34]. Available data show that drug availability is increasing in the border region [35] and may also be common in non-border areas [36] along coastal drug trafficking routes. Likewise, our results indicate that drug use and resulting harms may be increasing in rural Baja California, Mexico. The theoretical framework for this analysis drew from the Drugs-Violence Nexus Theory, which was developed to explain the association between drugs and outcomes of violence among gang members [37-38]. Applying this theory to the population of the San Quintín Valley, over time, an elevated level of drug use, drug scene familiarity, and exposure to gang violence could become normative, whereby tolerance for these activities and behaviors would increase within this community [39-40]. Without longitudinal studies it is impossible to know if this is occurring, but prospective studies could determine whether this trend is occurring.

The result that drug scene familiarity was associated the exposure to gang violence finds support in the global literature. Studies from the United States [41-42], Trinidad and Tobago [43], South Africa [44], Brazil [45], and Russia [46] have described associations between violence, gangs, and drugs. In rural settings in Mexico, this association has rarely been described [36]. However, given the increased levels of violence associated with drug cartel trafficking in Mexico [47], the opportunity for the spread of drug availability and related violence is evident.

Other correlates of exposure to gang violence include a higher level of educational attainment, younger age, and living in the community longer. With

respect to education level, this variable contradicts past research, which found that lower levels of education were associated with gang activity [48]. This variable may serve as a proxy for greater exposure to the school setting, where gang recruitment and other gang-related activities may take place [44, 49-51]. If gangs are prevalent in schools, residents with more years of education would subsequently experience an increased exposure to gangs. Younger age is a common correlate of exposure to gangs [48, 52]. This finding presents an opportunity to implement gang prevention interventions among youth in this community. Finally, living in the community longer was associated with exposure to gang violence. This may indicate a familiarity with the social networks in the community. Migrants from southern Mexico may be less integrated into the receiving community and may therefore be less exposed to activities there [53]. This study concludes that, in this region where drugs and gangs have not been previously reported and which is characterized by migration from poorer parts of Mexico, interventions are urgently needed to prevent the impacts of social harms that from manifesting in rural, non-border communities.

### **Further interpretation and synthesis of results**

The results for the chapters in this dissertation can be synthesized a number of ways. First, the results of Chapter 2 and Chapter 3 will be synthesized in order to reveal general interpretations related to male clients of FSWs in Tijuana. The results of Chapter 2 reveal that both approaches to measuring unprotected sex identified being high during sex as a correlate, indicating that both the number of unprotected sex acts and reporting any

unprotected sex with FSWs was associated with substance use during sex. This suggests that substance use may be influencing client behaviors and decision making, including possibly influencing unprotected sex. In fact, a 2010 study among the same male clients in Tijuana found that both higher amounts of drug use and lower self-efficacy for condom use were associated with unprotected sex, indicating direct or indirect relationships between self-efficacy for condom use, substance use, and unprotected sex in this population [5]. While Chapter 3 did not find that substance use or substance use during sex was directly associated with self-efficacy for condom use, it is still known that this is a population that engages co-occurring risky behaviors, including substance-using behaviors and sexual risk behaviors, and that these behaviors may be related. Therefore, it is important that any future study, or any reporting of results, or any future intervention take into account the possible relationship between these variables. For example, studies examining the direct and indirect relationships between the correlates of self-efficacy for condom use and condom use in this population should account for substance use by either controlling for it or by testing the direct and indirect associations between substance use and the other variables of interest. Furthermore, interventions attempting to prevent the transmission of HIV in FSWs and their male clients in Tijuana should consider that the success of safer sex interventions might be predicated on concurrent interventions that address substance use and/or substance dependence. Examples of possible interventions that contain components of safer sex and components for the decrease in substance use are discussed in detail in the

Recommended Interventions section that follows the Public Health Implications section.

Next, the results from the two populations studied in the current dissertation – male clients of FSWs in Tijuana and members of a rural community in Baja California – will be synthesized to reveal interpretations that apply to both populations. As mentioned in the introduction, while male clients of FSWs in the urban environment of Tijuana may not appear to be similar to a rural population consisting of mostly migrants in rural Baja California, there are similarities with regard to the findings from this dissertation. The main similarity between the results found between these two populations may be that the prevalence of drugs in the respective communities may have important implications for the behaviors and health outcomes of these groups. In Tijuana, the high prevalence of drug use has been previously documented [54], as it has on a whole for the state of Baja California Norte [55]. Less documentation of the drug availability in rural areas of Mexico has been shown until recently [47]. However, Chapter 4 found that drug scene familiarity was very common in the San Quintín Valley [1], indicating that drugs may be more common than has been previously suspected in rural communities in Baja California. As mentioned, this elevated drug availability is caused by the narco-trafficking routes that run up the Pacific Coast of Mexico [56]. As is likely the case in Tijuana, the abundance of drugs could be connected with the elevated level of drug use there. Drug using behavior, such as injection drug use, is associated with a number of adverse health outcomes, such as HIV transmission. This occurs both directly, (e.g., as a result of injection



drug use), and indirectly, as a result of unprotected sex related to drug use. If rural areas experience an increase in drug availability, as some data has indicated, these areas may be subject to the drug-related harms and negative public health outcomes that are occurring in such high numbers in Tijuana. It should also be mentioned that much of the gang violence that occurs in Mexico is drug-related [57]. The past drug-related violence in Tijuana may serve as a model for other areas as to the acute nature of the morbidity and mortality that can arise from such interpersonal violence. The negative public health outcomes related to this violence could also increase in rural Baja if drug availability increases.

Each of these populations would benefit from programs that prevent the initiation of drug use in their respective communities. Larger-scale interventions, such as policy-level interventions, could have an effect on both of these populations included in this dissertation. For example, a US policy that regulates illegal drugs could eliminate the need for a black market and could undermine the influence of the cartels, and possibly the underlying drug-related violence associated with the cartels [58]. This type of program recommendation is outside the scope of this dissertation, but future policy papers examining the public health implications of drugs and drug-related violence in Mexico may consider recommending this type of approach. With regard to small-scale interventions, those that prevent the individual-level initiation of drug use in rural communities in the San Quintín Valley versus the types of interventions that could be used to treat individual drug dependence in Tijuana are fundamentally different, and

therefore require individual discussions. These interventions are discussed further in the Recommended Interventions section.

The theoretical approaches in Aims 2 and 3 may seem to present a quandary, insofar as the theory in Aim 2 focuses on social cognitive (i.e., individual level) factors and Aim 3 focuses on structural (i.e., community level) factors. However, it can be argued that public health risk among high risk populations in Baja California could in fact be influenced by both individual-level and community-level factors. One way to reconcile the differences between the two theoretical approaches would be by considering these results through a social ecological theoretical lens. Social ecological theory was developed to explain the complex interrelations between various factors at the individual, relationship, community, and societal/structural levels [59].

An application of social ecological theory that could apply to both populations studied in this dissertation is the HIV Risk Environment Framework developed by Rhodes [60-61]. This framework was originally constructed to understand and reduce drug-related harm, especially HIV infection associated with drug injection [60]. Past research has found that HIV risk among male clients of FSWs in Tijuana is shaped by physical, social, economic, and political factors [62], including venues-based risk [63] and policies (e.g., deportation) [64]. Although it has not yet been documented in the San Quintín Valley, environmental factors at the macro- and micro-level could also affect the HIV risk environment.

To apply this framework to the male clients of FSWs in Tijuana, it was found in Aim 2 that socio-cognitive factors were associated with self-efficacy for condom use. These socio-cognitive factors are individual-level factors that can be understood using individual-level theoretical frameworks for health behavior, such as Social Cognitive Theory. Structural-level factors may also affect self-efficacy for condom use and condom-using behavior among male clients of FSWs in Tijuana. For example, in Aim 1, it was found that homelessness was associated with unprotected sex among male clients of FSWs. Therefore, it may be that a better understanding of self-efficacy for condom use and condom-using behavior could come from an examination of all levels of factors in the HIV risk environment, from the individual level to the structural level.

In Aim 3, the concept of exposure opportunities, which states that social factors may explain hard drug use initiation, was used to illustrate how initiation may proceed in some individuals. This social-level concept might seem to contradict the cognitive theories drawn upon in Aim 2. While social- and structural-level factors, such as the availability of drugs and the black market may influence drug use, individual-level factors may also influence drug use. Individual factors, such as genetic predisposition to use drugs and putative gene-environment interactions may explain why some individuals initiate hard drug use whereas others do not. Therefore, a broad framework encompassing risks at many levels, such as the HIV Risk Environment Framework [60] could enhance the understanding of HIV transmission risk among residents of farming communities in Baja California. A framework that includes host factors and

micro- and macro-level factors relating to physical social, economic, and policy factors may also facilitate the identification of drug prevention interventions. These approaches are discussed in the Recommended Interventions section.

## **STRENGTHS AND LIMITATIONS**

### **Causality**

Although all three studies included in this dissertation use data from different sources, all sources of data are cross-sectional in nature, whereby data were collected at only one time point rather than longitudinally. This means that the ability to imply causality is limited by the lack of temporality in the data. As such, in Chapter 2, it cannot be inferred that being high during sex necessarily influences the number of unprotected sex acts with Tijuana FSWs among male clients of FSWs. In Chapter 3, it was found that outcome expectations were a correlate of self-efficacy for condom use. However, it is impossible to determine which variable is upstream from which. Bandura posits that, in SCT, self-efficacy influences outcome expectancies [30]. Empirical evidence exists for this premise. For example, in a study of 1380 college students in the United States, it was found that self-efficacy for condom use directly affected outcome expectancies, which in turn affected condom using behavior [65]. However, the evidence is mixed, and some studies contradict the assumptions of SCT that self-efficacy precedes outcome expectancies. In a path model created by Wulfert & others, based on a study of college students, it was found that outcome expectancies influence self-efficacy for condom use. [32]. Substantial debate

regarding this issue prompted Williams to write a lengthy paper discussing implications for both sides of the argument [66]. He concluded that determining which construct is upstream is important because the placement may affect the development of safer sex interventions with the aim of influencing outcome expectancies or self-efficacy, and, in turn, safer sex behavior [66]. Examples of these interventions for male clients of FSWs are explored in the Recommended Interventions section below. Also, in Chapter 3, longitudinal design and structural equation modeling could be used determine the nature of the indirect and direct relationships among variables such as sexual sensation seeking, self-efficacy, and condom use.

In Chapter 4, no causal inferences could be made to determine if drug scene familiarity was influencing exposure to gang violence, or vice versa. It should be noted that, while the analysis from Chapter 4 examined drug scene familiarity and exposure to gang violence, the Drugs-Violence Nexus Theory that was used as a conceptual guide in Chapter 4 analysis instead relates specifically to the association between drug use and violence. Nevertheless, causality in the relationship between drugs and violence has been under examination for decades without resolution [37]. Valdez and others have traditionally viewed this relationship as one in which drug use temporally precedes violent events [37-38]. However, it could be hypothesized that gang violence occurs in communities when gangs are fighting to gain control of territory, and that drug use increases subsequently, after one gang begins supplying the community. In the case of the association examined in Chapter 4, drug scene familiarity cannot be substituted

directly for actual drug use as specified by the Drugs-Violence Nexus Theory. However, future studies in this community may be able to ask more direct questions about drug use and the association with violence, using the Drugs-Violence Nexus Theory as a theoretical framework. In all three of the dissertation chapters mentioned above, the findings are the first of their kind within the respective populations. As preliminary studies, they highlight the need for larger, time-dependent studies to better infer causality for the associations that were examined in this dissertation.

### **Recall bias and self-reporting error**

Given that all three studies included in this dissertation rely predominately on data that is self-reported by the participant rather than biological data, they are limited by recall bias and possible errors due to participants' memory and the likelihood of participants supplying truthful information. It should be mentioned that the data from Chapter 4 were extremely preliminary and the methodology and results cannot be compared to the rigor of the data collection instruments used in Chapters 2 and 3. The instruments used in Chapters 2 and 3 were derived from piloted and validated questionnaires, whereas the questionnaire used in Chapter 4 did not originate from questions validated within the study population. Therefore the source of study error may be very different, and this section is separated into sections separating Chapters 2 & 3 from Chapter 4.

### ***Chapters 2 & 3***

In Chapter 2, wherein two methods of analyzing measures of unprotected sex were compared, the outcome measure for both approaches relied on self-

report data participants provided via surveys. The participants were prompted to recall the total number of sex acts and the number of protected sex acts with FSWs in Tijuana during the four months prior to interview. Some participants, particularly those who reported many acts of sex over four months, may be more likely to forget the total number of sex acts. This is a differential misclassification bias, since those who engaged in more sex are more likely to forget the total number of acts of sex. The directionality of this bias could either increase or diminish the reported effects, since those who report many acts of sex could either over- or underestimate the true number of acts of sex they engaged in during the study period. In order to minimize incorrect recall of sexual behavior, some investigators prefer diary or timeline feedback methods for collecting this type of data. The potential loss due to recall in this study was minimized by only requesting participants to recall four months of behaviors rather than to recall six or more months.

In Chapters 2 and 3, male clients of FSWs, who as a group use more drugs than the general population, were asked to recall their drug-using behaviors. Self-report and recall can be diminished among drug users [18, 67], which is a differential misclassification compared to non-drug users. However, this misclassification could have an effect in either direction on the associations that were found, in that drug users could overestimate or underestimate their sexual behaviors. The study staff was mindful of this limitation and attempted to decrease any barriers to memory by providing ample time in a comfortable supporting environment to allow participants to recall their behaviors. Another

technique used to mitigate this limitation was to ask participants who were deemed too intoxicated to partake in the survey to return another day.

#### ***Chapter 4***

Several issues of recall and reporting were limiting in Chapter 4. For one, some of the measures of drug use and violence depended on second-hand reporting of others' behaviors, which may be less accurate than self-reporting. The possible errors in reporting can be considered non-differential misclassification because the second-hand reporters could have overestimated or underestimated the community behaviors, which could have increased or attenuated the effects found in this study. Some themes in this questionnaire included sensitive questions. However, safety concerns prevented the team of researchers from asking about personal gang involvement and personal drug use. Summary and second-hand variables were instead used to obtain information on community behaviors and perceptions. Given the small size and interconnectedness of the community, participants may not have felt comfortable admitting to certain illegal behaviors. Social desirability bias may have decreased the reported frequency of some of the personal drug-use responses and personal experience with gang activity. This differential misclassification would have attenuated the effects between violence and drug use. As such, the use of second-hand variables reporting others' behaviors may in fact have been an advantage in detecting truer effects, as more accurate information about community prevalence of behaviors could be collected than by asking about participants' own behaviors.



## **Measurement**

Similar to the limitations reported for self-report and recall, the rigor of the two-day pilot study in the San Quintín Valley cannot be compared with the rigor of the Tijuana male client studies. Many differences, including the limited training of data collectors, the use of non-validated studies, and the use of less-specific questions, among other differences, constitute these dissimilarities in rigor.

## ***Chapters 2 & 3***

In Chapters 2 and 3, these principal investigators and researchers have many years designing and implementing studies and surveys in Mexico within high risk populations. Still, the results and conclusions from these two chapters are limited by the strength of the objective measurements contained in the data and by the methodology of the studies. In Chapter 2, the analysis of the count variable representing the total number of unprotected sex acts was not controlled for by using an offset term representing the total number of unprotected sex acts. This issue is more of an analytic decision based on the aims of the research more than a measurement issue, but it merits some explanation with regard to the difference in results that were obtained using the two different analytic methods. The benefit of an offset term is that it would have standardized number of unprotected sex among clients, controlling for the exposure to unprotected sex. This is sometimes preferred in studies utilizing a count variable outcome [68]. Since the number of unprotected sex acts was not controlled for in the dichotomous model, this offset term was excluded from the count model, which improved the ability to compare two approaches by keeping them as similar to

each other as possible. When this offset term was added to the count model, the variable measuring the number of FSWs visited was no longer significant, but there was no additional agreement between the results of the two analyses in terms of final model variables.

In Chapter 3, the analysis of the correlates of self-efficacy for condom use, the use of scales to measure psychometric constructs was particularly important to accurately measure constructs of SCT. To ensure the consistency of scales, the internal reliability was measured using Cronbach's alpha. The measurement of the alpha value for negative attitudes toward condoms ( $\alpha=0.72$ ) was considered "acceptable" according to Kline [69], but this internal reliability was borderline acceptable. Dropping items from this scale did not improve its reliability. An improved internal reliability could have permitted the ability to detect an association between self-efficacy for condom use. Inversely, a low internal reliability may have limited the ability to measure this construct properly and could have led to an underestimation of associations. This particular variable was not included in the final model, and it was determined that all other psychometric variables had alphas that ranged in the acceptable or better level.

#### ***Chapter 4***

Chapter 4 identified an association between exposure to gang violence and familiarity with the drug scene in a small community in rural Baja California. This study drew from the Drugs-Violence Nexus Theory, which outlines three typologies of violence that can emerge within the model. Due to safety concerns, the survey did not specifically ask about the type of gang violence participants

had been exposed to. However, this study provided information for future qualitative studies that could identify possible themes related to the typologies of gang violence that are present in this community.

Qualitative data were not collected in Chapter 4. A mixed methods approach, which could contextualize quantitative findings, is recommended for future studies. For example, during data collection we asked some participants to expand upon their perception that gang violence was a serious concern in the community. Many of them iterated that gang members often frequent certain busy public spaces in the community, where they were able to use intimidation to control residents. Meanwhile, some of these gang members sold drugs in these public spaces. A mixed methods study could provide richer information about the behaviors of these gang members in the San Quintín Valley.

Due to the fact that most of the data in this study was collected on a Saturday, males were underrepresented because they were more likely than women to be working in the fields when the survey was conducted. As males are more likely to be involved in gangs [70] and may be more likely to engage in violent behavior related to drugs [71], gang violence, the oversampling of females could diminish the association between drug familiarity and gang violence. However, the study still reached its recruitment goal, and controlling for gender did not affect the associations for any of the variables in the final model. The potential for site differences was possible since recruitment occurred in the community and at the clinic. However, differences were found on less than 7% of variables by location, which could easily be explained by chance variation.

## **Generalizability**

This dissertation includes two unique and hard-to-reach populations: male clients of FSWs in Tijuana and members of a mostly migrant, rural community in Baja California, Mexico. In regards to the population of male clients of FSWs in Tijuana, caution should be used generalizing these results to other populations due to the specific characteristics of male clients of Tijuana. These include a relatively high prevalence of HIV/STIs and high substance use and unique drugs (e.g., black tar heroin, methamphetamine) epidemic to the region. The unique analyses from this dissertation should be replicated in other populations of male clients of FSWs to determine the similarities and differences among populations from other settings. While the study in Chapter 4 may have limited generalizability outside of the San Quintín Valley, it does characterize the high availability of drugs in this community, which may be symptomatic of areas lying on drug trafficking routes in Mexico.

## **PUBLIC HEALTH IMPLICATIONS**

Despite these limitations, this dissertation provides a close-up examination of two understudied and hidden high risk populations in Baja California, Mexico. Chapter 2 compares differences resulting from two divergent approaches to studying unprotected sex in male clients of FSWs in Tijuana. Since male clients may contribute disproportionately to the HIV/STI epidemic in Tijuana, studies examining correlates of their sexual behaviors may be important in developing interventions to reduce sexual risk behavior in this population. Findings

contribute to clarification about when certain analytical techniques are appropriate in studies of unprotected sex. Chapter 3 identifies factors that may influence self-efficacy for condom use, which has been shown to be an important correlate of unprotected sex in male clients of FSWs in Tijuana. Drawing from SCT and its constructs, this study identifies factors which are theoretically important to designing successful behavioral change interventions.

Chapter 4 contributes to the literature as the first study to determine the prevalence of drug use and familiarity and exposure to gang violence in a non-border population in Mexico. As drug cartels maintain power over drug trafficking routes and drug-related violence expands into rural Mexico, this study informs researchers and policy makers about current levels of drugs and gang violence, and provides a starting point for gang- and violence-prevention interventions, which will be included in the discussion of other interventions below. This dissertation sheds light on characteristics of two high risk populations in resource poor settings who are understudied, disenfranchised, and at risk for the public health harms implicit in the neglect of their current risky behaviors.

## **RECOMMENDED INTERVENTIONS**

Chapter 2 of this dissertation focused on methodological issues in the analysis of two different types of measurements of unprotected sex in male clients of FSWs. Based on the results of this comparison of methodological approaches, no specific recommendations were made for the high risk populations of male clients in Tijuana within the manuscript in Chapter 2.

However, below is an expansion of the general recommendations made in the manuscript, followed by specific recommendations for Chapters 2, 3, and 4.

### **Safer sex interventions for male clients of FSWs**

As was seen in the results of Chapter 2, the two analytical methods produced highly divergent results, in that only one correlate was common to the results of both approaches. Accordingly, the use of one approach may identify potential factors associated with sexual risk that are not indicators when using the other approach. Perhaps due to the fact that count dependent variables measure the *amount* of sexual risk, the literature shows that count variables are more often preferred for intervention research [9]. Dichotomous dependent variables have also been used to analyze the results of sexual behavioral interventions [72-73], but the vast majority of safer sex interventions have utilized a decrease in unprotected sex as the measure of intervention efficacy. Among male clients of FSWs in Tijuana, it is recommended that analyses examining the efficacy of sexual risk interventions that aim to decrease the number of unprotected sex exposures be conducted using a count variable approach. A difference in the number of unprotected sex acts, and therefore the total sexual risk, could be more easily detected using this approach.

As mentioned in Chapter 2, there are different meanings attached to measuring “any versus no unprotected sex” compared to measuring “more versus less unprotected sex.” For example, while a count variable looks at the total amount of sexual risk among subgroups, looking at the correlates of any versus no unprotected sex identifies subgroups that have a tendency to use

condoms all the time versus less than all the time. This permits a focus on the differences in these two categories of levels of sexual risk behavior. According to the results of this dissertation Chapter 2, those who do not revisit the same FSW, or presumably visit many different FSWs, are more likely report no unprotected sex, or 100% condom use. This approach is helpful in identifying a trait that may explain the reason for 100% condom use or the lack of condom use. Inversely, those who report some unprotected sex are more likely revisit the same sex worker. As specified in the results of Chapter 2, men who revisit FSWs may be more comfortable with not wearing condoms due to their familiarity with the FSW [6, 10]. This correlate was identified only by the dichotomous approach which may help explain *why* a male client does not participate in 100% condom use rather than explaining *how much* unprotected sex a client engages in with FSWs based on certain characteristics, as would be interpreted by the count approach.

With regard to interventions related to the specific correlates of the two approaches used in Chapter 2, an intervention to reduce sexual risk based on the correlates of the dichotomous approach would be aiming to reduce unprotected sex to zero, or to increase condom use to one-hundred percent. To continue the example from the previous paragraph, an intervention to increase condom use to 100% among male clients of FSWs in Tijuana might target those who revisit the same sex workers. An educational module that emphasizes the possible risks of engaging in *any* unprotected sex with a FSW, regardless of the familiarity of the relationship that may exist between the client and FSW, could be effective. Among those who are married or in a common-law relationship,

another correlate of unprotected sex using dichotomous approach in Chapter 2, emphasizing the risk of transmission from FSWs to the significant other via male clients could be another tactic to increase condom use. On the other hand, using interventions to target correlates identified by the count approach would mean endeavoring to lower the total amount of sexual risk, and therefore, the total number of unprotected sex acts. For example, those who report sex with a male sex partner have a higher relative rate of unprotected sex with FSWs in Tijuana. A targeted educational module as part of an intervention could remind individuals in this subgroup that every additional act of unprotected sex with a female sex worker represents an additional opportunity for HIV exposure, and that those living with their spouses could potentially be exposing their loved ones to an increased level of risk for HIV/STI transmission after every act of unprotected sex with FSWs.

Assuming that these results were not affected by errors in measurement, the fact that each approach identified different correlates may have implications for intervention efficacy. For example, according to the results from Chapter 2, whether the data are analyzed using count or dichotomous approach would determine which variables are correlates of the outcome, and therefore potentially for which groups an intervention was effective. Depending on which analytic approach is used, one group may be identified as benefiting from an intervention more than another group. Since preliminary studies are often conducted to identify which risky subgroups are in need of interventions, the analytic approach taken may determine for whom the intervention targets, so the



research question should be decided beforehand. In the case of male clients of FSWs, past research suggests that male clients of FSWs are important drivers of the HIV epidemic [74-77]. Studies identifying specific subgroups for interventions may therefore have major implications for resource allocation to groups that are potentially at more risk for HIV transmission, including male clients of FSWs. For example, the results of the count approach found that those who reported having a recent male sex partner reported a higher rate of unprotected sex with FSWs in Tijuana. It may be that those who have male sex partners therefore represent a subgroup with a higher total risk profile due to the average number of unprotected sex acts that they engage in. Given that this correlate was identified only by the count approach and was missed by the dichotomous approach, resource allocation could be affected if a researcher only had the option of using the dichotomous approach. The ignoring of those who report male sex partners could have the consequence of decreasing HIV prevention intervention effectiveness in male clients in Tijuana.

With regard to specific interventions for male clients of female sex workers, based upon findings from both Chapter 2 and Chapter 3, successful interventions targeted to those who use substances during sex, or to those who report both substance use and unprotected sex, could contain components of safer sex education and substance use education. In Chapter 2, it was found that being high during sex was a correlate of reporting any unprotected sex *and* with reporting a higher rate of unprotected sex. This suggests that being high during sex with a FSW during sex may be a major risk factor for unprotected sex

in male clients of FSWs in Tijuana. Past studies have shown that high-risk men who combine drug use with sex are more likely to report a history of high-risk sexual activity, indicating a relationship between substance use during sex and unprotected sex [78]. Given that male clients of FSWs in Tijuana report high levels of substance use, including alcohol use, and heroin, cocaine, and methamphetamine use, along with high levels of unprotected sex, a coordinated intervention with safer sex components and substance abuse education or treatment components, could decrease transmission of HIV among male clients and their sexual partners. Interventions to decrease substance use, for example, may have several benefits, as substance abuse is related both directly and indirectly to HIV infection among high risk males [79]. The substance use treatment and education platform represents an opportunity for those who are receiving one type of intervention to also receive a safer sex intervention concurrently. For male clients who are not in substance abuse treatment programs, a harm reduction approach that urges men to reduce sexual risk during substance use may be appropriate [80]. This could take the form of in-person educational sessions with interventionists or informational packets handed out to male clients.

Conceptualization of specific interventions for high-risk men who report both substance abuse and sexual risk behaviors have traditionally focused on men who have sex with men rather than on male clients of FSWs [80], but many of these ideas may be applicable, given the similarity in high risk behaviors. Targeted interventions for drug users who use specific types of substances may

be more successful than interventions targeting all substance users. This is because the use of each type of drug (or alcohol) may elicit different mechanisms that cause those under the influence of drugs to engage in unprotected sex. These include alcohol myopia and disinhibition, among other mechanisms [81-82]. In fact, some clients may be using substances such as methamphetamine specifically in order to facilitate unprotected sex. This has been seen in MSM populations in the literature [83], and it is thought that the high-risk male clients of Tijuana FSWs exhibit a similar risk profile to MSM [5]. Targeting methamphetamine using male clients as a group to encourage the disentanglement of substance use from high risk sexual behaviors could be an effective intervention strategy [80].

Also, targeting of Tijuana venues, where substance-using male clients combine substance use with sexual risk [63], may be a possibility, given the centralized nature of the sex work industry in Tijuana. For example, interventions including condom use education and promotion, along with a substance use treatment component, could be implemented at venues that sell alcohol, are known as venues where drug use occurs, and are known to be venues for the sale of sex. The interventions could be individual-level, using interventionists to conduct brief substance use awareness interventions either at the venue or at a future date outside of the venue. The interventions could also be community-level, which are discussed in more depth in subsequent paragraphs. The outstanding feature is that these interventions would target male clients who report both substance use and unprotected sex, and could be more specifically

targeted based on drug of choice, route of administration, and sexual orientation [80].

Other types of venue-based interventions that address the HIV risk environment could also be incorporated. For example, at the policy level, programs similar to the 100% Condom Use Program might be effective in increasing condom use among male clients and FSWs. In Thailand, this program, which requires collaboration between local authorities, sex business owners, and sex workers and their clients, is thought to be responsible for an increase from 14% to 90% condom use among FSWs and clients. This program is likely one of the main forces behind the decrease in HIV incidence in the countries that have implemented this policy [84].

Past research on male clients in Tijuana has found that clients' HIV risks are shaped by physical, social, economic, and political factors [62], including venue-based risks, and that structural interventions in nightlife venues are needed to address venue-based risks [63]. A policy similar to the 100% Condom Use Program could be implemented in Tijuana, whereby the local health department would regulate venues to ensure that FSWs were engaging in 100% condom use. In order for the venue to stay in business, its owners, operators, and FSWs would be required to agree to participate in 100% condom use. The structure of this regulation is already in place, as the Tijuana health department already certifies FSWs to legally work in sex work by requiring HIV/STI testing. This program would be an extension of these existing operations. An approach combining individual level, community-level, and structural level components to

affect the HIV risk environment in Tijuana might have the most impact on HIV prevention.

In discussing possible interventions for the results of Chapter 3, it should be reiterated that while the theoretical framework of Chapter 3 relied extensively on SCT, the major components of the theoretical model, including self-efficacy for condom use, outcome expectancies, social support, HIV knowledge, and others, are also shared by many other health behavioral theories when applied to HIV prevention, as specified in the introduction (Chapter 1) of this dissertation. Many of the interventions below, therefore, contain constructs common to several of these models and are not limited exclusively to the SCT-informed model that was tested in this dissertation. Fisher & Fisher support the idea of utilizing elements of multiple theories in HIV interventions [29], while Kalichman, et al. found that the liberal use of many of these central constructs has been effective in HIV prevention interventions [85]. Successful HIV prevention interventions among high risk males included in a review by Kalichman, et al. included multiple group sessions focusing on the following components of health behavioral theories applied to HIV prevention: information, educational games, role playing, coping, social skills, cognitive skills, social support, and personal empowerment [85-90]. Applications of possible interventions for male clients of FSWs in Tijuana using several of these components are discussed in further detail below.

In Chapter 3, higher social support was found to be a correlate of higher self-efficacy for condom use among male clients of FSWs. The findings indicate that components of SCT and other theories of behavioral change could be used

to design and implement interventions within this population. Social support, along with health risk information, and risk-reduction and self-regulatory skills and maintenance, is one of the major components of HIV-related behavioral health interventions included in SCT and other theories that have been utilized for to influence change in HIV risk behaviors [29]. Higher social support may enhance learning opportunities that lead to correct condom use, which could influence the perceived ability to practice safer sex. This suggests that social support could be included in the design of safer sex interventions for high risk populations such as male clients of FSWs.

One example of leveraging social support to improve self-efficacy to prevent HIV infection is outlined by Bandura, 1990 [91]. This “community-mediated” approach, which is a health promotion program rooted in and implemented by the community in which the intervention is taking place, is sustained through community ownership. The success of this approach lies in harnessing community networks to influence knowledge and behavior patterns [91]. The community-mediated approach works by creating motivation for behavioral change, modeling of skills, and development of community norms, which in turn create social incentives for adopting safer sex behaviors such as condom use [91]. This approach can be tailored for specific subpopulations, and was successfully employed for HIV prevention in the MSM community. In the case of male clients of FSWs in Tijuana, who are not nearly as cohesive a group as some MSM networks, a community-mediated approach might utilize local community members with an interest in HIV prevention rather than actual

male clients of FSWs in Tijuana. Community leaders could be taught to design and implement programs that disseminate health information on how to change condom behavior in order to create self-sustaining norms within the community [91].

Due to the various levels of HIV risk inherent in the HIV risk environment in Tijuana, a multilevel approach to improving self-efficacy for condom use is recommended. Among other activities, peer outreach at the individual and small group level could help reduce unprotected sex by improving HIV knowledge and motivation to use condoms. For example, bringing together groups of male clients of FSWs into an intervention mediated by an interventionist, community advocate, or a trained client, could foster peer discussion and communication about HIV/STI prevention [92]. This could be part of the greater community-mediated social support program, and would be particularly effective if members of the peer group were deeply socially embedded members of the male client “community.”

Another aspect that could be included in intervention design to increase self-efficacy for condom use for male clients of FSWs in Tijuana is to feature visual cues such as condom promotion billboards and signage [23]. Working within the already existing public health infrastructure in Tijuana, a media campaign could be highly effective in reaching male clients of FSWs. Since sex work is partially regulated by the city, and the majority of sex work confined to a small zone in the center of Tijuana, billboards and posters with information about condoms could reinforce motivation to use them. This program could operate

through city licensing, whereby venues that sell liquor in the central zone of Tijuana could be required to provide flyers about condom use at the entrance. Venues could also be required to hang posters that normalize condom use during sexual acts. This structural intervention could have potentially beneficial effects for clients who are reticent to attend individual or group interventions or who are less connected to community networks. Much of the sexual activity between clients and FSWs occurs in the street rather than in venues. Public billboards displaying messages promoting condom use could also be displayed in the center of the busiest sex work areas. This multilevel approach, including the individual, group, and community levels, would likely be more effective than an individual-only intervention approach.

Social support has been empirically incorporated into health behavioral models in an effort to change condom use behaviors in a number of populations [28, 93]. A key construct of SCT and other models, self-efficacy for condom use, is believed to be influenced by social support [29]. Self-efficacy for condom use – the perceived ability to use condoms – is causally related to HIV-related sexual behaviors such as unprotected sex. Therefore, interventions attempting to increase condom use have sometimes focused on the association between social support and self-efficacy for condom use. While studies to date have examined the role of social support on self-efficacy for condom use among youth [25] and young adults [27], this association has not been examined among high-risk heterosexual adult males prior to the study included in this dissertation as Chapter 3. Considering the theoretical framework that informed this study, the



finding that social support is associated with self-efficacy for condom use in male clients of FSWs in Tijuana indicates that tailored interventions designed for this population could improve self-efficacy for condom use among male clients [94], especially if used alongside other constructs of health behavioral theories, including SCT [29].

In Chapter 3, no association was found between HIV knowledge and self-efficacy for condom use. This finding could have resulted from the fact that the particular HIV knowledge scale that was used in this survey contained only two questions that pertained to condom use, while the majority of questions were in reference to antiretroviral treatment and possible modes of HIV transmission. Had the HIV knowledge scale contained more questions about HIV prevention related to condoms, a statistically significant association between HIV knowledge and condom use self-efficacy may have been found. Nevertheless, HIV knowledge has been shown to influence self-efficacy for condom use in health behavioral models, which indicate that this knowledge is a key component in HIV behavioral interventions [29]. Given its inclusion into many health behavior theories, HIV knowledge should still be a component of safer sex interventions. HIV knowledge is low in some parts of urban Mexico [95], including among FSWs in the US-Mexico border region [10], suggesting that increasing knowledge could be integral to self-efficacy change in interventions. As previously mentioned, a safer sex intervention is more likely to be successful if it includes an informational component, skill-building and maintenance components, and a social support component [29] (see figure 1.1).

Sexual sensation seeking, another variable found to be associated with self-efficacy for condom use in the analysis in Chapter 3, is a personality trait characterized by the continued pursuit of novel sexual experiences [96]. While not originally a component of SCT or other health behavioral theories, sexual sensation seeking has been tested as a correlate of condom use and self-efficacy for condom use in socio-cognitive models and in a behavioral intervention [97]. In this intervention, targeted messages especially designed for high sensation seekers were employed over five months, after which time condom use and self-efficacy for condom use increased among targeted participants. Such targeted interventions are recommended for male clients of FSWs in Tijuana. It should be noted that male clients of FSWs may be more likely to be sexual sensation seekers than non-clients [98]. Therefore, targeted socio-cognitive interventions should take into account the likelihood of seeking novel sexual experiences that may influence self-efficacy for condom use [24]. For example, if it is determined that male clients of FSWs in Tijuana are higher sexual sensation seekers than non-clients, Tijuana clients could be targeted using cognitive interventions that promote the use of condoms as a stimulating sexual activity to improve self-efficacy for condom use.

Outcome expectancies were also associated with self-efficacy for condom use among male clients of FSWs. The literature is mixed on whether outcome expectancies influences self-efficacy, or whether the inverse is true. For interventions to be successful in the high risk male client of FSW population in Tijuana, it is important to know the directionality of the relationship between

outcome expectancies and self-efficacy for condom use. If outcome expectancies precede self-efficacy for condom use, an intervention to improve self-efficacy could aim to overcome the negative expectancies associated with negotiating condom use with partners among sexually sensation seeking male clients by practicing dialogues for condom negotiation. If, however, self-efficacy precedes outcome expectancies, then traditional theoretical safer sex intervention approaches, such as skill building involving effective methods of preventive behavior [29] (e.g., condom use), could be utilized.

It has been suggested that the three most important factors influencing condom use behavior are outcome expectancies, self-efficacy for condom use, and social support for condom use [93]. Successful interventions utilizing SCT and other theories have found that using peer modeling and motivational modeling is an effective way to increase both outcome expectancies and self-efficacy [28, 93, 99-100]. Together, the factors above represent central constructs in socio-cognitive models that explain behavioral change. Health behavioral constructs could be used as intervention targets for improving self-efficacy for condom use, and ultimately, safer sex behavior. With the results of these studies of male clients of FSWs in Tijuana in mind, SCT and other health behavioral theories should guide future interventions within the male client population, which is at high risk for transmission of HIV.

### **Drug/gang interventions for non-border Mexican communities**

The results from Chapter 4 of this dissertation indicate that drug availability and gang violence may be high in rural, non-border communities

along drug trafficking routes. While these data are preliminary, preventing gang and drug use initiation could be important in reducing harms associated with drugs and gangs in these communities. In addition to decreasing possible morbidity and mortality, development of preventive interventions could be cost effective and could deter potential epidemics of drug and gang violence from becoming established in these communities. Before preventions are developed, it is recommended that more qualitative research be conducted in this region in order to characterize the nature of drug availability and gang violence. Without a more nuanced understanding of the behaviors associated with gangs and drugs, these interventions could be ineffective.

Gangs are usually urban by nature [44, 101-102]. Recent research has noted that gangs may be increasing in rural areas of the United States [103]. In the San Quintín Valley, results from this dissertation showed a high prevalence of exposure to gang violence in this rural community. This being a novel result, evidence from Mexico concerning rural gangs is limited. Applications of gang prevention interventions from the rural United States could possibly be extended to this rural area of Mexico. But without knowing the similarities and differences between rural gangs in the United States and Mexico, it is difficult to recommend specific interventions. As rural communities are often tightly knit, US gang prevention efforts have often relied on community unity in deterring gangs from conducting their activities in rural areas. Enforcement agencies have stressed community and family cooperation and pressure as a prevention measure [103]. In Chapter 4 it was found that younger individual in the San Quintín Valley who

had more education were more likely to have been exposed to gang violence. If youth in the San Quintín Valley are being targeted for gang recruitment at schools, an approach conducting gang prevention interventions in the local school system communitywide could be essential to prevent the harms associated with gang violence.

With regard to drug use prevention, The US Department of Justice reports that, in general, drug prevention interventions are less successful once illegal drug dependence becomes common in communities [104]. Therefore, intervention strategies should be implemented before the availability of illegal drugs becomes established within communities. Rural drug prevention interventions are often communitywide approaches to prevent substance abuse. These include school-based programs emphasizing the risks of illegal drugs and town forums to educate parents and community members about the harms of drug use. Programs focusing on the interconnectedness and social cohesion within communities have shown success in preventing drug use initiation in rural areas in the United States [104]. Increasing supervised activities for youth, such as creating youth soccer leagues, and increasing drug trafficking law enforcement may also show positive effects on prevention of drug initiation [104].

Literature describing the relationship between drugs and gang violence in Mexico outside of the border region is rare. However, the drugs-violence nexus described by Valdez, et al. [37] may provide a framework for future interventions in small Mexican communities where a high availability of drugs and gang violence are co-occurring [37]. Drug use and gang activity could be addressed

together as toxic hazards that will introduce societal harms into the community. In a community that is characterized by poverty, the allure of drugs and gangs may seem appealing to the residents. Prevention interventions that prevent the impact of social harms from manifesting in non-border communities should be considered.

## **RECOMMENDATIONS FOR FUTURE RESEARCH**

### **Unprotected sex methodology**

In Chapter 2, two approaches to analyzing unprotected sex were explored using a population of male clients of FSWs in Tijuana. As this chapter focused primarily on methodology, the recommendations made here suggest future research directions based on the results of this methodological study. In studies focusing on sexual behavior, the research question dictates which analytical approach will be used. Given that each approach is catered to answering a certain question, it may not benefit researchers to utilize more than one approach. Using multiple techniques will produce a variety of answers, but these answers will likely include more than one set of results that may not be reconcilable. Each approach is based on different assumptions and may identify different correlates. With regard to the results from Chapter 2, it is recommended that researchers match their analytic approach to the research question that has been posed. This approach will ultimately provide an answer that specifically addresses the unique characteristics of the population being investigated. The population of male clients of FSWs in Tijuana serves as a good example. This

population reports a high mean number of unprotected sex acts and a high variation in the standard deviation of the number of sex acts. To understand factors related to the number of unprotected sex acts in this population, an approach that takes into account high variation in the dependent variable and the high number of zeros in the dependent variable would be a count approach using negative binomial regression. A proper analytic approach facilitates a better understanding of the factors that may lead to increased transmission of HIV/STI within this high risk population.

### **Analytical tools**

In Chapter 3, psychosexual and psychosocial correlates of self-efficacy for condom use were identified among male clients of FSWs. Due to the cross-sectional design of the study and the analytic method utilized, the placement of the social support, sexual sensation seeking, and outcome expectations variables within the SCT theoretical framework was impossible to infer. While some studies have conceptually mapped these variables, the evidence is mixed concerning which direct and indirect relationships ultimately affect self-efficacy and condom use. The lack of conceptual placement of these variables represents a gap in the literature.

Future analyses could employ structural equation modeling (SEM) to test multivariate models including the correlates of self-efficacy for condom use from Chapter 3, in order to better understand the nature of their direct and indirect relationships. For example, past studies have found limited evidence for a direct association between sexual sensation seeking and condom use [24], indicating a

possible complicated relationship among sexual sensation seeking, self-efficacy for condom use, and unprotected sex. Using theoretical models such as SCT, multiple direct and indirect relationships could be tested using SEM. These analyses could provide a more nuanced understanding of the relationships between sexual sensation seeking and other variables within health behavior theoretical theories, and could also guide the development of successful intervention strategies.

Based on the unknown nature of the relationships of the variables identified as correlates of self-efficacy for condom use, more complex moderation analyses could determine whether sexual sensation seeking moderates the relationship between self-efficacy for condom use and condom use. The results of these analyses could identify specific groups (e.g., high sensation seekers) for which interventions aiming to increase self-efficacy may be more effective. Likewise, given the implications for safer sex interventions, in order to determine causality in the relationship between outcome expectancies and self-efficacy for condom use, prospective studies using SEM are recommended.

Specific to the population of male clients of FSWs in Tijuana, it has been reported that clients report a progressive increase in the proportion of unprotected sex acts over time with FSWs whom they have become increasingly familiar [6, 10]. The unprotected sex that accompanies this familiarity may represent a decrease in the level of perceived risk for HIV/STI transmission by male clients. This perception may be an illusion, and any other partners of both



the FSW and the male client may be at increased risk of HIV/STI transmission due to the resulting sexual risk behaviors between FSW and client. Finally, approximately 12% male clients of FSWs studied in Tijuana identify as gay or bisexual, indicating a possibility that these men are partaking in risky sexual behavior with men who have sex with men (MSM) and with FSWs, two high risk groups in Tijuana. The nature of these possible relationships should be investigated in the future.

### **Qualitative and mixed methods studies**

In Chapter 4, the association between exposure to gang violence and drug scene familiarity was identified in a rural community in Baja California. This study was the first of its kind to identify this relationship. While this study provided important information regarding the prevalence of gang violence and drug availability, there is a need to explore the context of these findings within the community. Brief conversations with community members corroborated the finding that gang activity was common in the community. Some residents commented that “*cholos*” (gang members) occupy certain areas of the community, and that residents avoid these areas out of fear of being attacked. Characterization of the types of gangs (i.e., street level gangs versus drug cartels) in the community and their connection to violence and drugs are areas for further exploration. Collection of qualitative data could elucidate the possible relationship between the larger cartels and the local, street-level gangs.

Regarding drug use and gang violence, a number of other future avenues for mixed methods research exist in the San Quintín Valley. Future research

should seek to identify societal factors that are common to both the San Quintín Valley and other regions of the world where gang violence is problematic. Identification of these factors could permit interventions that have been successfully utilized elsewhere to be adapted to these communities. Further, based on the finding that exposure to gang violence is more likely among those who attend school, future studies could investigate the role of gangs in San Quintín Valley schools. Finally, researchers conducting further studies in the San Quintín Valley should consider examining the social networks within the community as a means of deducing levels of social isolation, community integration, and other potential correlates for gang exposure.

The results of the three dissertation chapters outlined in this discussion chapter highlight new and important findings among two high risk populations in Baja California, Mexico. Further research using innovative analytic techniques, and qualitative, mixed methods, and prospective approaches is recommended to build on these results. The identification of interventions to prevent the spread of gang violence, to prevent the initiation of and reduce the harms associated with drug use, and to prevent the transmission of HIV due to sexually risky behavior are also recommended for highly vulnerable populations in Baja California.

## **CONCLUSIONS**

Given recent research that has identified male clients of FSWs as a possible bridge for HIV/STI transmission, and the rapid spread of drugs and violence outside of urban areas in Mexico, this dissertation presents preliminary

analyses among populations who are at high risk transmission of HIV/STIs and for drug- and violence-related harms in Baja California, Mexico. The results of this dissertation indicate that different approaches to analyzing unprotected sex as an outcome in male clients of FSWs in Tijuana provide results that are unique to the approach used, and that psychosocial and psychosexual factors may influence self-efficacy for condom use within a SCT framework in this same population. Interventions to increase safer sex behavior and decrease HIV/STI transmission among male clients of FSWs in Tijuana may be enhanced by the incorporation of psychosocial and psychosexual variables into socio-cognitive behavioral change frameworks. This dissertation study also found a high prevalence of drug scene familiarity and exposure to gang violence, and a relationship between the two among members of a rural, non-border community in the San Quintín Valley. Harms related to drug use and gang violence may be avoided by employing school-based interventions that prevent the further spread of these activities into rural communities.

## REFERENCES

1. Volkmann, T., M. Fraga, S. Brodine, E. Iñiguez-Stevens, A. Cepeda, J. Elder, and R. Garfein, *Drug scene familiarity and exposure to gang violence among residents in a rural farming community in Baja California, Mexico*. Global Public Health, 2012. **In press**.
2. Goldenberg, S., M. Gallardo Cruz, S. Strathdee, L. Nguyen, S. Semple, and T. Patterson, *Correlates of unprotected sex with female sex workers among male clients in Tijuana, Mexico*. Sex Transmitted Dis, 2010. **37**(5): p. 319-324.
3. Arminger, G., C. Clogg, and M. Sobel, *Handbook of statistical modeling for the social and behavioral sciences*. 1995, New York: Plenum Press.
4. Sirotin, N., S. Strathdee, R. Lozada, D. Abramovitz, S. Semple, J. Bucardo, and T. Patterson, *Effects of government registration on unprotected sex amongst female sex workers in Tijuana; Mexico*. International Journal of Drug Policy, 2010. **21** p. 466-470.
5. Semple, S., S. Strathdee, M. Cruz, A. Robertson, S. Goldenberg, and T. Patterson, *Psychosexual and social-cognitive correlates of sexual risk behavior among male clients of female sex workers in Tijuana, Mexico*. AIDS Care, 2010. **22**(12): p. 1473-1480.
6. Patterson, T., T. Volkmann, M. Gallardo, S. Goldenberg, R. Lozada, S. Semple, C. Anderson, and S. Strathdee, *Identifying the HIV Transmission Bridge: Which Men Are Having Unsafe Sex with Female Sex Workers and with Their Own Wives or Steady Partners?* J Acquir Immune Defic Syndr, 2012 **60**(4): p. 414-20.
7. Patterson, T., S. Goldenberg, M. Gallardo, R. Lozada, S. Semple, P. Orozovich, D. Abramovitz, and S. SA, *Correlates of HIV, sexually transmitted infections, and associated high-risk behaviors among male clients of female sex workers in Tijuana, Mexico*. AIDS, 2009. **23**(13): p. 1765-1761.
8. Wee, S., M. Barrett, and W. Lian, *Determinants of inconsistent condom use with female sex workers among men attending the STD clinic in Singapore*. . Sex Transm Infect, 2004. **80**: p. 310 -314.
9. Schroder, K., M. Carey, and P. Venable, *Methodological Challenges in Research on Sexual Risk Behavior: I. Item Content, Scaling, and Data Analytical Options*. Ann Behav Med, 2003. **26**(2): p. 76-103.

10. Robertson, A.M., V.D. Ojeda, L. Nguyen, R. Lozada, G.A. Martínez, S.A. Strathdee, and T.L. Patterson, *Reducing harm from HIV/AIDS misconceptions among female sex workers in Tijuana and Ciudad Juarez, Mexico: A cross sectional analysis*. Harm Reduction Journal 2012. **9**(35).
11. Fritz, R., *AIDS knowledge, self-esteem, perceived AIDS risk, and condom use among female commercial sex workers*. Journal of Applied Social Psychology, 1998. **28**: p. 888-911.
12. Sanderson, C. and E. Maibach, *Predicting condom use in African American STD patients: The role of two types of outcome expectancies*. Journal of Applied Social Psychology 1996. **26**: p. 1495-1509.
13. Morrison, D., G. Rogers, and S. Baker, *Determinants of condom use among high-risk heterosexual adults: A test of the Theory of Reasoned Action*. Journal of Applied Social Psychology, 1995. **25**: p. 651-676.
14. Norris, A. and K. Ford, *Condom use by low-income African American and Hispanic Youth with a well-known partner: Integrating the Health Belief Model, Theory of Reasoned Action, and the Construct Accessibility Model*. Journal of Applied Social Psychology, 1995. **25**: p. 1801-1830.
15. Sheeran, P., C. Abraham, and S. Orbell, *Psychosocial correlates of heterosexual condom use: A meta-analysis*. Psychological Bulletin, 1999. **125**: p. 90-132.
16. Jaccard, J., R. McDonald, and C. Wan, *The accuracy of self-reports of condom use and sexual behavior*. Journal of Applied Social Psychology, 2002. **32**(9): p. 1863-1905.
17. Jemmott, J. and L. Jemmott, *HIV risk reduction behavioral interventions with heterosexual adolescents*. AIDS, 2000. **14**: p. S40-S52.
18. Fishbein, M. and W. Pequegnat, *Evaluating AIDS prevention interventions using behavioral and biological outcome measures*. Sexually Transmitted Diseases, 2000. **27**: p. 101-110.
19. Carey, M., S. Maisto, S. Kalichman, A. Forsyth, E. Wright, and B. Johnson, *Enhancing motivation to reduce the risk of HIV infection for economically disadvantaged urban women*. Journal of Consulting and Clinical Psychology, 1997. **65**: p. 531-541.
20. Kalichman, S., D. Rompa, and B. Coley, *Lack of positive outcomes from a cognitive-behavioral HIV and AIDS prevention intervention for inner-city men: lessons from a controlled pilot study*. . AIDS Education and Prevention, 1997. **9**: p. 299-313.

21. St. Lawrence, J., T. Brasfield, K. Jefferson, E. Alleyne, R. O'Bannon, and A. Shirley, *Cognitive-behavioral intervention to reduce African American adolescents' risk for HIV infection*. *Journal of Consulting and Clinical Psychology & Health*, 1995. **63**: p. 221-237.
22. Ogden, J., *Some problems with social cognition models: A pragmatic and conceptual analysis*. *J Health Psychology*, 2003. **22**: p. 424-428.
23. Noar, S., R. Zimmerman, P. Palmgreen, M. Lustria, and M. Horosewski, *Integrating personality and psychosocial theoretical approaches to understanding safer sexual behavior: implications for message design*. *Health Commun*, 2006. **19**(2): p. 165-74.
24. Donohew, L., R. Zimmerman, P. Cupp, S. Novak, S. Colon, and R. Abell, *Sensation seeking, impulsive decision-making, and risky sex: implications for risk-taking and design of interventions*. *Personality and Individual Differences*, 2000. **28** p. 1079±1091.
25. Meekers, D. and M. Klein, *Understanding gender differences in condom use self-efficacy among youth in urban Cameroon*. *AIDS Educ Prev*, 2002. **14**(1): p. 62-72.
26. Sarafian, I., *Process assessment of a peer education programme for HIV prevention among sex workers in Dhaka, Bangladesh : A social support framework*. *Soc Sci Med*, 2011 [**Epub ahead of print**].
27. Basen-Engquist, K., *Psychosocial predictors of "safer sex" behaviors in young adults*. *AIDS Educ Prev*, 1992 **4**(2): p. 120-34.
28. Bandura, A., *Social foundations of thought and action: A social cognitive theory*. 1986, Englewood Cliffs, NJ: Prentice Hall.
29. Fisher, J. and W. Fisher, *Theoretical Approaches to Individual-Level Change in HIV Risk Behavior*, in *Handbook of HIV prevention*, J. Peterson and R. DiClemente, Editors. 2000, Kluwer Academic/Plenum.: New York. p. 3-55.
30. Bandura, A., *Reflections on self-efficacy*. *Advances in Behaviour Research and Therapy*, 1978. **1**: p. 237-269.
31. Bandura, A., *Self-efficacy: Toward a unifying theory of behavioral change*. *Psychological Review*, 1977. **84**: p. 191-215.
32. Wulfert, E. and C.K. Wan, *Condom use: A self-efficacy model*. *Health Psychology* 1993. **12**(5): p. 346-353.

33. Wagner, F.A. and J.C. Anthony, *Into the World of Illegal Drug Use: Exposure Opportunity and Other Mechanisms Linking the Use of Alcohol, Tobacco, Marijuana, and Cocaine*. American Journal of Epidemiology, 2002. **155**(10).
34. Maxcy KF, e., *Papers of Wade Hampton Frost, M.D.: a contribution to epidemiological method*. 1941, New York, NY: The Commonwealth Fund.
35. Brouwer, K.C., S.A. Strathdee, C. Magis-Rodriguez, E. Bravo-Garcia, C. Gayet, T.L. Patterson, S.M. Bertozzi, and R.S. Hogg, *Estimated numbers of men and women infected with HIV/AIDS in Tijuana, Mexico*. J Urban Health, 2006. **83**(2): p. 299-307.
36. Guzmán-Facundo, F.R., L.J. Pedrão, K.S. Lopez-García, M.M. Alonso-Castillo, and S.E. Esparza-Almanza, *[Drugs use as a cultural practice within gangs]*. Rev Lat Am Enfermagem, 2011. **19**: p. 839-47.
37. Valdez, A., C.D. Kaplan, and A. Cepeda, *The drugs-violence nexus among Mexican-American gang members*. J Psychoactive Drugs, 2006. **38**(2): p. 109-21.
38. Goldstein, G., *The Drugs/Violence Nexus: A Tripartite Conceptual Framework*. Journal of Drug Issues, 1985. **39**: p. 143-174.
39. Valdez, A. and C. Kaplan, *Conditions That Increase Drug Market Involvement: The Invitational Edge and The Case Of Mexicans In South Texas*. Journal of Drug Issues, 2007. **37**(4): p. 893-917.
40. Bourdieu, P., *'Structures, habitus, practices', in The Logic of Practice*. 1990, Cambridge: Polity.
41. Klein, M.W., C.L. Maxson, and L.C. Cunningham, *"Crack," Street Gangs, and Violence*. Crimonology, 1991. **9**(4).
42. Howell, J.C. and S.H. Decker. *The Youth Gangs, Drugs, and Violence Connection*. Juvenile Justice Bulletin 1999 [cited 2011 February 25]; Available from: <http://www.ncjrs.gov/pdffiles1/93920.pdf>.
43. Katz, C.M. and A.M. Fox, *Risk and protective factors associated with gang-involved youth in Trinidad and Tobago*. Rev Panam Salud Publica, 2010. **27**(3): p. 187-202.
44. Matthews, I., R. Griggs, and G. Caine, *The Experience Review of Interventions and Programmes Dealing with Youth Violence in Urban Schools in South Africa*. 1999, Independent Projects Trust.

45. McLennan, J., I. Bordin, K. Bennett, F. Rigato, and M. Brinkerhoff, *Trafficking among youth in conflict with the law in São Paulo, Brazil*. Soc Psychiatry Psychiatr Epidemiol, 2008. **43**(10): p. 81-23.
46. Zdun, S., *Violence in street culture: Crosscultural comparison of youth groups and criminal gangs*. New Directions for Youth Development, 2008. **119**: p. 39-54.
47. Intelligence, S.G. *Mexico and the Cartel Wars in 2010*. 2010 [cited 2011 February 24]; Available from: <http://www.stratfor.com/weekly/20101215-mexico-and-cartel-wars-2010>.
48. Hill, K.G., C. Lui, and J.D. Hawkins. *Early Precursors of Gang Membership: A Study of Seattle Youth*. Juvenile Justice Bulletin 2001 [cited 2011 March 3]; Available from: <http://strategicliving.org/190106.pdf>.
49. Goldstein, A.P. and D.W. Kodluboy, *Gangs in Schools: Signs, Symbols, and Solutions*. 1998, Champaign: Research Press.
50. Swahn, M.H., R.M. Bossarte, B. West, and V. Topalli, *Alcohol and drug use among gang members: experiences of adolescents who attend school*. J Sch Health, 2010. **80**(7): p. 353-60.
51. Griggs, R., *Children at Risk: The Security Situation in Durban Schools*, in *Public Information Briefing 3*. 1997, Independent Projects Trust: Durban.
52. Rodgers, D., *Youth Gangs and Violence in Latin America and the Caribbean: A Literature Survey*, in *Urban Peace Program Series*. 1999, The World Bank.
53. Hack-Pola, D., *Migrant Integration: Case for a Necessary Shift of Paradigm*. Journal of Identity and Migration Studies, 2008. **2**(1): p. 37-56.
54. Pollini, R., *Drug Use and Abuse in San Diego County, California*, in *Oral presentation to the National Institute on Drug Abuse's Community Epidemiology Work Group*. 2010: San Diego.
55. Moreno, J., J. Licea, and C. Ajenjo, *Tackling HIV and drug addiction in Mexico*. Lancet, 2010. **376**(9740): p. 493-495.
56. Bucardo, J., K.C. Brouwer, C. Magis-Rodríguez, R. Ramos, M. Fraga, S.G. Perez, T.L. Patterson, and S.A. Strathdee, *Historical trends in the production and consumption of illicit drugs in Mexico: implications for the prevention of blood borne infections*. Drug and Alcohol Dependency, 2005: p. 281-293.



57. Chabat, J., *Mexico's War on Drugs: No Margin for Maneuver*. The Annals of the American Academy of Political and Social Science, 2002. **582**.
58. Miron, J. and J. Zwiebel, *The Economic Case against Drug Prohibition*. The Journal of Economic Perspectives 1995 **9**(4).
59. Bronfenbrenner, U., *Measuring environment accross the life span: Emerging methods and concepts*, ed. S. Friedman and T. Wachs. 1999, Washington, DC: American Psychological Association Press.
60. Rhodes, T., *The 'risk environment': a framework for understanding and reducing drug-related harm*. International Journal of Drug Policy, 2002. **13**: p. 85-94.
61. Rhodes, T. and M. Simic, *Transition and the HIV risk environment*. BMJ, 2005. **331**: p. 220-223.
62. Goldenberg, S.M., S.A. Strathdee, M. Gallardo, T. Rhodes, K.D. Wagner, and T.L. Patterson, "Over here, it's just drugs, women and all the madness": *The HIV risk environment of clients of female sex workers in Tijuana, Mexico*. Soc Sci Med, 2011. **72**(7): p. 1185-92.
63. Goldenberg, S.M., S.A. Strathdee, M. Gallardo, L. Nguyen, R. Lozada, S.J. Semple, and T.L. Patterson, *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.
64. Goldenberg, S., S. Strathdee, M. Gallardo, and T. Patterson, "People Here Are Alone, Using Drugs, Selling their Body": *Deportation and HIV Vulnerability among Clients of Female Sex Workers in Tijuana*. Field Action Science Report, 2011.
65. Dilorio, C., W. Dudley, J. Soet, J. Watkins, and E. Maibach, *A social cognitive-based model for condom use among college students*. Nurs Res, 2000 **49**(4): p. 208-14.
66. Williams, D., *Outcome Expectancy and Self-Efficacy: Theoretical Implications of an Unresolved Contradiction*. Personality and Social Psychology Review, 2010. **14**(4): p. 417-425.
67. Brewer, D., S. Garrett, and S. Kulasingam, *Forgetting as a cause of incomplete reporting of sexual and drug injection partners*. . Sex Transm Dis, 1999. **26**(3): p. 166-176.
68. Rudolph, A., K. Jones, C. Latkin, N. Crawford, and C. Fuller, *The association between parental risk behaviors during childhood and having*

- high risk networks in adulthood*. Drug Alcohol Depend, 2011 **118**(2-3): p. 437-43.
69. Kline, P., *The handbook of psychological testing* 1999, London: Routledge.
  70. Dishion, T., S. Nelson, and M. Yasui, *Predicting Early Adolescent Gang Involvement from Middle School Adaptation*. Journal of Clinical Child and Adolescent Psychology, 2005. **34**(1): p. 62-73.
  71. Yonas, M., P. O'Campo, J. Burke, G. Peak, and A. Gielen, *Urban youth violence: do definitions and reasons for violence vary by gender?* J Urban Health, 2005. **82**(4): p. 543-51.
  72. Reinecke, J., P. Schmidt, and I. Ajzen, *Application of the Theory of Planned Behavior to adolescents' condom use: A panel study*. Journal of Applied Social Psychology, 1996. **29**: p. 749-772.
  73. Kegeles, S., R. Hays, and T. Coates, *The Mpowerment Project: a community-level HIV prevention intervention for young gay men*. Am J Public Health, 1996 **86**(8): p. 1129-36.
  74. Hesketh, T., J. Zhang, and D. Qiang, *HIV knowledge and risk behaviour of female sex workers in Yunnan Province, China: potential as bridging groups to the general population*. AIDS Care, 2005. **17**(8): p. 958-966.
  75. Thomas, T., L. Urada, D. Morisky, and R. Malow, *Best Practice Example from the Philippines: A Low-Level Prevalence Country and the Male "Bridge" Population*, in *HIV/AIDS: Global Frontiers in Prevention/Intervention*. 2008, Routledge.
  76. Ruxrungtham, K., T. Brown, and P. Phanuphak, *HIV/AIDS in Asia*. Lancet, 2004. **364**(9428): p. 69-82.
  77. Lowndes, C., M. Alary, C. Gnintoungbé, E. Bédard, L. Mukenge, N. Geraldo, P. Jossou, E. Lafia, F. Bernier, E. Baganizi, J. Joly, E. Frost, and S. Anagonou, *Management of sexually transmitted diseases and HIV prevention in men at high risk: targeting clients and nonpaying sexual partners of female sex workers in Benin*. AIDS, 2000. **14**(16): p. 2523-2534.
  78. Stall, R., L. McKusick, J. Wiley, T. Coates, and D. Ostrow, *Alcohol and drug use during sexual activity and compliance with safe sex guidelines for AIDS: the AIDS Behavioral Research Project*. Health Educ Q, 1986. **13**(4): p. 359-71.

79. McLellan, E.T., A.I. Alterman, D.S. Metzger, G. Grissom, G.E. Woody, L. Luborsky, and C.P. O'Brien, *Similarity of outcome predictors across opiate, cocaine, and alcohol treatment: Role of treatment services*. *Journal of Clinical and Consulting Psychology & Health*, 1994. **62**: p. 1142-1158.
80. Stall, R. and D. Purcell, *Intertwining Epidemics: A Review of Research on Substance Use Among Men Who Have Sex with Men and Its Connection to the AIDS Epidemic*. *AIDS and Behavior*, 2000. **4**(2).
81. MacDonald, T., G. Fong, M. Zanna, and A. Martineau, *Alcohol myopia and condom use: can alcohol intoxication be associated with more prudent behavior?* *J Pers Soc Psychol*, 2000. **78**(4): p. 605-19.
82. Darkes, J., P.E. Greenbaum, and M.S. Goldman, *Sensation seeking–disinhibition and alcohol use: Exploring issues of criterion contamination*. *Psychological Assessment*, 1998. **10**(1): p. 71-76.
83. Semple, S.J., J. Zians, I.G. ., and T.L. Patterson, *Sexual Compulsivity in a Sample of HIV-Positive Methamphetamine-using Gay and Bisexual Men*. 2006.
84. Rojanapithayakorn, W., *The 100% Condom Use Programme in Asia*. *Reproductive Health Matters*, 2006. **14**(28): p. 41-52.
85. Kalichman, S., M. Carey, and B. Johnson, *Prevention of sexually transmitted HIV infection: A meta-analytic review of the behavioral outcome literature*. *Annals of Behavioral Medicine*, 1996. **18**(1): p. 6-15.
86. Jemmott, J., J. LS, and F. GT, *Reductions in HIV risk associated sexual behaviors among Black male adolescents: Effects of an AIDS prevention intervention*. *American Journal of Public Health*, 1992. **82**: p. 372-377.
87. Rotheram-Borus, M.J., C. Koopman, and C. Haignere, *Reducing HIV sexual risk behaviors among runaway adolescents*. *Journal of the American Medical Association*, 1991. **266**: p. 1237-1241.
88. St. Lawrence, J., T. Brasfield, and K. Jefferson, *Cognitive behavioral intervention to reduce African-American adolescents' risk for HIV infection*. *Journal of Consulting and Clinical Psychology*, 1995. **63**(221-237).
89. St. Lawrence, J., K. Jefferson, E. Alleyne, and T. Brasfield, *Comparison of education versus behavioral skills training interventions in lowering sexual HIV risk behavior of substance-dependent adolescents*. *Journal of Consulting and Clinical Psychology*, 1995. **63**: p. 154-157.

90. Walter, H. and M. Vaughan, *AIDS risk reduction among a multiethnic sample of urban high school students*. . Journal of the American Medical Association, 1993. **270**: p. 725-730.
91. Bandura, A., *Perceived Self-Efficacy in the Exercise of Control over AIDS Infection*. Evaluation and Program Planning 1990. **13**: p. 9-17.
92. Yang, X., G. Xia, X. Li, C. Latkin, and D. Celentano, *Social influence and individual risk factors of HIV unsafe sex among female entertainment workers in China*. AIDS Educ Prev, 2010. **22**(1): p. 69-86.
93. Wulfert, E. and C. Wan, *Safer Sex Intentions and Condom Use Viewed from a Health Belief, Reasoned Action, and Social Cognitive Perspective*. The Journal of Sex Research, 1995. **32**(4): p. 299-311.
94. Fisher, J. and W. Fisher, *Changing AIDS-risk behavior*. Psychol Bull 1992 **111**(3): p. 455-74.
95. Moyer, L., K. Brouwer, S. Brodine, R. Ramos, R. Lozada, M. Cruz, C. Magis-Rodriguez, and S. Strathdee, *Barriers and missed opportunities to HIV testing among injection drug users in two Mexico--US border cities*. Drug Alcohol Rev, 2008 **27**(1): p. 39-45.
96. Kalichman, S., n.T. Heckma, and J. Kelly, *Sensation seeking as an explanation for the association between substance use and HIV-related risky sexual behavior*. 1996.
97. Zimmerman, R., P. Palmgreen, S. Noar, M. Lustria, H. Lu, and M. Horosewski, *Effects of a Televised Two-City Safer Sex Mass Media Campaign Targeting High-Sensation-Seeking and Impulsive-Decision-Making Young Adults*. Health Educ Behav, 2007. **34**(5): p. 810-826.
98. Xantidis, L. and M. McCabe, *Personality characteristics of male clients of female commercial sex workers in Australia*. Arch Sex Behav, 2000 **29**(2): p. 165-76.
99. Abraham, C. and P. Sheeran, *Modelling and modifying young heterosexuals' HIV-preventive behaviour; a review of theories, findings and educational implications*. Patient Educ Couns, 1994. **23**(3): p. 173-86.
100. Semple, S.J., T.L. Patterson, and I. Grant, *Psychosocial characteristics and sexual risk behavior of HIV+ men who have anonymous sex partners*. Psychology & Health, 2004. **19**(1): p. 71-87.
101. Robinson, P.L., W.J. Boscardin, S.M. George, S. Teklehaimanot, K.C. Heslin, and R.N. Bluthenthal, *The effect of urban street gang densities on*

*small area homicide incidence in a large metropolitan county, 1994-2002.*  
J Urban Health, 2009. **86**(4): p. 511-23.

102. Sigler, R.T., *Gang violence*. J Health Care Poor Underserved, 1995. **6**(2): p. 198-203; discussion 203-4.
103. Weisheit, R. and L. Wells, *Youth Gangs in Rural America*. National Institute of Justice, 2004(251).
104. USDOJ, *Alcohol, tobacco and other drug use by youth in rural communities*, R. Edwards, Editor. 1996, Department of Justice: Washington, DC.