Title
HIV, Sexually Transmitted Infections and Sexual Risk among Women who Use Methamphetamine

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Publication Date
2011

Peer reviewed|Thesis/dissertation

HIV, Sexually Transmitted Infection and Sexual Risk among Women who Use Methamphetamine

by

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A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Public Health

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Patricia Morgan, Chair
Professor Amani M. Nuru-Jeter
Professor Norman A. Constantine
Professor Charis Thompson

Spring 2011

Abstract

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This dissertation examines the prevalence of HIV and sexually transmitted infections (STIs), sexual risk behavior and violent victimization in a community-based sample of women who use methamphetamine in San Francisco, CA (N=322). Methamphetamine use has grown rapidly in the United States since the mid-1990's. Nearly half of methamphetamine users are female, a proportion higher than for most other illicit drugs. Among gay and bisexual men, methamphetamine use has been linked to sexual risk behavior and increases in HIV and STI infection. To date, however, little research has been conducted about the sexual health and risk behaviors of heterosexual women who use methamphetamine.

This work addresses the dearth of knowledge regarding sexual health (HIV, STIs) and sexual risk among heterosexual women who are active methamphetamine users, taking on three key issues. First, it assesses the prevalence of sexual risk behavior, HIV and STIs. Results point to high levels of risk behavior, but relatively low levels of HIV and STI infection. Second, this work examines the relationship between sex and methamphetamine use for women, using mixed methods (quantitative and qualitative). Findings suggest that women see the relationship between sex and methamphetamine in terms of pleasure rather than risk, and suggests that traditional risk behavior assessment approaches may not provide information sufficient to inform behavioral interventions. Third, this dissertation examines violence against methamphetamine-using women, and finds that suffering and violence go hand-in-hand, as women with the greatest subsistence difficulties also experienced the highest levels of non-intimate partner violence. This work regarding women who use methamphetamine brings forward new knowledge about an understudied and vulnerable population, and contributes to a basis for developing effective public health responses to the needs of women who are active methamphetamine users.

Dedication

This dissertation is dedicated to the legacy of John K. Watters

Acknowledgments

You know, you see homelessness, you see drug addiction, you see violence. You could teach about it, you can read about it, but until you're in it…

39-year-old study participant

This research would not have been possible without the women who agreed to participate in the Women and Methamphetamine (WAM) study. While this work focuses on aspects of their experience that are relevant to my research interests and to public health, it does little justice to the complexity, hardship, and joy of their lives. I am deeply grateful for their willingness to share their experiences with the RTI research team.

I thank the RTI team that carried out the study on which this research is based, including Lynn Wenger, Alexandra Lutnick, Michele Thorsen and Helen Cheng. The talent and compassion they bring to their work is unparalleled. I would also like to thank my colleague Alex Kral, who has been my most important and steadfast supporter throughout this long process. Simply put, I could not have done it without him.

I would like to thank my partner, Angela Hildebrand, for her patience and support, and our daughters, Rae Lorvick-Patt and Stella Hildebrand, for being a much-needed counterbalance to the pressures of academia. I would also like to thank my mother, Ruth Lorvick, whose active and inquiring mind has always set a good example of how to be engaged with the world. Friends who have encouraged and sustained me include Beth Segal, Cindy Changar, Jennie Harris and Sonya Arreola.

Finally, I am grateful to the members of my dissertation committee, including Norman Constantine, Amani Nuru-Jeter and Charis Thompson, for supporting and advancing my goal of obtaining a terminal degree. I am particularly indebted to my committee Chair, Patricia Morgan, who provided strong and consistent guidance throughout this journey.

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Introduction

This dissertation examines HIV, sexually transmitted infections (STIs) and health risks among women who use methamphetamine. Methamphetamine is an illicit stimulant drug that affects the central nervous system, creating heightened awareness and activity for hours at a time. Prolonged use can lead to anxiety, paranoia and damage to the brain's dopamine receptors.[1] Methamphetamine use grew rapidly in the United States throughout the 1990's and the 2000'sand was frequently referred to as a drug "epidemic" in the popular press. [2,3] The public health ramifications of this upsurge have been numerous, including the rapid spread of methamphetamine use to previously unaffected regions of the country,[4] toxic hazards in rural communities caused by homegrown "meth labs,"[5] and, in some populations, increases in infectious disease directly linked to methamphetamine use.[6,7] However, one aspect of the rise in methamphetamine use has often failed to garner attention: its impact on women. Whereas the proportion of women using most illicit drugs hovers around 20-30 percent, national data indicate that nearly half of methamphetamine users are female.[8]

Similarly, in the fields of drug abuse and HIV/STI prevention, scant attention has been paid to the potential sexual health risks associated with methamphetamine use for women, despite the growing proportion of HIV cases occurring among women through sexual contact, as well as evidence that the use of another stimulant drug, crack cocaine, is associated with elevated levels of sexual risk.[9-12] Most work to date regarding methamphetamine use and sexual risk has focused on gay/bisexual men, which has found that methamphetamine use is associated with sexual risks such as unprotected sex with multiple partners. [13-17] In some urban areas, methamphetamine use was shown to the primary driver of a surge in HIV and syphilis infections among gay/bisexual men.[18,19] Research regarding methamphetamine and sexual risk among women has been scarce but worrying. Multiple partners and unprotected intercourse appeared widespread. Baseline data from an intervention study with heterosexual methamphetamine users showed that female participants (N=146) reported an average of 4.7 sex partners in the two months prior to intervention. Two-thirds had unprotected intercourse with casual or anonymous partners in those two months.[20] Among female injection drug users (IDUs) in San Francisco, methamphetamine use was independently associated with anal sex and more than five sexual partners in the past six months, compared to non-meth injectors.[21] In a separate sample of heterosexual IDUs sampled throughout California at syringe exchange programs, methamphetamine users had two-fold odds of unprotected sex and multiple sexual partners (5 or more) in the past six months, compared to non-meth injectors.[22] Furthermore, there was has been almost complete absence of biological data regarding HIV and STIs among methamphetamine-using women. In the studies of IDUs mentioned above, the prevalence of HIV infection among IDU women who injected methamphetamine was similar to that among non-meth injectors; nine percent in the San Francisco sample[21] and four percent in the statewide sample.[22] However, there was no published research regarding HIV prevalence among methamphetamine-using women who were not IDUs. In addition, there has been a notable absence of data regarding the prevalence of STIs among methamphetamine-using women. One study, relying on a self-report measure, found that 31 percent of women reported having an STI in the past two months.[20] It is uncertain how accurate these data may be.[23]

It was in this context that RTI International received funding from the National Institutes on Drug Abuse to conduct one of the first U.S. studies specifically examining HIV, sexual risk and sexually transmitted infections (STIs) among methamphetamine-using, heterosexual women,

beginning in 2006. The substance of this dissertation is based on secondary analysis of these data. A brief description of the study is presented below.

The Women and Methamphetamine (WAM) Study was a community-based study of women who use methamphetamine in San Francisco, CA (N=322). The objectives were to assess HIV and STI prevalence and sexual risk behavior among women who were had heterosexual sex and were active users of methamphetamine. Eligibility criteria included (a) age 18 or older; (b) used methamphetamine in the past 30 days; (c) one or more male sexual partners in the past six months. Participants were recruited using Respondent Driven Sampling (RDS), a form of chain-referral sampling with associated methods for calculating inclusion probabilities and weighing estimates.[24,25] This sampling method has been widely used in studies of 'hidden' or stigmatized populations in the US and internationally.[26] All participants engaged in informed consent, a one-on-one quantitative risk assessment interview, and testing for HIV and STIs (gonorrhea, Chlamydia, vaginal trichomonas, syphilis and herpes simplex virus-2). Results of tests were provided in one-on-one counseling sessions, which included referral to social and medical services as appropriate. Per San Francisco Department of Public Health protocols, women with gonorrhea, Chlamydia or trichomonas infection were screened for contraindications to standard therapy and provided with treatment on-site. The study also included a qualitative component. Purposive samlpling was used to seltect a subset (N=34) of women to participate in qualitative, open-ended interviews with trained staff. Topics of discussion included drug use history, living situation, intimate relationships, service utilization, sexual experiences and history, current methamphetamine use and perceived links between methamphetamine use and sexual behavior. Participants received cash incentives for taking part in the quantitative interviews, the HIV/STI disclosure sessions and the qualitative interviews. Quantitative data were entered into a computer-assisted interview program (Blaise®, Westat) as they were being collected, and then uploaded to SAS Version 9.2 (Cary, NC). Qualitative data were captured on digital recorders, transcribed and entered into Atlas ti (Atlas.ti GmbH, Berlin).

This dissertation, based on data from the RTI study, addresses the dearth of knowledge regarding sexual health (HIV, STIs) and sexual health risk among heterosexual women who are active methamphetamine users. In doing so, it takes on three key issues. First, it assesses the prevalence of HIV and STIs among women who use methamphetamine, characterizing the scope of the problem as it applies to this population in San Francisco, CA. Second, it examines the relationship between sex and methamphetamine use for women, as described qualitatively and quantitatively by participants. Third, it examines the prevalence and correlates of non-partner violence against women. Gender-based violence is strongly linked to HIV risk and infection among women in the United States[27,28] and worldwide.[29,30] To each of these areas of inquiry, my research strove to apply the methods that could best capture and investigate these phenomena within the constraints of the available data. Below, I introduce each of these three papers in greater detail.

Paper One describes the prevalence of HIV, STIs and sexual risk behavior among methamphetamine-using women in San Francisco (N=322). Prevalence is presented in two ways: standard point prevalence and prevalence estimates (with confidence intervals) that adjust for inclusion probabilities in the RDS sample. In addition, Paper One explores factors associated with infection, some of which are established in the STI literature (eg, race/ethnicity,

age) and some of which were theorized based on my research. In particular, the paper explores the hypothesis that a greater frequency of stimulant use (methamphetamine and crack cocaine) is associated with higher levels of sexual risk behavior and, as a consequence, higher prevalence of vaginal trichomonas, the most common non-viral STI in this sample. The proposed explanatory relationship is tested using theory-based data analysis,[31] an analytic strategy that provides a framework to test for evidence of causal relationships when working with cross-sectional data. Paper One concludes with careful consideration of some surprising findings, as well as concrete recommendations for public health measures that would improve the sexual health of methamphetamine-using women.

Paper Two explores the relationship between sex and methamphetamine use for women, an area which has been studied among gay men but not among heterosexual women. Using mixed (quantitative and qualitative) methods, I consider the role of methamphetamine use relative to multiple facets of women's sexual experience, including sexual risk, desire and pleasure. In this paper, the use of mixed methods extends and challenges the boundaries of conventional HIV-related risk assessment. To date, interventions to reduce sexual risk among heterosexual drug users have produced lackluster results. The marriage of quantitative and qualitative methods in Paper Two results in the identification of potential new directions for public health practitioners who want to reduce sexual risk among marginalized women.

Paper Three addresses another gap in the research about women who use drugs, specifically their vulnerability to violence from people other than intimate partners. While there is extensive literature regarding intimate partner violence in this population, there is surprisingly little that examines non-partner violence. Paper Three examines women's lifetime and recent experiences of physical and sexual violence from a variety of perpetrators. In addition, this paper assesses factors associated with non-partner violence, drawing on the concept of risk environment, described by Rhodes[32] as "the space – whether social or physical – in which a variety of factors interact to increase the chances of harm. (p. 193)" Poor drug users often live in dangerous environments, such as the streets of inner-city neighborhoods, engage in risky income-generating activities, such as drug running and sex work, and have few resources to bring to bear that might increase their safety. Using standard multivariate analysis, I explore correlations between recent non-partner violence and a theoretically-derived group of factors related to risk environment. The results point to a number of social and structural interventions, some of them quite simple, that could reduce "everyday violence"[33] among drug-using, impoverished women.

These three papers bring together intellectual rigor and innovation to examine the health and health risks of sexually active women who use methamphetamine. This dissertation addresses key gaps in the knowledge base regarding the prevalence of HIV, STIs and sexual risk behavior among methamphetamine-using women. It delves into the complex issue of sexual behavior in the context of drug use and HIV/STIs, offering new insights generated from the narratives of methamphetamine-using women. In addition, this work explores a largely overlooked issue for marginalized women, namely the violence encountered on their streets and communities, and examines factors that may increase vulnerability. This dissertation puts forward substantial new knowledge about women who use methamphetamine, and contributes ideas for effective public health measures to reduce risk in this understudied and vulnerable population.

Paper One
Sexual Risk and Sexually Transmitted Infections among Women who Use Methamphetamine

Introduction

Methamphetamine stands out among illicit drugs for its unusually high proportion of female users. According to data from the National Survey on Drug Use and Health (NSDUH), 46 percent of past-year methamphetamine users in 2007 were women. By comparison, 28 percent of crack users and 22 percent of heroin users were female.[34] Similarly, while women make up about a third of drug treatment admissions for heroin and cocaine in the United States, they make up 46 percent of admissions for methamphetamine.[8] In 2008, methamphetamine was by far the most common drug of abuse among women in publicly-funded treatment programs in the State of California, with 40 percent of admissions related to methamphetamine use.[35] In the 1990's and 2000's, methamphetamine use in the United States grew dramatically. Drug treatment entries for methamphetamine use doubled between 1995 and 2005, as the drug spread from the West Coast to other regions of the country.[4,36] This same period saw marked increases in methamphetamine-related emergency department visits, with some municipalities reporting increases of over 200 percent.[36]

Research to date indicates that methamphetamine use is associated with risky sexual behavior and sexually transmitted infections (STIs), including HIV. The preponderance of this research, however, focuses on men who have sex with men (MSM). Among MSM, studies have documented strong associations between methamphetamine use and unprotected anal intercourse (UAI) [13-15,37] and UAI with HIV+ or unknown-status partners,[16,17] multiple partners,[37-39] and sexual disinhibition.[13,40,41] In addition, epidemiologic studies have found that methamphetamine use among MSM predicts HIV infection, [6,7] syphilis[42] and other STIs, [43] and is linked to incident syphilis infection.[18]

Far less is known about HIV and STIs among women who use methamphetamine. An emerging body of research indicates that women who use methamphetamine, like their MSM counterparts, engage in high levels of sexual risk behavior. In a study of heterosexual methamphetamine users in San Diego, women (N=146) reported an average of 4.7 sex partners in the two months prior to interview. One-third reported unprotected vaginal sex with paying partners; two-thirds had unprotected intercourse with casual or anonymous partners; and 92 percent with steady partners in the past two months.[20] An earlier examination of women from the same study (n=98) reported that the mean number of unprotected sexual encounters in the past two months was 34.6. In addition, 41 percent of women reported anal sex in the past two months, with a mean of 7.5 unprotected anal sex acts.[44] Both reports utilize baseline data from an intervention focused on sexual risk reduction among high-risk, HIV-negative heterosexuals. Thus, the women represented may differ from female methamphetamine users who would not volunteer for such interventions. In a study population drawn from publicly-funded HIV testing sites in 1994-1995, Molitor[45] compared individuals who reported using methamphetamine during sex with individuals who did not use methamphetamine during sex. Women who reported methamphetamine use during sex had more sexual partners and participated in more acts of vaginal and anal intercourse than women who didn't report methamphetamine use during sex. Among females, methamphetamine use during sex was independently associated with unprotected anal and vaginal sex, sex work and self-reported history of STIs.

Higher levels of sexual risk are also found among female injection drug users (IDUs) who use methamphetamine, when compared to women who inject other drugs. A study of female IDUs

in San Francisco found that methamphetamine use was independently associated with anal sex and more than five sexual partners in the past six months.[21] In an examination of heterosexual methamphetamine injectors recruited from syringe exchange programs throughout California, 56 percent of women reported unprotected vaginal sex, 22 percent reported anal sex and 17 percent reported more than five sexual partners in the past six months.[46] A 1994 study of IDUs in California found similarly elevated rates of sexual risk among methamphetamine-injecting females.[47] In event-level analysis of sexual activity among heterosexual IDUs in North Carolina, Zule found that the highest-risk sexual activity occurred among dyads where both male and female partners were using methamphetamine.[48] As a group, these findings drawn from community-based studies of IDUs point to substantially higher levels of sexual risk among methamphetamine injectors than non-meth injectors. However, they do not address sexual risk among methamphetamine-using women who do not inject. This study examines sexual risk both injectors and non-injectors.

Despite the increasingly clear links between methamphetamine use and unsafe sexual activity, data regarding STIs among methamphetamine-using heterosexual men or women are rare and rely mostly on self-report. For example, in the San Diego study described above, all data regarding STIs were self-reported.[20] Some studies of IDUs provide data on HIV prevalence among women who inject methamphetamine. HIV prevalence was three percent among female methamphetamine injectors using syringe exchanges in California,[46] and nine percent among female IDUs n San Francisco. [21] In both these studies, there were no significant differences in prevalence between methamphetamine and non-meth injectors. The dearth of biological data regarding HIV and STIs among methamphetamine-using women needs to be addressed, given the indications of high sexual risk in this population and the increasing proportion of heterosexually-acquired HIV infections among women.[49] The findings of this study contribute to addressing that gap.

Research regarding drugs another common illicit stimulant, crack cocaine, has generated some findings regarding drug use and STI infection among women. Crack use is a predictor of STI infection among women in several studies.[9-12] In addition, there is evidence that greater frequency of crack use is associated with more participation in high-risk sexual behaviors and higher levels of HIV/STD infection.[50-52] In a comprehensive review regarding STIs among drug users, Seeaman described elevated levels of syphilis, gonorrhea, and Chlamydia among female crack users.[53] Most studies reviewed did not have sufficiently large samples to determine independent predictors of infection. Nor did they assess the potential association between methamphetamine use and STIs. This study makes a unique contribution by focusing on methamphetamine users, unlike previous studies, and by assessing correlates of infection.

Research regarding STIs in virtually any group of US women must account for marked racial disparities in infection, with the highest burden of disease among African Americans.[54] Nationally, gonorrhea and syphilis rates are 14 times greater among African American women than White women.[55] Similarly, Chlamydia is seven times higher, HSV-2 is three times higher[55] and Trichomonas vaginalis (TV) is 12 times higher.[56] The extensive literature examining these disparities demonstrates that they are attributable to social and structural factors, such as high male incarceration rates and racial segregation, rather than differences in individual-level risk behaviors.[57-59] Research assessing racial disparities in STIs among drug-using women

specifically is scarce. Studies examining male and female drug users together have found higher rates of HSV-2, gonorrhea and HIV among African Americans compared to whites.[53,60] A five-city study of young IDUs (ages 18-30) found no differences in Chlamydia prevalence by race among female participants (5.6%) , but the prevalence of gonorrhea was significantly higher in non-white women (3.4%) than white women (0.8%).[61] Age is another area in which disparities in STI prevalence are well-established. Nationally, gonorrhea, Chlamydia and syphillis are most prevalent among younger sexually active women (ages 15-24)[62] while Trichomonas vaginalis (TV) is more prevalent among women 30 and older than among women under 30.[10,40, 51]

Trichomonas vaginalis (TV) is the most common non-viral STI in the US.[10] In a recent population-based sample of US women aged 14-49, the prevalence of TV was 3.2 percent, higher than gonorrhea and Chlamydia combined.[56] In a sample of urban African American women who used drugs, the prevalence of TV was 37 percent and the incidence was 35 cases per 100 person years.[63,64] Once thought to be relatively benign, emerging research indicates that TV substantially enhances women's susceptibility to acquiring HIV infection, increasing the odds of infection 1.5 to 3-fold. [65] It is estimated that as many as six percent of new HIV infections in US women each year may be attributable to susceptibility caused by TV.[66] Trichomonas vaginalis may play a major role in amplifying HIV transmission, particularly in urban African American communities where prevalence is high.[67] Co-infection with other STIs is common.[56,63,67]

STIs increase susceptibility to HIV infection two to five fold among women.[68] The lack of knowledge regarding HIV and STIs among methamphetamine-using women needs to be addressed, given high sexual risk in this population, the risk posed by STIs in terms of sexual health and susceptibility to HIV, and the increasing proportion of heterosexually-acquired HIV infections among women nationally.[49] This paper addresses a fundamental gap in the literature by providing biological data regarding the HIV and STI prevalence among women who use methamphetamine. In addition, it examines whether factors associated with STIs in other studies of marginalized women, such as race/ethnicity and age, hold true for a methamphetamine-using population. Finally, it investigates the hypothesis that STI infection may be related to frequency of stimulant use, a potential link that has been largely unexplored.

Methods

Data collection was conducted from July 2007 – June 2009 in San Francisco, California, with funding from the National Institute on Drug Abuse (R01 DA021100). All study procedures were reviewed and approved by the Institutional Review Board at RTI International. Use of these data for the author's dissertation project was exempted as secondary data analysis by the Committee for Protection of Human Subjects at the University of California, Berkeley. A community-based sample of female methamphetamine users was recruited using respondent-driven sampling (RDS). [24] RDS is a form of chain-referral sampling that uses statistical adjustment for recruitment patterns (who recruited whom) and network size to produce samples that, theoretically, are generalizable to the target population.[69] RDS is being used increasingly in epidemiological studies of "hidden" populations, where stigma or illicit activity preclude the development of a true sampling frame.[26] A group of initial recruits (or "seeds") were identified by the research team through outreach. Participants were then given up to six coupons entitling

them to a cash incentive for successfully recruiting other methamphetamine-using women in their networks into the study. The women recruited by seeds were also given coupons, and so on. Participants received a cash incentive ($10-$20) for each eligible person referred. Each "generation" of recruits is referred to as a "wave." Seventeen waves of data collection occurred in this study (see Figure 1 for illustration of recruitment networks). Eligibility criteria for the study were (a) biological female; (b) age 18 or older; (c) methamphetamine use in past 30 days; (d) one or more male sexual partners in past six months; and (e) referred by another participant with RDS recruitment coupon (except seeds). Eligibility was determined through a telephone screening process that masked criteria by including several questions unrelated to eligibility.

Participants engaged in an informed consent process, quantitative interview and HIV/STI testing at a centrally located community field site. The quantitative interview was conducted face-to-face, with interviewers posing items verbally and recording responses in a computer-based personal interviewing system (Blaise®, Westat). Biological testing included HIV, syphilis, herpes simplex virus 2 (HSV-2), gonorrhea, Chlamydia and Trichomonas vaginalis (TV). Blood samples were drawn by a certified phlebotomist and tested for HIV antibodies, syphilis and HSV-2 at laboratories run by the San Francisco Department of Public Health. Pharyngeal (throat) swabs were collected by the phlebotomist for pharyngeal Chlamydia and gonorrhea screening. Self-administered vaginal swabs were used for vaginal Chlamydia, gonorrhea and TV screening. In this procedure, participants entered a private restroom, briefly wiped a long-stemmed cotton swab around the inside of the vagina and placed the swab in labeled specimen bag. Self-collected swabs have high acceptability among women at risk for STIs[70,71] and are both feasible and accurate for testing in non-clinical settings.[72]

All participants received pre- and post- testing counseling for HIV and STIs from trained staff. Individuals testing positive for gonorrhea, Chlamydia or TV were screened for contraindications and offered STI treatment on site, per Department of Public Health protocols. Those with contraindications to field-delivered therapy and those with a positive syphilis screen were referred to the municipal STI clinic for treatment. HIV-positive women were referred to appropriate medical and social services, as were many other study participants. Study participants received $40 for the initial interview and testing session and $30 for HIV and STI counseling sessions. They also received a $10-$20 incentive for each eligible participant they referred to the study (this incentive was increased midway through the study to improve recruitment). During the informed consent process, participants were notified regarding California State reporting requirements for Chlamydia, gonorrhea and syphilis. HIV was not reportable under a research exemption.

Laboratory Testing

Laboratory analyses were conducted by the San Francisco Department of Public Health, with the exception of TV, which utilized a point-of-care test (OSOM, Genzyme Diagnostics) This required trained study staff to place the vaginal swab in a vial of solution on site and then read the results after 10 minutes. Serum specimens were screened for HIV-1 antibodies using an enzyme immunoassay (EIA) (Vironostika HIV-1 Microelisa; Organon Teknika Durham, North Carolina). Repeatedly reactive specimens were confirmed by Western blot (Bio-Merieux Vitek, Inc., Rockville, Maryland). Serum specimens were tested for HSV-2 antibody using a commercial type-specific EIA (HerpeSelect HSV-2 EIA, Focus Technologies, Cypress,

California). For syphilis, serum were screened for antibody using the venereal disease research laboratory (VDRL) and confirmed with treponema pallidum particle agglutination (TPPA) (Fujirebio, Tokyo, Japan). Pharyngeal and vaginal swabs were tested for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* using FDA-cleared and regulatory compliant molecular amplification assays on clinical specimens (GenProbe Aptima [GenProbe, San Diego, California]).

Measures

Dependent variables
The dependent variables in bivariate analyses were biological outcomes (positive or negative) for HIV, HSV-2, TV, Chlamydia and gonorrhea. In multivariate analyses, the dependent variable was TV infection.

Independent variables – demographic characteristics
All independent variables were based on self-report. Participants were asked their age in years at the time of interview, and responses were categorized for analysis as 18-39; 30-39; 40-49; ≥50. Race/ethnicity was based on an open-ended question, "Which racial/ethnic groups do you consider yourself?" This was coded into seven categories (African American, White, Latina, Asian/Pacific Islander, Native American, mixed and other). For analysis, race was trichotomized into three groups: African American, white and all others. Homelessness was defined as a positive response to the question, "Do you consider yourself homeless?"

Independent variables – sexual behavior
Two separate questions were asked regarding sex trade: "In the past six months, have you received money in exchange for sex?" and "In the past six months, have you received drugs in exchange for sex?" These items were combined in analysis. Number of male partners was measured with the item: "In the past six months, how many different male sexual partners (including steady, casual or paying partners) did you have vaginal, anal or oral sex with?" For each type of partner, participants were asked "how many of your [steady, casual or paying] partners did you have vaginal sex with?" and "what percent of the time did you use condoms when you had vaginal sex with your [steady, casual, paying] partners?" Unprotected vaginal sex was defined as < 100% condom use with any type of male partner in the past six months. Unprotected vaginal sex with ≥2 partners was defined as < 100% condom use with 2 or more male partners of any types in the past six months. The question about methamphetamine-using partners was, "As far as you know, do any of the male sexual partners you've had sex with in the past six months use methamphetamine?" Negative and "don't know" responses were grouped together.

Independent variables – Use of methamphetamine and crack cocaine
Meth and crack use were assessed separately by items asking "In the past 30 days, have you used methamphetamine [crack]?" Affirmative responses were followed by the question, "how many days in the past 30 have you used methamphetamine [crack]?" Participants were asked separately about injection and non-injection use of all drugs in the past 30 days. We combined injection and non-injection use for analysis. Individuals who reported 30 days or more of methamphetamine and crack use combined were classified as "used stimulants ≥30 days." In

multivariate analysis, frequency of stimulant use was treated as a continuous variable reflecting the number of days of use in the past 30.

Table 1.1: Sample Characteristics (n=322)

	Crude %	Weighted %	95% CI*
Race/ethnicity			
African American	45.9	42.0	31.4, 50.1
White	32.8	34.7	28.3, 43.9
Native American	4.7	4.5	2.4, 7.8
Latina	4.4	8.2	3.1, 13.6
Asian or Pacific Islander	2.2	0.3	0.1, 0.6
Mixed race	9.4	6.8	3.9, 11.3
Other/refused	0.6	0.1	0.0, .02
Age			
18-29	20.8	20.3	14.9, 30.3
30-39	22.7	25.4	17.7, 31.0
40-49	32.9	32.1	22.5, 38.3
50 or older	23.6	22.2	17.2, 29.9
High school diploma or GED	71.7	72.9	67.5, 81.5
Homeless	56.8	54.6	45.8, 63.2

* for weighted estimates

Descriptive variables

Additional data are presented that were not used analytically, but which help describe this little-studied population (Tables 1.1-1.3). Variables not addressed above are described here. Education was measured by an item asking, "What is the highest level of schooling you completed?" Open-ended responses were coded as "less than high school diploma or GED," "high school diploma or GED," and "any college." Injection of heroin and heroin combinations was determined by a positive response to the questions, "In the past 30 days, have you injected heroin [speedball] [goofball]?" Participants were also asked, "In the past 30 days, did you smoke marijuana?" and "In the past 30 days, did you drink alcohol?" Unprotected anal sex was defined as anal sex with one or more male partners with less than 100 percent condom use in the past six months. Sex with female partners was defined as a response of $\geq$1 to the question, "How many different female sexual partners have you had in the past six months?"

Analyses

Point prevalence data were obtained using SAS and Respondent Driven Sampling Analysis Tool (RDSAT version 5.6, available at www.respondentdrivensampling.org), a free software package that adjusts for network size and recruitment patterns, and weights observations accordingly. RDSAT generates both adjusted point estimates and 95 percent confidence intervals. Both crude and weighted data are presented in tables of descriptive findings (Tables 1.1-1.4). Because there are no established methodological guidelines for using RDSAT weights in bivariate and multivariate analyses,[73] the author used unweighted data in these analyses (see discussion for more detail). Bivariate associations between STI infections and demographic/behavioral variables were examined with Pearson's $\chi 2$ tests of significance. Independent variables that were

associated with TV infection in bivariate analyses at a significance level of ≤.10 were entered into the multivariate models of TV infection. Three separate logistic regression models were carried out to explore the relationship of frequency of stimulant use and TV infection, and the potential explanatory effect of sexual risk behaviors on this relationship. The first model tests for the existence of a statistically significant association between frequency of use and TV infection, the second tests potential confounders (race, age and homelessness) and the third tests sexual risk behaviors as potential mediators of infection. Multivariate models were assessed for goodness of fit using the Hosmer-Lemeshow test.[74]

Results

The study population was diverse (Table 1.1). Over half of participants were homeless. About 40 percent of participants were African American, and over half were aged 40 or older. Twenty-four percent of women lived with a steady sexual partner, 40 percent had a steady partner they did not live with and 36 percent had no steady partner at the time of interview. While 42 percent of women reported having children under 18 years of age, only nine percent had minor children living with them.

Table 1.2: Drug Use past 30 Days (n=322)

	Crude %	Weighted %	95% CI[#]
Modes of meth use			
Injected	47.2	39.4	31.2, 48.0
Non-injected	85.1	84.6	77.7, 90.6
Both	25.7	24.8	17.9, 30.8
Frequency of meth use			
1-9 days	29.5	44.4	37.7, 53.3
10-29 days	50.3	45.3	36.8, 51.3
≥30 days	20.2	10.3	7.5, 13.6
Other drug use			
Injected heroin, speedball* or goofball**	27.6	26.1	18.1, 34.0
Used crack cocaine	61.8	61.4	51.1, 70.1
Smoked marijuana	58.4	57.4	49.8, 64.7
Drank alcohol	75.2	71.1	62.5, 78.5

*mixture of heroin and cocaine; **of heroin and methamphetamine
[#] for weighted estimates

Both injection and non-injection methamphetamine use were common, and about a third of women reported both modes of use in the past 30 days (Table 1.2). The most frequent mode of methamphetamine use in the past six months was smoking for 54 percent of women, injecting for 32 percent and snorting for 11 percent. The remaining three percent of women said they most often either ingested methamphetamine (with food or drink) or insert it in the vagina or anus. Sixty-eight percent of women reported binge use in the past 30 days, defined as three or more days of consecutive use without "coming down." Nearly all (91%) of women reported using illicit drugs in addition to methamphetamine in the past 30 days, most commonly crack cocaine (Table 1.2)

Table 1.3: Sexual Behavior, past Six Months (n=322)

	Crude %	Weighted %	95% CI*
Number of male partners			
1	21.1	29.0	21.5, 37.9
2-3	25.5	29.1	22,2, 36.7
≥ 4	53.4	41.8	33.4, 49.3
Unprotected vaginal sex, ≥2 partners	58.3	46.4	37.1, 53.7
Unprotected anal sex	22.1	26.3	19.3, 33.0
Sex with female partner(s)	36.0	36.1	28.0, 42.3
Sex with male meth-using partner(s)	81.0	76.7	71.4, 83.5
Traded sex for drugs	45.0	36.6	28.7, 43.7
Traded sex for money	56.2	45.3	36.2, 52.8

*for weighted estimates

Sexual Risk Behavior

Multiple male partners, unprotected sex and sex trade activity were common (Table 1.3). When asked to identify their sexual orientation, 61 percent of women said they were heterosexual, 32 percent bisexual, three percent lesbian and four percent "other." Sexual assault, which may put women at involuntary risk for HIV/STIs, was experienced by 30 percent of women in the six months prior to interview

HIV and STIs

The prevalence of HIV and STIs are presented in Table 1.4. The most common STI was HSV-2. Age was strongly correlated with HSV-2 infection, with prevalence increasing from

Table 1.4: Crude and Weighted HIV and STI Prevalence (n=322)

	Crude %	Weighted %	95% CI*
HIV	7.8	9.0	8.2, 9.5
Herpes Simplex Virus 2	75.8	74.9	68.8, 87.8
Trichomonas vaginalis	21.7	24.5	18.6, 33.1
Gonorrhea			
Vaginal	2.2	1.4	0.3, 2.9
Pharyngeal	1.2	1.7	0.1, 2.0
Chlamydia			
Vaginal	1.9	0.6	0.0, 0.7
Pharyngeal	0.6	0.5	0.0, 0.1

* for weighted estimates

46 percent among women aged 18-29 to 91 percent among women 50 and older ($p<.001$). Prevalence of HSV-2 was significantly higher among African Americans (Table 1.5), compared to white women and women of other racial/ethnic backgrounds. HIV infection did not differ significantly by race. Women age 40 or older had a higher HIV prevalence compared to women under 40 (10% vs. 4%, $p<.05$). Among the 25 women with HIV in the study, 19 (76%) had a history of injection drug use.

The number of Chlamydia and gonorrhea infections was low. The combined prevalence of Chlamydia and gonorrhea of both types (pharyngeal and vaginal) was 5%. Neither age nor race was correlated with infection. Only one case of primary syphilis was discovered over the course of the study.

Table 1.5: Crude HIV and STI Prevalence by Race/Ethnicity (N=320)*

	African Am. (n=147) **%**	White (n=105) **%**	Other (n=68) **%**
HIV	6.1	8.6	10.2
Herpes Simplex Virus 2**	83.7	73.3	63.2
Trichomonas vaginalis**	26.5	19.1	14.7
Gonorrhea or Chlamydia	6.1	4.8	0.6

*race/ethnicity missing for 2 cases; **p≤.05

Nearly a quarter of participants were positive for TV infection. We examined potential sex- and drug-related correlates of HSV-2 and TV, the two most prevalent STIs in the study population. Tests of bivariate associations with TV are presented in Table 1.6. Because a large number of analyses were conducted for this single outcome, the test of significance should be interpreted with caution. Only frequent stimulant use (daily or more often) was associated with TV infection at the <.01 level. None of the sex risk or drug use variables appearing in Table 1.6 were associated with HSV-2 infection.

The relationship between frequent stimulant use and TV infection was further investigated in multivariate analyses (Table 1.7). The first model tested the association between frequency of stimulant use (measured as a continuous variable) and TV infection, and points to a small increase (2%) in odds of TV infection with each additional day of stimulant use. The second model tests potential socio-demographic confounders. In this model, the middle age group (30-49) and African American race were independently correlated with infection, while the strength of the relationship between stimulant use and TV infection remained the same. The third model tested sexual risk behaviors as potential mediators of the association between frequent stimulant use and TV. The association between frequency of stimulant use and TV falls below the level of statistical significance, indicating that sex risk has a potential mediation effect, but the change is quite small. In addition, neither of the sexual risk variables is associated with infection. Therefore, we did not find support for the hypothesis that sexual risk behavior mediates the relationship between frequency of stimulant use and TV infection. Models 2 and 3 provided adequate fit of the data (Model 2: Hosmer-Lemeshow $X^2 = 4.9$, df=8, p=0.76; Model 3: Hosmer-Lemeshow $X^2 = 6.6$, df=8, p=.57)

Pattern of TV Infection

Because the sample was recruited using RDS, we tested the possibility that TV cases clustered in certain referral chains. First, the multivariate models shown in Table 1.7 were run using General

Table 1.6: Correlates of Trichomonas (TV) Infection (n=322)

	TV neg (%) (n=252)	TV pos (%) (n=70)	p
Descriptive characteristics			
Age			
18-29	83	17	
30-39	77	23	
40-49	71	29	
≥50	86	14	.07
Homeless			
Yes	75	25	
No	83	17	.10
HIV +			
Yes	76	24	
No	78	22	ns
HSV-2 +			
Yes	77	23	
No	83	17	ns
Sexual behavior (past six months)			
Unprotected vaginal sex			
Yes	78	22	
No	85	15	ns
Unprotected vaginal sex, ≥2 partners			
Yes	75	25	
No	83	17	.09
Traded sex for drugs or money			
Yes	74	26	
No	84	16	.04
Meth-using male sex partner			
Yes	80	20	
No	77	23	ns
Drug use (past 30 days)			
Used meth ≥30 days			
Yes	69	31	
No	81	19	.05
Used crack ≥30 days			
Yes	65	35	
No	80	20	.02
Used stimulants* ≥30 days			
Yes	70	30	
No	85	15	<.01

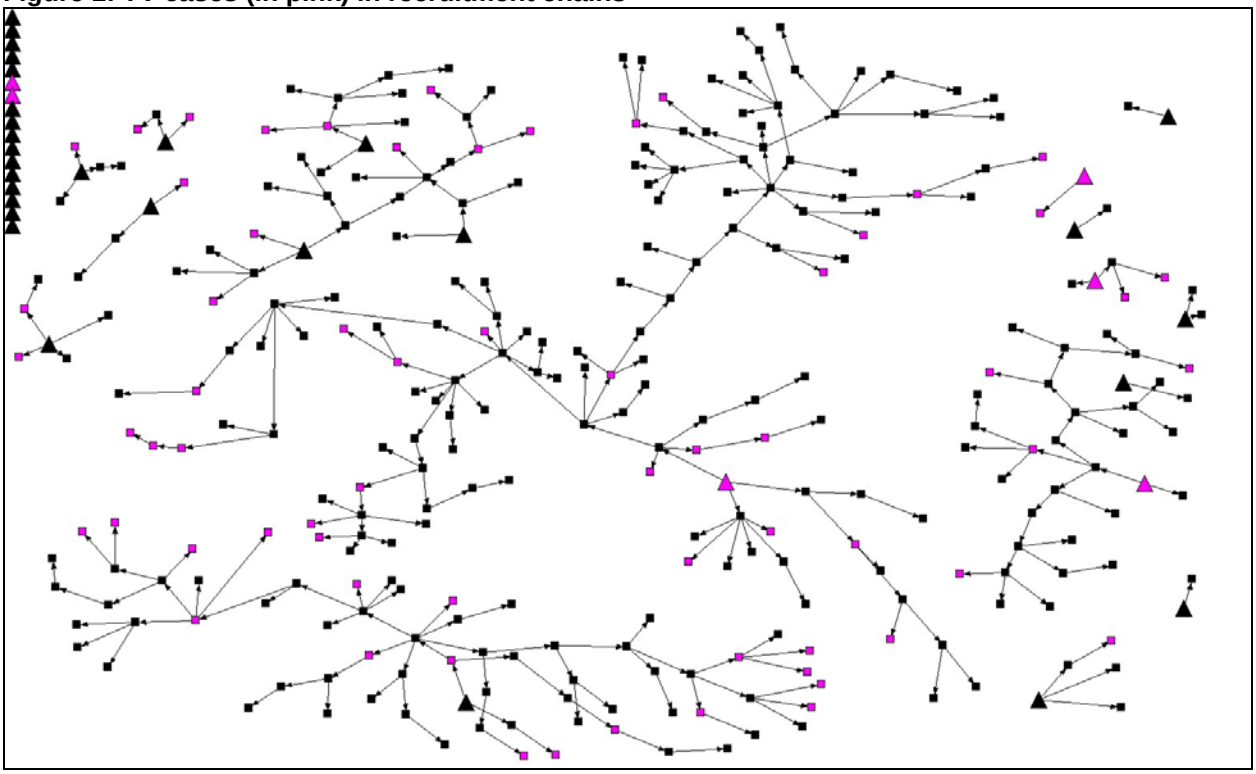
***crack cocaine or methamphetamine

Table 1.7: Multivariate Models Predicting Trichomonas (TV) Infection

	Model 1		Model 2		Model 3	
Independent variables	***OR***	***95% CI***	***OR***	***95% CI***	***OR***	***95% CI***
Frequency of stimulant use	1.02	(1.00, 1.03)	1.02	(1.00, 1.03)	1.01	(0.99, 1.03)
African American			1.77	(1.02, 3.07)	1.75	(1.00, 3.06)
Age 30-49			1.99	(1.10, 3.49)	2.00	(1.12, 3.57)
Homeless			1.66	(0.94, 2.94)	1.52	(0.84, 2.74)
Unprotected vaginal sex with ≥2 male partners					1.32	(0.73, 2.40)
Traded sex for drugs or money					1.27	(0.66, 2.46)

Estimating Equations (GEE), adjusting for within-group and cross-group effects. The results were almost identical (data not shown). Second, we used RDSAT to assess the degree to which TV-infected persons preferentially recruited other infected persons. This measure runs from completely heterophilous (-1) to completely homophilous (+1). The result was -.11, indicating an absence of significant homophily in terms of recruitment. Thus, no adjustment was made to the statistical model to account for confounding related to within network patterns. Figure 1, below, illustrates study recruitment chains and TV cases within those chains.

Figure 1: TV cases (in pink) in recruitment chains



Discussion

This study offers some of the first findings that examine HIV and STI prevalence among women who use methamphetamine. HIV prevalence among methamphetamine-using women was similar to previously-studied populations of IDU and crack-using women in San Francisco.[21,75] Most HIV-positive women had a history of injection drug use. However, growing evidence regarding the importance of sexual transmission of HIV among IDUs, particularly female IDUs, cautions against assuming that none of these cases was sexually acquired.[75,76] In addition, six HIV-infected women reported no history of IDU, indicating a likelihood of sexual transmission. There was a high prevalence of HSV-2 in the study population, similar to findings from other studies of marginalized women.[58,64] Both HIV and HSV-2 prevalence were higher for women with older ages, reflecting more cumulative years of exposure as women aged. Conversely, the low prevalence of Chlamydia and gonorrhea is likely related to the small representation of participants under 25 in our study, as this is the age group most affected by these infections.[62] Syphilis was rare.

A central finding of this paper is that, while the odds of TV infection increased with frequency of stimulant use, this relationship was not mediated by sexual risk behavior, at least as we measured it. We found no strong evidence for a causal link between the frequency of stimulant use, sexual risk behavior and TV infection. There are a number of potential explanations for this. First, our measures of sexual risk, while fairly comprehensive, focused only on the six months prior to interview. Since TV infection is frequently asymptomatic and therefore goes undiagnosed,[56] it is possible that infections occurred before this 6-month window of observation rather than in concurrence with the time-frame of the risk behaviors measured. Secondly, some researchers have pointed out a lack of data regarding male sexual partners seriously compromises current understanding regarding TV among women, given that virtually all cases are heterosexually transmitted.[77,78] This study did not include screening of male sexual contacts, and thus an important source of risk remains unmeasured. Another plausible explanation is that frequent stimulant use somehow increases biological susceptibility to TV (eg., through increased vaginal dryness and resultant tearing), but there is currently no literature to uphold or dismiss this hypothesis. Clearly, additional research is needed to understand the mechanics underlying frequent stimulant use and TV infection among women. In the meantime, this finding, along with the body of evidence that links stimulant use and sexual risk, suggests that women who engage in frequent stimulant use should be the focus of sexual risk reduction interventions which include routine TV screening.

Age between 30-49 years was associated with TV infection among women in this study, which is consistent with other epidemiological studies of TV among women.[10,56,79] The implications of this finding bear discussion. TV is the most common non-viral STI in the United States.[10] Once thought to be relatively benign, emerging research indicates that TV substantially enhances susceptibility to HIV infection.[67] It is estimated that as many as six percent of new HIV infections in US women each year may be attributable to susceptibility caused by TV.[66] Adding complexity is the fact that TV is usually asymptomatic. For example, in a recent population-based study, 85 percent of TV-infected women reported no physical symptoms.[56] Current community-level STI screening efforts focus primarily on women in their early reproductive years (15-24), while recommendations for women 25 and older are advised to screen when

symptomatic.[80] Given the fact that TV is often asymptomatic, there is a strong likelihood that TV infections among older, sexually active women are going undetected, elevating their risk for sexually acquired HIV.

We found that African American race was associated with TV and HSV-2 infection among methamphetamine-using women. This is consistent with other studies of STIs among women,[54,55] although in this study disparities were less pronounced than usual. Nationally, the higher prevalence of STIs in African American communities is thought to be driven by social and structural factors, such as poverty and incarceration, rather than individual-level risk behaviors or biological factors.[81] As our study sample was drawn from an inner-city neighborhood that is impoverished, marginalized and racially diverse, social and structural contributors to infection may have come into play to some degree for all participants, regardless of race.[59] The strong representation of African American women in our sample belies the common assumption that methamphetamine is a "white" drug. While this may be the case in certain rural populations,[82,83] the composition of our sample suggests that, in urban, racially diverse areas, there is no reason to assume that women of color are eschewing methamphetamine use. Other studies have found fairly large proportions of Hispanic and Asian/Pacific Islander female methamphetamine users.[20,84]

Several limitations of this study should be noted. With the exception of biological test results, all data were self-reported, and may be subject to response bias. A review of research regarding the validity and reliability of self-report data from illicit drug users suggests that such data are sound.[85] As we conducted a number of bivariate analyses to examine correlates of TV infection, some p values of $\leq$.05 may have occurred by chance. Thus, interpretation of results should be based primarily on the multivariate analyses. The study employed RDS with the goal of recruiting a representative sample of methamphetamine-using women in San Francisco. However, several concerns regarding RDS arose in the analysis phase of the study. A central concern were recent research findings regarding "equilibrium," the concept that sample composition stabilizes over time and overcomes any bias introduced by the original group of seeds.[86] The statistical rationale of RDS rests on this fundament.[69,87] While common practice is to measure equilibrium cumulatively over waves of data collection, this practice capitalizes on the fact that, in any sufficiently large sample, characteristics will appear to stabilize over time, as 'new' recruits will make up an increasingly small proportion of the total sample. In addition, the theoretical literature describing RDS appears to indicate that equilibrium should be assessed wave-by-wave rather than cumulatively.[88] This concern is exemplified by a recent study conducted in Beijing, China that presented two RDS samples that focused on the same population, each demonstrating equilibrium by the cumulative definition, but with substantially different characteristics.[89] In this case, equilibrium did not ensure a reproducible (and hence, generalizable) sample. Other authors have pointed out unresolved issues regarding the underlying assumptions involved in calculating RDS inclusion probabilities [90-92] and the lack of consensus or peer-reviewed standards regarding the employment of RDS weighted estimates in multivariate analysis.[37,73] Due to the lack of clarity regarding fundamental assumptions and methods of applied analysis, RDS weights were not employed in bivariate and multivariate analyses in this paper. Thus, as with other non-probability-based samples, findings have uncertain generalizability to other populations of urban methamphetamine-using women.

Nearly half of methamphetamine users in the United States are female. This study addresses the dearth of data regarding HIV and STIs among women who use methamphetamine.
The findings of this study indicate a strong need for sexual risk reduction interventions among methamphetamine-using women, as well as a need for routine, easily accessible and voluntary TV screening for drug-using women beyond their early reproductive years.

Paper Two
Desire, Pleasure and Risk:
A Mixed Methods Analysis of Methamphetamine Use and Sex among Women

I do feel invincible…like nothing's gonna touch me…like I could do this forever. And sometimes I wish that I could have that sexual pleasure feeling forever. I don't want it to end.

(49-year-old African American woman)

Introduction

This paper explores the relationship between sex and methamphetamine use in a community-based sample of women who use drugs in San Francisco, CA. Using mixed methods, it examines not only sexual risk, but also desire and pleasure, and the role of methamphetamine use relative to these aspects of women's sexual experience. By extending the boundaries of conventional HIV-related risk assessment research, this paper strives to bring new depth and insights to understanding the sexual behavior of drug-using women.

The intersection of drug use, sexual pleasure and sexual risk is rarely explored when it comes to "high-risk" women. Rather, research regarding HIV and sex among female drug users has been dominated by an risk-focused epidemiological paradigm[93,94] which defines risk behaviors, measures their prevalence, explores the correlates of these behaviors (e.g., age, race/ethnicity, depression), and sometimes seeks to identify larger social or contextual influences on risk (e.g. housing status, gender-power dynamics). These studies have contributed vital knowledge about drug-using women and sexual risk behavior.[64,95,96] A particularly valuable result of this work is the recognition of the importance of gender-based violence and social disadvantage in shaping risk. [97-99] As Bourgois calls it,[33] the 'everyday violence' experienced by women who use drugs provides a context for health behavior which cannot be overlooked. However, the focus on trauma and social disadvantage often predominates to the degree that it obscures any sense of agency on the part of women who use drugs. Higgins[100] calls this view of HIV among women the "vulnerability paradigm." This refers to the growing recognition, particularly over the past two decades, that gender-based social and structural inequalities enhance women's susceptibility to HIV. Although a groundbreaking and vitally important shift in addressing HIV among women worldwide, Higgins points out that the paradigm's focus on women's vulnerability can "mask women's power and agency." Similarly, Valentine [101] and others [94,102] contend that while it is essential to recognize the marginalization, abuse and deprivation that accompanies drug use, it is also important to avoid seeing these factors as deterministic to the degree that they obliterate any "inherent capacity for agency."

The pursuit of pleasure is one arena in which this agency may play out. Despite the fact that pleasure is a core motivation for drug use and sexual activity, it is rare for research on substance abuse and HIV risk to address pleasure.[93,103] One explanation for this absence is the emphasis on pathologizing theories of drug use in public health. Drug use is seen as irreparably compromising to rational thought, individual autonomy, and mental and physical health.[94] For poor women in particular, the amelioration of psychological pain is often assumed to be the primary motivation for drug use.[101] Similarly, drug-related needs – not pleasure or desire – are seen as the primary motivation for sexual engagement. In this framework, it is difficult to make room for potentially positive aspects of drug use. The privileges of sexual desire and pleasure are reserved to the untraumatized, as if trauma and pleasure could not co-exist.[101] In addition, the widespread social condemnation of drug use contributes to a scientific environment that rewards

scientists for focusing on disease and risk, and provides little incentive to delve into areas that seems vaguely disreputable, not to mention difficult to quantify and analyze.[103]

The public health response to HIV/AIDS has been pragmatic and results-driven, focused on measuring and intervening in risk behaviors such as unsafe sex and sharing of hypodermic syringes. There are reasons, from this perspective, that it might it be fruitful to pursue the study of desire and pleasure, as they relate to sex and drug use. To date, interventions to reduce sexual risk among drug users, tested in randomized controlled trials, have been moderately successful at best. Meta-analyses reveal that such interventions most often have small effect sizes, when compared to no-intervention control conditions.[104,105] Furthermore, differences in behavior change between groups typically are not sustained over time.[106,107] In addition, it has been found repeatedly that intensive interventions are no more effective than 'standard' or minimal interventions.[108,109] The lackluster results of most interventions suggests that we may be missing key information to bring about sustained changes in sexual behavior among drug users, and that intensive intervention efforts to date may not be pursuing a productive direction. An enhanced evidence base – one which incorporates the perceived rewards and benefits of sex and drug use – may be needed to develop effective risk reduction strategies. In addition, research which ignores the positive aspects of sex and drug use runs the risk of not only being ineffective but also of alienating drug users, by dismissing some of their key motivations and experiences as irrelevant.[93,94] A better understanding of the subjective motivations for drug use and sexual activity, including pleasure, may help inform interventions that are more responsive to the experiences of drug users. Finally, the pursuit of pleasure reflects a certain amount of individual agency. As Valentine writes, "Rather than seeing those who use drugs in terms of passive victimhood, it is possible to acknowledge both the damage done to them and their capacity to respond and act in their own lives (p.412)." Understanding this capacity may lead to new ideas and approaches to effect healthy behavior change.

This paper uses mixed methods to explore methamphetamine use and sexual behavior in a community-based sample of women in San Francisco, CA. It strives to address a key gap in the literature on women and HIV risk, by addressing the positive aspects of the combination of sex and drug use, as expressed by women. Working to understand sex as an experience, rather than as a risk behavior, could bring new insights to improving sexual health among impoverished, drug-using women.

Methods

This paper uses mixed methods, defined as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches."[110] Mixed methods can help build an understanding of phenomena that are multi-dimensional and contextually driven, by providing a multifaceted understanding of the issue under study.[111] As Solsuki[112] writes,

> The power of numbers and an aim of generalizing quantified outcomes balanced with the rich context of lived experiences captured in qualitative inquiry can yield results that are quite distinct from single-method designs. As such, mixed

> methods studies are often suggested as away to disentangle intricate relationships and more fully understand complex social phenomena. (p.130)

Iteratively building an understanding of *what* is happening and *why* it is happening has a pragmatic appeal that often outstrips loyalty to a single research paradigm, particularly in practice-oriented fields such as public health.[111,113] That said, there are inherent difficulties in integrating data that arise from substantially different epistemological traditions.[114] For example, strong qualitative research may seek to explore the breadth of meanings surrounding a behavior such as sex trade (e.g., reciprocity, need, drug acquisition), while solid epidemiological research relies on single clearly-defined meanings, such as "number of paying male partners in past 30 days," in order to accurately reflect prevalence. Qualitative data do not simply 'illustrate' quantitative findings nor do quantitative data simply 'summarize' what is learned through qualitative methods. Rather, the two methodological approaches provide different perspectives on similar, but often not identical, issues.

The study described here was designed to use mixed methods from its inception. Based on the knowledge that sexual behavior among disadvantaged women is complex and multi-dimensional, the plan was to complement quantitative findings with qualitative data regarding the contexts and circumstances of sexual risk. Greene[115] describes this purpose as *complementarity,* which she defines as "enhancement, elaboration, illustration, clarification of results from one method with results from another (p. 259)." In the data collection and analysis process, it became clear that risk was only one of the dimensions of sexual activity that was important to the women being studied. Desire, pleasure and disinhibition arose as central themes relevant to sex and methamphetamine use. Greene refers to the emergence of new concepts as a result of mixed methods analysis as *initiation*, the development of fresh insights and areas of inquiry.[115] Thus, in this paper, the use of mixed methods served both the purposes of complementarity (as planned) and initiation (as discovered).

Study Procedures

Quantitative and qualitative data collection was conducted simultaneously from July 2007 – June 2009 in San Francisco, California. All study procedures were reviewed and approved by the Institutional Review Board at RTI International. Use of these data for the author's dissertation project was exempted as secondary data analysis by the Committee for Protection of Human Subjects at the University of California, Berkeley. A community-based sample was recruited using respondent-driven sampling (RDS), a form of chain-referral sampling. [24,69] A group of initial participants (or "seeds") were identified by the research team through outreach in the community. Participants were then given six coupons to recruit other methamphetamine-using women that they knew, and so on, using this process to build the quantitative sample. Eligibility criteria for the study were (a) biological female; (b) age 18 or older; (c) methamphetamine use in past 30 days; (d) one or more male sexual partners in past six months; (e) referred by another participant with RDS recruitment coupon (except initial recruits). Eligibility was determined through a screening process that masked criteria by including several questions unrelated to eligibility. All participants engaged in an informed consent process, a quantitative interview, and HIV/STI testing at a centrally located community field site. The quantitative interview was conducted face-to-face, with interviewers posing questions verbally and recording responses in a

computer-based personal interviewing system (Blaise®, Westat). Participants received $40 for the initial interview and testing session and $30 for HIV and STI results counseling sessions. They also received a $10-$20 incentive for each eligible participant they referred to the study (the incentive was increased midway through the study to improve recruitment).

Data collection for the quantitative and qualitative components of the study was conducted in the same timeframe, from mid-2007 to mid-2009. Participants for in-depth qualitative interviews (N=34) were drawn from the ongoing quantitative component using purposive sampling.[116] The purpose was to achieve diversity in the qualitative sample in terms of race/ethnicity, age, relationship status and housing status (see Table 2.1). We also sought variation in sexual experiences and sexual risk. For example, "marathon sex" was captured in a quantitative survey item, and, for qualitative interviews, we intentionally recruited some women who did and some who did not report this behavior. Similarly, we recruited women who did and did not report sex work, who reported differing sexual identities, and who did and did not report condom use. In weekly meetings, the research team discussed and identified potential candidates for in-depth interviews . Qualitative participants were recruited when they returned to the field site for HIV and STI results counseling, one week after the quantitative interview.

Following informed consent, open-ended interviews lasting 60-90 minutes were conducted using a topic-based interview guide. Topics included life history, family and intimate relationships, drug use history, sexual experiences and preferences, and methamphetamine use. Interviews were conducted in a conversational style flowing from the participants' perspective, and sought to strike a balance between maintaining focus on issues related to study objectives while allowing ideas to flow freely.[117] Interviews were digitally recorded, transcribed and entered into Atlas Ti (Atlas.ti GmbH, Berlin). Qualitative data collection reached the point of saturation at 34 interviews, as the research team noted the repetition of central findings with little new information arising.

Quantitative Measures

Quantitative data was used primarily to provide context for the exploration of the relationship between sexual activity and methamphetamine use, by describing the prevalence of different sexual behaviors and patterns of drug use. Perceptions of the impact of methamphetamine use on sexual behavior was also examined.

Sexual risk

The number of male partners was measured with the item: "In the past six months, how many different male sexual partners (including steady, casual or paying partners) did you have vaginal, anal or oral sex with?" The identical question was asked regarding female partners. These items were followed with questions regarding the number of partners by type (steady, casual and paying) in the past six months. For each type of partner, participants were asked "how many of your [steady, casual or paying] partners did you have vaginal sex with?" and "what percent of the time did you use condoms when you had vaginal sex with your [steady, casual, paying] partners?" The same questions were asked regarding anal sex. The variable "unprotected sex with $\geq$2 male partners" was defined as vaginal or anal sex with two or more male partners of any type, and less than 100 percent condom use. Marathon sex was defined as "prolonged sexual

activity for several hours." A series of items designed to maximize recall examined each participant's most recent sexual encounter. They were asked, "The last time you had sex, did you have vaginal sex?" "The last time you had sex, did you use a condom?" "The last time you had sex, were you high on meth?"

Drug use
Participants were asked about the use of several drugs, including methamphetamine, crack cocaine and heroin. The 30-day measure was "in the past 30 days have you used [drug]?" Affirmative responses were followed by the question, "how many days in the past 30 have you used [drug]?" Injection and non-injection use were recorded separately.

Impact of methamphetamine use on sex
The perceived impact of methamphetamine use on sex was assessed using the Subjective Experience of Meth Sex (SEMS) subscale,[44] which poses 14 statements regarding how methamphetamine may affect sexual activities, thoughts and feelings. The scale has been used previously with heterosexual methamphetamine users (alpha = 0.93). Response categories are: strongly disagree, somewhat disagree, somewhat agree and strongly agree. Values from 1-4 was assigned to responses in this order.

Quantitative Analysis

The primary use of quantitative data was descriptive. Data were summarized using SAS Version 9.2 (Cary, NC). To assess the similarity of qualitative subsample to the larger quantitative sample, we compared the two groups on a number of demographic, drug use and sexual risk characteristics (Tabe 1). These comparisons were conducted using Pearson's $\chi 2$ tests of significance.

Point prevalence data describing demographic characteristics and prevalence of risk behaviors obtained using SAS. The bivariate comparisons of qualitative and quantitative participants (Table 2.1) were conducted using Pearson's $\chi 2$ tests of significance. For the SEMS subscale, means were calculated per participants and then combined for overall scores.

Qualitative analysis

Qualitative analysis was conducted using an inductive approach, which Thomas describes as "detailed readings of raw data to derive concepts, themes, or a model."[118] Initially, a small group of transcripts were reviewed separately and coded thematically by the author and two other individuals involved with the project. Codes were then compared, expanded and refined to develop a working codebook. Transcripts were entered into Atlas Ti and coded accordingly. Research team members discussed transcripts in monthly meetings, identifying key constructs, new themes and emerging findings, and modifying codes as warranted. The author engaged in a second phase of analysis focusing in on the relationship of sex and methamphetamine use. Through the lens of this specific line of inquiry, transcripts were re-read and re-analyzed to cull the full range of data that described and helped illuminate the phenomenon under study. Data were then grouped by theme (eg., "desire"), and analysis conducted using constant comparative

methods.[119] Through constant comparisons and the author's ongoing process of immersion and crystallization[120] the relationships between sex and methamphetamine use were explored, elucidated and clarified.

Integrating qualitative and quantitative data

Synthesis of qualitative and quantitative findings was an iterative process. Quantitative data were summarized in a series of tables and cross-tabulations. Qualitative data were organized thematically. Matrices were then developed that summarized quantitative and qualitative findings in key topic areas.[116] Topic areas were loosely defined and somewhat fluid, as findings rarely matched up neatly across paradigms.[114] Data were integrated with the goal of adding depth and richness to findings, rather than a directed effort at triangulation.

Table 2.1: Characteristics of Qualitative & Quantitative Participants Compared to Quantitative Participants only* (n =322)

	Qual & quant (n=34) %	Quant only (n=286) %
Age		
18-29	22	21
30-39	22	23
40-49	25	34
50+	31	23
Race		
White	47	31
African American	36	47
Latina	5	4
Mixed race	8	9
Other	4	9
Drug use past 30 days		
Injected meth	58	52
Smoked/snorted meth	85	89
Smoked crack	50	63
Mean no. days used meth	17	18
Sexual behavior past six months		
Unprotected sex, ≥2 partners	61	56
Sex trade	69	59
Mean no. male partners	24	21

*all p values non-significant (>.05)

Findings

The full study sample consisted of 322 women, of whom 34 participated in qualitative data collection. The qualitative subsample did not differ significantly from the rest of the sample in terms of demographic characteristics, frequency and modes of methamphetamine use or sexual behavior (Table 2.1). The sample was racially diverse, and over half of participants were age 40

Table 2.2: Sexual behavior past six months (N=322)

	%
Number of male partners	
1	21
2-5	39
≥ 6	40
Number of female partners	
0	64
1	16
≥2	20
Types of male partners	
Steady	69
Casual	43
Paying	58
How often high on meth during sex	
Never	4
Sometimes	59
Always	37
Unprotected vaginal sex	79
Unprotected anal sex	22

or older. The mean days of methamphetamine use in the past month was 18. Most women (91%) used illicit drugs in addition to methamphetamine, most commonly crack cocaine.

Participants in the study were very sexually active. Most (79%) had multiple male sexual partners in past six months (Table 2). The median number of male partners was four (interquartile range 2, 10). In addition, over a third of participants had one or more female sex partners. Most sexual activity occurred in the context of methamphetamine intoxication. Women were asked, "When you had sex with male partners in the past six months, what percent of the time were you high on meth?" The median percent time was 80 percent. Over a third of women said they were *always* high on methamphetamine when having sex with men, and over half (59%) said they were *always* high on methamphetamine when having sex with women.

Desire

Interpretation of these findings is enriched by qualitative data which suggest a strong relationship between methamphetamine use and sexual desire. In open-ended interviews, many participants described methamphetamine as creating an intense desire for sex. Methamphetamine created a "High sex drive. I gotta have it, gotta have it," as one participant said. Levels of sexual activity were often attributed to methamphetamine use.

> *It [methamphetamine] definitely made - increased my libido, to put it nicely… So that part of it I enjoyed. I wasn't promiscuous by any means but I, you know, I had about three sexual partners in the last year… It definitely reduced my inhibitions and increased my desire, or libido, to want to have sex.*
>
> (50-year-old African American woman)

Methamphetamine-related intensification of sexual desire may have contributed to multiple sexual partnerships. In addition, methamphetamine use contributed to protracted sexual encounters, or marathon sex, defined as "prolonged sexual activity for several hours." Over half of women reported engaging in marathon sex in the past 30 days (Table 2.2). Women described this practice as inherently linked to methamphetamine use.

> *… Marathon sex, I don't think I would ever do that without being high… it's not my normal thing. But when you're high, that's real - I mean, I've done that quite a bit. Yeah. But never not high.*
>
> (51-year-old white woman)

Participants linked methamphetamine use with a desire for more sex and more prolonged sex. This fostering of sexual desire is connected to the relatively high levels of sexual activity reported by participants.

Pleasure

Women participating in the study described sexual pleasure as a key benefit of meth use. "I love the way it makes me feel sexually," said one participant. Meth use facilitated sexual satisfaction: Many women felt their orgasms were better when using methamphetamine and some reported only having orgasms when high. Another dimension of pleasure was that sex on methamphetamine was longer lasting.

> *When you're not high it's just really, it's quick even if there's foreplay… When you get high it's like it prolongs everything and makes you want to take the time… And it, it prolongs, um, my orgasms. Being on meth, I…it, it prolonged the orgasming.*
>
> (42-year-old white woman)

Some women described methamphetamine in instrumental terms, as a pleasure-increasing sex aid. As one 54-year-old African American woman said, "Meth is my sex drug." The mutually reinforcing pleasure provided by sex and methamphetamine use was described by another participant:

> *It's almost like an orgasm to begin with, when you fix [inject] you know. It really is, it's like an orgasm and uh, you feel it travel your body and you know, it's very warm and it's very nice, you know. And you put it with sex it's gonna really be exciting.*
>
> (56-year-old White woman)

These findings suggest that a key reason women used methamphetamine was to enhance sexual pleasure.

Disinhibition

The Subjective Experience of Meth Sex (SEMS) subscale,[44] described above, measured the perceived influence of methamphetamine use of sexual thoughts and behavior. Three-quarters of participants agreed strongly or somewhat with statements such as, "when I'm high I enjoy sex more," and "when I'm high on meth I'm more sexually disinhibited" (Table 2.3). The mean score on the scale was 2.9 (range 1-4).

Table 2.3: Selected Items from Meth Sex Scale

When I'm high on meth…	Agree* %	Disagree* %
my desire for sex increases	75	25
I enjoy sex more	82	18
I am able to satisfy my intimate sexual needs	72	28
I feel less shy	82	18
I'm less nervous about sex	76	24
I am more sexually disinhibited	72	28
My desire for sex is out of control	43	57
I'm less concerned about getting HIV or another STD	46	54

* Combined categories of 'strongly' and 'somewhat'

A strong relationship between meth use, disinhibition and sexual pleasure was described by many women. Loss of inhibition was considered a positive experience that enhanced sex.

> *I do like the way it [methamphetamine] makes me feel sexually. It makes me uninhibited… It gives you a sense of euphoric, 'Yeah, let's try it.' It opens the door, let's just put it that way.*
>
> (42-year-old White woman)

Women described methamphetamine as promoting sexual exploration and freedom. Sex was described "fun" and "liberating."

> *You have sex for hours… nonstop, every position – every which way but loose. (laughs) Any which way you can. (laughs). Sex was fun.*
>
> (54-year-old White woman)

Disinhibition enabled women to act on sexual desires that they perceived as unconventional, or "freaky." Voyeurism, masturbation, multiple partners and sex with women were some of the sexual activities ascribed to methamphetamine-related disinhibition. As one woman described it, "I have been more open to the multiple partners at one time, like female and maybe just a little more freaky shit." Another said:

> *I get so horny…I wanna have two men on me, never one… My sexual pleasures are more intense. It's like I've taken a Spanish Fly or something. I don't know, but I get so horny and I wanna engage in orgies or oral sex with multiple partners. I get real freaky.*
>
> (49-year-old African American woman)

As women described it, methamphetamine use opened up new sexual possibilities.

The loss of inhibition associated with methamphetamine use felt sexually empowering to some women. They described feeling more confident and assertive. *"I guess it kinda*

makes me a little more confident, a little more straightforward," said one participant. Another said she feels more sexually attractive when using methamphetamine. *"It makes me feel sexy. It makes me feel like, 'I know you want me, damn it!'* Enhanced sexual confidence seemed to facilitate sexual pleasure for many women.

In addition to enhancing confidence, methamphetamine use allayed insecurities regarding sex or body image for some participants. One woman described how methamphetamine use made her more comfortable being naked in front of her husband. Another compared sex while not high to sex while high as follows:

> *When I'm not doing meth it [sex] feels like I'm – it feels, feels like more painful or something. It's not as pleasurable as it, as it would be when you're doing meth because when you're not doing meth you kinda get shy during the middle of it… When you're not high, you're actually thinking about, "Oh, god, how do I look?" You know, you're thinking about your self-image… But when you're doing meth you don't care, like it – you jump around; you know, you go with the flow. Like you're not gonna think about how your body looks.*
>
> (31-year-old White woman)

This suggests a fluid relationship between the seeking of pleasure and avoidance of pain for some participants.

Methamphetamine use and sexual trauma

As the excerpt above suggests, some women felt methamphetamine helped them cope with uncomfortable sexual situations. Disinhibition verged on dissociation in some of these descriptions, as women described physically and/or emotionally 'checking out' when they had sex on methamphetamine. In these instances, methamphetamine use was more focused on amelioration of pain rather than enhancement of pleasure.

> *It's like you leave your body in the middle of sex when you smoke speed… It's like with meth you don't feel any pain. You don't feel no pain whatsoever.*
>
> (29-year-old African American woman)

One woman who disliked doing sex work described methamphetamine as both numbing her feelings and enhancing her focus:

> *it [meth] numbs you in order to focus on getting the job done without feeling bad about yourself, or letting the trick [customer] make you feel bad about yourself… being high kind of like numbs your emotions and, and just, you know, keeps me a little focused, like a painkiller.*
>
> (24-year-old Latina woman)

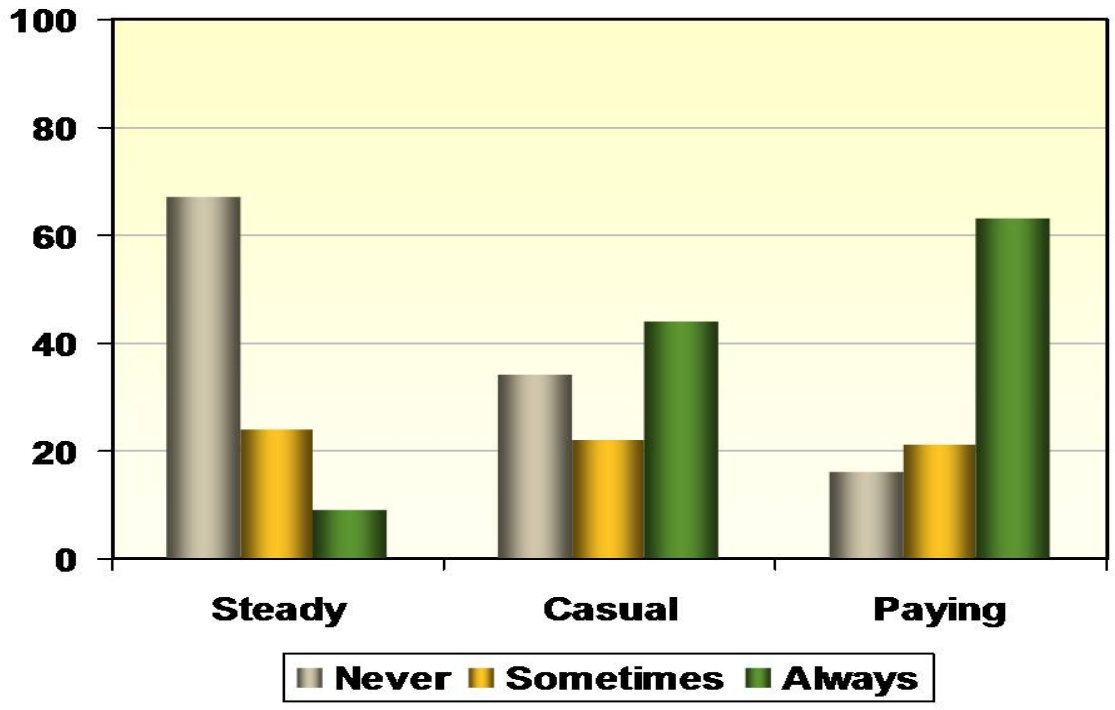
The use of methamphetamine to assuage sexual pain is perhaps best understood in the context of extremely high levels of adverse sexual experiences among study participants. In the full study sample, 68 percent of women in the study experienced childhood sexual abuse, and the median

age of abuse was 8.5 years. In addition, nearly three-quarters (73 percent) reported sexual assault during their adult lifetime and 30 percent reported sexual assault in the past six months. The psychological sequelae of sexual trauma are far reaching, and include both dissociation and hypersexuality, potentially influencing the perceptions and behavior of participants.[121,122]

Meth and sexual risk

In addition to the high prevalence of multiple sexual partnerships in the past six months (Table 2.2), the prevalence of condom use was low. Only 12 percent of women used condoms consistently during vaginal sex with all types of partners. Over a third of women reported unprotected vaginal sex with sex trade partners in the past six months, and the proportion increases with casual and steady partners (Figure 1). In addition, 22 percent of women reported unprotected anal sex in the past six months. Overall, the level of participation in sexual risk behavior was substantial.

Figure 2.1: Frequency of Condom Use for Vaginal Sex by Partner Type, past Six Months



The perceived relationship between sexual risk and methamphetamine use varied considerably among women in the study. While many participants felt that methamphetamine influenced both the frequency and content of sexual activity, fewer than half agreed that being high on methamphetamine reduced their concerns about HIV/STD transmission or made their desire for sex 'out of control' (Table 2.3). In other words, many participants did not attribute their sexual risk behavior to methamphetamine use.

Some women described proactively assessed the potential sexual risks created by methamphetamine use and adapting to control them. Several said they avoided men while high

on methamphetamine in order to avoid sexual situations. One woman explained why, despite increased sexual desire, she chooses to be alone when high on methamphetamine.

> *I do get hornier, like, yeah, but you see, I just can't let myself off, because I, I know that there's AIDS…I know that there's STDs, I know that these people don't give a fuck…*
>
> (47-year-old White woman)

In addition, many women felt they were taking steps to reduce their risk of sexual infections. Some women described using condoms with selected partners – new partners or sex trade partners – as a risk reduction measure. Others felt they avoided sexual risk by avoiding sex work, or by engaging in serial monogamy. One woman described how she relies on her powers of observation and judgment skills to stay safe:

> *If it doesn't look right, the skin looks a mess or whatever, I'm not touching it. There's no need for me to touch it 'cause I'm putting myself at risk…. So the partners that I do have, I can say that I'm, I'm not totally sure, but I'm confident with their health and mine.*
>
> (24-year-old Latina woman)

Although their effectiveness may be variable, the sexual safety measures described by participants evoked a sense of agency about managing sexual risk. Some participants were insistent that methamphetamine use did not impair their judgment in terms of sexual risk behavior.

Other women did feel that methamphetamine use reduced their concerns about safer sex. The loss of inhibition related to methamphetamine use undermined considerations about sexual safety.

> *… when I'm high on meth, I don't even think about any type of disease. It's like a, oh, I'm gonna get this orgasm and that's all that matters. I'm not thinking about what I could catch. And it could be just 'cause I just don't wanna think about it or because I really feel I'm untouchable.*
>
> (49-year-old African American woman)

Another women described thoughts of safer sex as "something you compartmentalize and set aside" when high. The long duration of sex while high on methamphetamine was also seen to undermine safer sex efforts.

> *"… even if you start with using some kind of protection, it generally - you discard it before you're finished, you know?*
>
> (51-year-old white woman)

Quantitative analyses were conducted to explore possible correlations between methamphetamine use and sexual risk behavior. In one of these analyses, we examined participant reports on their most recent sexual encounter. We assessed whether they reported being high on methamphetamine during that encounter, whether they had vaginal or anal sex, and whether they used condoms. Condom use for vaginal sex was reported by 30 percent of

those who were high and 32 percent who were not high; for anal sex, condom use was reported by 31 percent of those who were high and 15 percent of those were not high. None of these differences was statistically significant. In other words, the proportion using condoms did not differ significantly between women who were high on methamphetamine at last encounter and those who were not.

Quantitative and qualitative analyses provided no conclusive insight on the relationship between methamphetamine use and sexual risk. Although unprotected sex was common, there were no clear correlations between condom use and being high at last encounter or being more vulnerable due to the influence of methamphetamine. Perceptions of the role of methamphetamine use on sexual risk varied.

Discussion

The pleasurable aspects of sex and substance use are largely overlooked in studies focusing on drug use and HIV, which instead tend to emphasize risk, addiction and disease.[101] Studies of sex risk among drug-using women often focus on victimization,[98,123] mental health morbidities,[95,124] and relationship abuse.[97,125] We do not seek to minimize the importance nor the intensity of these experiences, which create a great deal of danger and suffering in women's lives.[33] Indeed, the prevalence of sexual violence in this study sample was appalling. However, there was much positive discourse about sex and drug use among this population of mostly middle-aged, impoverished women. Many of them enjoyed sex, and the combination of sex and methamphetamine. By utilizing mixed methods, we were able to capture a dimension of sex and drug use ordinarily overlooked in epidemiological risk behavior surveys, one that could be useful in developing strategies to help women reduce sexual risk.

Our quantitative findings regarding sexual risk were consistent with the handful of other studies examining women who use methamphetamine. The prevalence of unprotected sex and multiple partners in the past six months was similar to a state-wide study of methamphetamine injectors attending syringe exchange programs[46], and seems in line with results of a study of methamphetamine-using women in San Diego, which examined risk using a different timeframe (two months rather than six months).[20] Some studies have found a correlation between methamphetamine use and unprotected sex at last sexual encounter, but ours did not.[45,48] To the best of the author's knowledge, no previous qualitative or mixed methods work has been conducted exploring the relationship between methamphetamine use and sexual behavior among women. Work exploring the relationship between methamphetamine use and sexual behavior among men who have sex with men has identified some similar themes as this study, in particular the connections between methamphetamine use, sexual arousal and disinhibition.[40,126]

While there were high levels of sexual risk among participants, it is unclear to what degree this risk may be attributed to methamphetamine use. Some women felt that methamphetamine use contributed to unsafe sexual behavior and others did not. An association between methamphetamine use and unprotected sex were not established in this study's quantitative analyses. Unprotected sex is common among drug using women in general, and the increased sexual activity that accompanies methamphetamine use may amplify these risks. However, our findings do reflect that many women maintained a sense of sexual agency even though they were

having sex while high, and even though that sex may have been unprotected. Building on this agency may result in more positive behavior change than advising women to avoid sex under the influence.

The discourses regarding sex and methamphetamine use were decidedly different in the quantitative and qualitative data. Findings regarding sexual disinhibition provide a good example of this. In the discourse of HIV risk behavior epidemiology, sex is essentially defined in terms of potential HIV risk, and disinhibition is seen primarily as pathway to risk and infection.[127] This was the assumption inherent in our survey items, which focused on potential risk behaviors, and of our quantitative analyses regarding potential associations between meth use and sexual risk behavior. By comparison, in the less pre-defined qualitative discourse, sex had many meanings, including pleasure, self-confidence and, in some cases, the experience of grappling with trauma. In this context, we learned that disinhibition is often related to increased sexual confidence, sexual exploration and pleasure. In other words, while HIV prevention specialists may define methamphetamine-related disinhibition as a 'negative' that increases risk behavior, many participants saw it as a 'positive' that improved their sexual experiences. This suggests that messages warning methamphetamine-using women to avoid disinhibition may be unproductive, while messages that promise some of the benefits of disinhibition may be potentially useful. For example, it may be worth testing a prevention messaging strategy that ties the use of condoms to feelings of sexual confidence.

Several limitations of the study should be noted. While the qualitative sub-sample appears to be roughly representative of the larger quantitative sample, the generalizability of our findings to methamphetamine-using women on a greater scale is unknown. Data were self-reported, and may be subject to response bias. A review of research regarding the validity and reliability of self-report data from illicit drug users suggests that such data are sound.[85] Qualitative data analysis is an interpretive and subjective process, and author bias is always a potential concern.

A strength of this work is that it puts forward a fresh strategy for tackling the complex issue of sex and HIV risk among women. It shows that a focus on sexual risk alone may not be adequate to truly understand – and effectively promote – sexual health among drug-using women. In particular, women's positive feelings about disinhibition and their validation of pleasure need to be incorporated into current thinking about sexual risk among women who use meth and other stimulants.

Both the World Health Organization and the Centers for Disease control are beginning to promote a comprehensive approach to sexual health that extends beyond combating negative outcomes such as HIV and unwanted pregnancy. As defined by WHO,

> *Sexual health* is a state of physical, emotional, mental and social wellbeing in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence. (http://www.who.int/reproductivehealth/en/)

Findings from this paper support the importance of this more holistic approach to defining and investigating sexual health. Working to understand sex as an experience, rather than as a risk behavior, could bring new insights to improving sexual health among impoverished, drug-using women.

Paper Three
Subsistence Difficulty and Non-Partner Violence against Women who Use Methamphetamine

Introduction

The preponderance of research addressing violence against women focuses on intimate partner violence. [128] However, socially and economically marginalized women are subject to violence not only in intimate relationships, but also by virtue of living in dangerous communities.[99,129,130] Poor women who use drugs, in particular, are vulnerable to many assailants, including strangers, acquaintances, sex work clients, police and drug dealers.[99,128,131,132] This paper examines violent victimization in a sample of women who use methamphetamine, drawn from an urban inner-city community in San Francisco (N=322). It describes and compares levels of intimate partner violence (heretofore referred to as "partner violence") and violence by assailants other than intimate partners (heretofore referred to as "non-partner violence") against women methamphetamine users, a group of women largely overlooked in drug use research to date. In addition, it addresses a gap in the research by exploring correlates of non-partner violence against drug-using women.

The distressingly high level of partner violence against women who use drugs is well-established. Intimate partner violence is three times higher among drug-using women than non-drug-using women,[131] and appears to be particularly high among drug-using women with drug-using male partners.[133] In studies of women in drug treatment, correlates of intimate partner violence include cocaine or crack use,[97,134] heavy alcohol use[97] and binge drinking.[135] Several studies indicate that drug-using women who experience partner violence engage in higher levels of sexual risk behavior than women who don't experience partner violence, including multiple sex partners, sex trade and unprotected vaginal intercourse.[28,136-138] In two studies, the odds of having a sexually transmitted infection were substantially higher among women who experienced partner violence than among those who did not experience partner violence.[27,28] Most of these studies were conducted with female injection drug users and crack cocaine smokers; none examined methamphetamine users as a distinct group.

Other research has assessed correlates of violence against marginalized groups of women from a broader perspective, without distinguishing between partner and non-partner violence. In a large sample of homeless women in Los Angeles, the lifetime prevalence of adult physical violence was 33.2 percent and of sexual violence was 28.6 percent.[139] Wenzel[140] identified several predictors of recent physical violence against women who were homeless or living in public housing, including childhood violence, poor social support, poor mental health, and multiple sexual partners. Again, these analyses did not distinguish between partner and non-partner violence. A Vancouver study of women who used drugs and engaged in sex work examined violence by clients and non-clients, but did not distinguish between intimate partners and other types of assailants. Over an 18-month period, physical violence by clients occurred among 20 percent of women and sexual violence by clients occurred among 14 percent of women. homelessness and forms of police harassment were associated with both forms of violence.

Little is known specifically about non-partner violence against women who use drugs. Poor women who use illicit drugs often live in harsh social environments and have limited, sometimes perilous, options for generating income (eg., sex work, drug dealing, panhandling).[99,132] This makes them vulnerable to physical and sexual violence from a variety of quarters. A small number of studies have examined non-partner violence against various disadvantaged groups of

women, including the homeless, sex workers and drug users. A study of injection drug users in Vancouver found that 66 percent of women reported being victims of physical violence at least once during the five-year study period. Among those experiencing physical violence, three-quarters were attacked by acquaintances or strangers.[129] The odds of violence were significantly higher among women who reported daily crack use, binge drug use, homelessness, drug dealing and living in a specific high-risk neighborhood (Downtown Eastside). Data on sexual violence were not included in this paper. In a national substance abuse treatment sample, 46 percent of women reported experiencing non-partner physical violence in the past year.[135] Correlates of violence included non-white race, heavy alcohol use and childhood experiences of violence. In a representative sample of women in homeless shelters and low-income housing, 14 percent experience physical violence by non-partners and 2 percent experienced sexual violence by non-partners in the past six months.[142] The prevalence and severity of physical violence was substantially higher among women living in shelters than women living in low-income housing.

This exploratory work on non-partner violence against women who use methamphetamine is guided by this previous research on violence against marginalized women and by risk environment theory, which purports that harm among drug users is shaped by the physical and social environments where they conduct their lives.[143,144] More a social-ecological framework than a fully developed theory, the concept of the risk environment which was first developed in the context of HIV risk among drug users[143] and more recently has been extended to the study of violence.[129,145] Features of risk environment that have been associated with harm among drug users include homelessness, [129] residence in single-room occupancy hotels,[146] inaccessibility of services,[128,147] unsafe sex work and drug dealing venues,[145,148] and residence in high-crime neighborhoods.[129] In this paper, we explore whether a small group of factors reflecting risk environment are correlated with non-partner violence.

An important reason to better understand non-partner violence against women, separately from partner violence, is the possibility that different types of violence have different health impacts.[27,142] Effective public health responses to partner and non-partner violence may need to be substantially different. Non-partner violence may be amenable to structural interventions such as those focusing on community safety[145] and the provision of gender-specific services.[99] Understanding the prevalence and correlates of non-partner violence is a first step to identifying appropriate intervention strategies.

This paper first provides an overview of lifetime and recent violence in a sample of women who use methamphetamine (N=322), drawn from an inner-city community in San Francisco. It describes and compares levels of partner and non-partner violence against women methamphetamine users, a group of women largely overlooked in drug use research to date. The paper then moves forward to explores correlates of non-partner violence among methamphetamine-using women, addressing a gap in the research. Finally, it points to future directions for research, building on these early cross-sectional findings and discusses options for action to reduce non-partner violence.

Methods

Data collection was conducted from July 2007 – June 2009 in San Francisco, California. All study procedures were reviewed and approved by the Institutional Review Board at RTI International. Use of these data for the author's dissertation project was exempted as secondary data analysis by the Committee for Protection of Human Subjects at the University of California, Berkeley. A community-based sample was recruited using respondent-driven sampling (RDS).[24] RDS is a form of chain-referral sampling that is being used increasingly in epidemiological studies of "hidden" populations, where stigma or illicit activity preclude the development of a true sampling frame.[26] In theory, data from RDS samples can be weighted for network size and inclusion probabilities to make them generalizable to the larger target population.[69] A group of initial recruits (or "seeds") were identified by the research team through outreach. Participants were then given up to six coupons to recruit other methamphetamine-using women that they knew. The women recruited by seeds were also given coupons, and so on. Participants received a cash incentive for each eligible person referred by coupon. Eligibility criteria for the study were (a) biological female; (b) age 18 or older; (c) methamphetamine use in past 30 days; (d) one or more male sexual partners in past six months; (e) referred by another participant with RDS recruitment coupon (except seeds). Eligibility was determined through a telephone screening process that masked criteria by including several questions unrelated to eligibility.

Participants engaged in an informed consent process, quantitative interview and testing for HIV and sexually transmitted infections (STIs) at a centrally located community field site. The quantitative interview was conducted face-to-face, with interviewers posing items verbally and recording responses in a computer-based personal interviewing system (Blaise®,Westat). Biological testing included HIV, syphilis, herpes simplex virus 2 (HSV-2), gonorrhea, Chlamydia and vaginal trichomonas. All participants received pre- and post- testing counseling for HIV and STIs from trained staff. Individuals testing positive for gonorrhea, Chlamydia or trichomonas were screened for contraindications and offered STI treatment on site, per San Francisco Department of Public Health protocols. Those with contraindications to field-delivered therapy were referred to the municipal STI clinic for treatment. HIV-positive women were referred to appropriate medical and social services, as were many other study participants. Study participants received $40 for the initial interview and testing session and $30 for HIV and STI counseling sessions. They also received a $10-$20 incentive for each eligible participant they referred to the study (this incentive was increased midway through the study to improve recruitment).

Measures

Dependent variables in bivariate and multivariate analyses

The dependent variable for bivariate and multivariate analyses was "non-partner violence." This dichotomous variable encompassed both non-partner physical violence and non-partner sexual violence. To determine physical violence, participants were asked "In the past six months, have you ever been hit, slapped, kicked, or physically hurt by an adult?" To determine sexual violence, participants were asked, "In the past six months, have you had any unwanted sexual experiences?" These items were drawn from the Behavioral Risk Factor Surveillance System survey, developed by the Centers for Disease Control.[149] A "yes" response to each of the items

above was followed with the query, “What was that person’s relationship to you at the time?” Response categories were: (a) Current boyfriend or husband; (b) former boyfriend or husband; (c) male you were dating; (d) male friend; (e) female friend; (f) family member; (g) acquaintance; (h) paying sex partner; (i) stranger; or (j) other. Participants who reported physical and/or sexual violence perpetrated by male or female friends, acquaintances, paying sex partners and strangers were considered to have experienced non-partner violence. This was dichotomized yes/no and used as the primary dependent variable. Participants who reported physical and/or sexual violence by a current or former boyfriend, a current or former husband, or male they dated were considered to have experienced partner violence. There was one report of violence by a family member, which we removed from analysis.

Independent variables in bivariate and multivariate analyses
Independent variables were selected from the literature (described above) regarding drug- and sex-related correlates of violence against marginalized women. In addition, variables were selected by the author to reflect aspects of the risk environment which have been shown or were hypothesized to share an association with violence among drug users.

Independent variables encompassing drug-use factors included heavy alcohol use,[97,135] crack cocaine use,[97,134] daily crack cocaine use [129] and injection drug use.[97,129] In addition, we examined “binge” methamphetamine use, meaning an extended period of continuous use.[129] Daily alcohol use was determined by the item, “How many days in the past 30 did you drink alcohol?” Individuals who responded “30” to this continuous measure were considered daily alcohol users. Crack cocaine use was measured by the item, “in the past six months have you used crack cocaine?” Daily crack use was defined as a response of “30” to the continuous measure, “In the past 30 days, how many days have you used crack?” Items measuring number of days of use were restricted to the past 30 days in order to maximize recall. Injection drug use was determined by the item, “In the past six months, have you injected drugs?” Binge methamphetamine use was determined by the item, “In the past six months, have you used methamphetamine for three or more days without coming down?”

Sexual risk factors examined included unprotected vaginal sex,[28,138] multiple partners,[136,140]and STI infection.[27,28,150] Participants were asked, “In the past six months, how many different male sex partners (including steady, casual and paying partners) have you had vaginal, anal, or oral sex with?” A response of 2 or greater was defined as “multiple male partners.” Participants were asked what percent of time they used condoms for vaginal sex with each type of partner (steady, casual and paying). A response of <100% condom use for one or more partner types was defined as “unprotected vaginal sex.” The variable “sexually transmitted infection” includes participants who received positive laboratory test results for Chlamydia, gonorrhea or vaginal trichomonas.

Independent variables reflecting risk environment included homelessness,[128,129,142], risky income generating activities,[128,148] and ability to meet subsistence needs.[130] Homelessness was defined as a positive response to the question, “Do you consider yourself homeless?” Participants were classified as having traded sex for money or drugs if they responded “yes” to either or both of the items, “In the past six months, have you traded sex for money?” and “In the past six months, have you traded sex for drugs?" Panhandling was based on the item, “In the past six months, did

you earn income from panhandling?" We included "steady male partner" as an independent variable based on ethnographic literature suggesting that women sometimes partner with men for protection from street violence.[33,130] Steady male partner was defined as a response of one or more to the question, "Of the male sexual partners you've had in the past six months, how many were steady partners?" "Frequent subsistence difficulty" was based on the Competing Priorities Scale by Gelberg,[151] which consists of five items: "In the past six months, how often had you had trouble (a) finding a place to sleep; (b) getting enough to eat; (c) having enough clothing; (d) finding a place to wash; (e) finding a place to use the bathroom." There are four response categories, which range from never (scored as 1) to usually (scored as 4), for a range of 5-20 points. A score >15 on the 20-point scale was defined as frequent subsistence difficulty.[151,152]

Descriptive variables

Additional variables were included to describe the population and participants' lifetime experiences of violence. To characterize the study population, we provided demographic data were based on participant responses to questionnaire items regarding age, race/ethnicity and education. Respondents were asked their age during the interview, which we report as a categorical variable: 18-39; 30-39; 40-49; $\geq$50. Race/ethnicity was based on an open-ended question, "Which racial/ethnic groups do you consider yourself?" This was coded into seven categories (African American, White, Latina, Asian/Pacific Islander, Native American, mixed and other). The mixed race category reflects over a dozen different racial/ethnic combinations, with no single combination predominating. Education was measured by an item asking, "What is the highest level of schooling you completed?" Open-ended responses were coded as "less than high school diploma or GED," "high school diploma or GED," and "any college."

Adult lifetime and recent experiences of violence

Lifetime adult violence was assessed by a series of items that asked "Since the age of 18, has anyone ever threatened to physically hurt you?," "Since the age of 18, has anyone threatened you with a knife, gun or other weapon?," "Since the age of 18, have you ever been hit, slapped, kicked, or physically hurt by an adult?" "Since the age of 18, have you ever had any unwanted sexual experiences?" Recent violence was determined by a follow-up item that asked participants if they experienced each of these types of violence in the past six months. Childhood violence was assessed using two items, "Before the age of 18, were you ever hit, slapped, kicked, or physically hurt by an adult?" and "Before the age of 18, were you personally ever touched in a sexual way by an adult or older child when you did not want to be touched that way, or were you ever forced to touch an adult or older child in a sexual way that you did not want to do?"

Data Analysis

Point prevalence data were summarized using SAS Version 9.2 (Cary, NC). Data were not statistically adjusted to account for recruitment patterns and network size, due to a number of problems with calculating RDS inclusion weights that are discussed in the limitations section. Comparisons of partner and non-partner violence (Table 3.2) were conducted using the McNemar test. Bivarate comparisons of two groups, those who reported non-partner violence and those who did not, were conducted using Pearson's Chi-square test**.** Standard multivariate regression analysis was used to identify whether non-partner violence was independently associated with selected outcomes described above. Only those outcomes that that were

statistically significant at the .05 level or lower in bivariate analysis were included in the model. Pearson correlation coefficients were examined for all the independent variables in the model. The model was assessed for goodness of fit using the Hosmer-Lemeshow test.[74]

Findings

The study sample was racially diverse and the majority of women were 40 or older (Table 3.1). Over half the sample was homeless at time of interview. The mean number of days of methamphetamine use in the past month was 17. Both injection and non-injection routes of methamphetamine administration were common. Nearly all women (91%) reported using illicit drugs in addition to methamphetamine in the past 30 days, most commonly crack cocaine. Unprotected sex and multiple sex partners were common (Table 3.1).

Table 3.1: Sample Characteristics, Drug Use & Sexual Behavior (N=322)

Selected characteristics	%
Race/ethnicity	
African American	46
White	33
Native American	5
Latina	4
Asian or Pacific Islander	2
Mixed race	9
Other/refused	1
Age	
18-29	21
30-39	23
40-49	33
50 or older	24
High school diploma or GED	72
Homeless	57
Drug use past 30 days	
Modes of methamphetamine use	
Injected	47
Non-injected	85
Other drug use	
Injected heroin	28
Smoked crack cocaine	62
Smoked marijuana	58
Sexual behavior past six months	
Number of male sex partners	
1	21
2-3	26
$\geq$ 4	53
Unprotected vaginal sex	79
Traded sex for drugs	45
Traded sex for money	56

Prevalence of violence

The lifetime prevalence of violence was very high, both in childhood and adulthood (Table 3.2). Notably, over 70 percent of women reported childhood physical and/or sexual abuse. The mean age that childhood physical abuse commenced was seven (median 7); the mean age that sexual abuse commenced was eight (median 8).

Table 3.2: Lifetime Prevalence of Violence (N=322)

	%
Since age 18	
Physically threatened	86
Threatened with weapon	66
Physically assaulted	86
Sexually assaulted	75
Before age 18	
Physical abuse	74
Sexual abuse	71

Experiences of violence in the past six months are described in Table 3.3, which presents and compares the prevalence of non-partner and partner violence of four different types. As some women experienced violence from both partners and non-partners, the categories are not mutually exclusive.

Physical threats and threats with weapons were equally likely to be perpetrated by partners and non-partners in the past six months. Physical violence was significantly more prevalent at the hands of partners than non-partners (Table 3.3). By contrast, sexual violence was significantly more common by non-partners than partners.

Perpetrators of Non-Partner Violence

Non-partner violence against women was carried out by a variety of assailants. The most commonly reported perpetrators of non-partner physical violence were acquaintances (35%), strangers (27%) and male friends (21%). The most commonly reported perpetrators of non-partner sexual violence were male friends (33%), sex work clients (32%) and acquaintances (22%). Non-partner physical violence and non-partner sexual violence were strongly correlated ($p<.0001$).

Table 3.3: Violence Experienced past Six Months (N=322)

	%	*p=
Physically threatened		
Non-partner	29	
Partner	22	ns
Either	46	
Threatened with weapon		
Non-Partner	10	
Partner	6	ns
Either	16	
Physically assaulted		
Non-Partner	15	
Partner	22	.05
Either	34	
Sexual assaulted		
Non-Partner	21	
Partner	11	<.001
Either	30	

* comparison of partner & non-partner

Correlates of non-partner violence

In order to explore non-partner violence, a variable was created that encompassed both non-partner physical violence and non-partner sexual violence. Participants who reported non-partner physical violence and/or non-partner sexual violence in the past six months were considered to have experienced "non-partner violence." By this definition, a total of 90 women (28% of the sample) had experienced non-partner violence in the past six months. Bivariate associations between non-partner violence and selected independent variables, drawn from the literature on violence against marginalized women and risk environment discussed above, are presented in Table 3.4. Neither race nor age was statistically associated with non-partner violence (data not shown). There were no associations between non-partner violence and drug use factors, including injection drug use, crack use, daily crack use or

daily alcohol use, and "binge" methamphetamine use. Similarly, no association was found between non-partner violence and frequency of methamphetamine use. The number of days of methamphetamine use in the past 30 days was 18.5 days among those who had experienced non-partner violence and 17.6 days among those who had not (one-sided t test = 0.289). Among the sexual risk and infection variables, only having multiple male sexual partners was correlated with non-partner violence.

Table 3.4: Correlates of Non-Partner Violence in the past six Months (N=322)

	Non-partner violence		
Independent variable	Yes (n=90) %	No (n=232) %	p.
Injected drugs	60	53	ns
Smoked crack	68	59	ns
Smoked crack daily*	17	11	ns
Drank alcohol daily*	22	17	ns
"Binge" meth use	73	76	ns
Unprotected vaginal sex	78	77	ns
≥2 male partners	92	74	<.001
STI (gonorrhea, trichomonas or Chlamydia)	27	24	ns
Homeless	69	52	.007
Panhandled	39	23	.003
Traded sex for money or drugs	78	53	<.001
Frequent subsistence difficulty	33	13	<.001
Steady male sex partner	24	37	.021

ns = not significantly associated (p>.10); * 30 day measure

Associations were found between non-partner violence and factors bearing upon the risk environment of participants. These included homelessness, panhandling and trading sex for money or drugs (Table 3.4). In addition, there was an association between frequent subsistence difficulty and non-partner violence. A third of women who reported non-partner violence met criteria for frequent subsistence difficulty, compared to 13 percent of women who did not experience non-partner violence. Women who had steady male partners reported significantly less non-partner violence than women who did not have steady male partners.

Over three-quarters of women who traded sex for drugs or money had experienced non-partner violence in the past six months. These women identified a diverse group of assailants: 36 percent reported violence by paying partners, 33 percent by acquaintances, 26 percent by male friends, and 23 percent by strangers. Multiple male partners and trading sex for money and drugs were strongly correlated (Pearson correlation coefficient = .53).

Standard multivariate regression was used to test the independent relationship between risk environment factors and non-partner violence (Table 3.5). The correlation between homelessness and frequent subsistence difficulty was low to moderate (Pearson correlation coefficient = .32), so both were included in the model. There was no evidence of correlation among other independent variables in the model. Women who traded sex for money or drugs had over twice the odds of experiencing non-partner violence, as did women who had the greatest

difficulty meeting subsistence needs. Neither homelessness nor panhandling maintained an association with non-partner violence when controlling for other independent variables. Similarly, having a steady male partner, hypothesized to be potentially protective, was not independently associated with non-partner violence. The model fit the data adequately (Hosmer-Lemeshow $X^2 = 4.3$, $df=7$, p=0.74).

Table 3.5: Multivariate Model of Factors Associated with Non-Partner Violence (N=322)

	OR	(95% CI)	p.
Homeless	1.29	(0.7, 2.3)	.383
Panhandled	1.58	(0.9, 2.7)	.101
Traded sex for money or drugs	2.27	(1.3, 4.1)	.006
Frequent subsistence difficulty	2.43	(1.3, 4.6)	.006
Steady male partner	0.66	(0.4, 1.1)	.138

Discussion

This exploration of non-partner violence against women who use methamphetamine offers some compelling preliminary findings. A fundamental observation is that the prevalence of non-partner violence was high (28% in the past six months), and roughly equal to that of intimate partner violence (24% in the past six months). This suggests that non-partner violence should not be overlooked in efforts to understand the role of violence in the lives and choices of marginalized women. We also found that non-partner violence was not associated some of the factors commonly identified in the literature on partner violence against women who use drugs. For example, there was no evidence of relationships between non-partner violence and the substance use factors examined, including heavy alcohol and crack cocaine use. Similarly, there was a lack of association between non-partner violence and unprotected sex, or STI infection. These findings suggest that the correlates of non-partner violence may be unique, and that further work is needed to understand non-partner violence as a distinct phenomenon.

Consistent with the concept of risk environment, non-partner violence was most strongly associated with factors that reflected disadvantaged social circumstances. These included homelessness, panhandling, trading sex for drugs or money, and frequent subsistence difficulty. Independently predictive in multivariate analysis were sex trade and subsistence difficulty, although it cannot be determined from these analyses whether survival sex and subsistence difficulty are consequences or causes of non-partner violence. In the harsh reality of drug use and "street life," either is conceivable. For example, frequent subsistence difficulty could indicate a level of deprivation that exposes women to particularly dangerous situations, or the violent environments in which they live could adversely affect their ability to meet their subsistence needs. Interestingly, violence against women who traded sex for money or drugs was not concentrated among sex trade clients. Rather, women engaged in survival sex were subject to violence from a variety of perpetrators, including friends, acquaintances and strangers. This suggests that women engaged in survival sex experience risk for non-partner violence that extends beyond actual sexual transactions.

Several limitations of this study should be noted. The variable measuring sexual violence is vague ("unwanted sexual contact"), and varying interpretations of this item by participants may have resulted in over-reporting. Even when clearly defined, perceptions of physical and sexual violence can differ among women depending on their circumstances.[142] In addition, data were lacking regarding the frequency and severity of violence, which in some studies has affected outcomes.[153] Measures of "daily alcohol use" and "daily crack use" are subject to misclassification, as there may be little conceptual difference between a person who smoked crack 29 days in the past month and one who smoked 30. An examination of the numeric distribution of responses showed that less than four percent of responses fell between 25 and 30 days for each of these items. The operational definitions of "non-partner violence" and "partner violence" in this paper leave open some questions that merit further exploration, probably through qualitative work. For example, violence by a "male friend," was included in the definition of non-partner violence, but it remains unclear what the nature of a friendship that includes violent assault might be. With the exception of STI test results, all data were self-reported, and may be subject to response bias. A review of research regarding the validity and reliability of self-report data from illicit drug users suggests that such data are sound.[85]

As with other non-probability-based samples, it is not known whether findings in this work apply generally to poor women who use methamphetamine. While the research project employed respondent driven sampling (RDS) with the goal of recruiting a representative sample of methamphetamine-using women in San Francisco, RDS has not lived up to its promise of generating samples that represent larger target populations. Rather, a growing body of research presents evidence questioning the representativeness of RDS samples.[89,154,155] RDS assumes that recruitment networks mirror larger social networks of a given population; however, this assumption cannot be verified. As Spiller[156] writes, "There is no theoretical reason to expect information collected in an RDS sample to consistently map onto the grouping structure of the population social network (p.8)." Recent research also points to unresolved issues regarding the underlying assumptions involved in calculating inclusion probabilities for RDS data[90,91] and the lack of peer-reviewed standards regarding the employment of weighted estimates in analysis.[37,73] Furthermore, there are a number of critical unresolved issues with the use of RDS data for regression analysis.[156] One of these is that participants in the chain referral sample are both recruiters and recruits, rather than mutually exclusive groups. Traditional regression adjustment strategies, based on working with non-overlapping groups, are not appropriate for RDS samples. In addition, because each participant can conduct multiple recruitments, there is a strong possibility of clustering of characteristics at the shared recruiter level. Due to the lack of clarity regarding fundamental assumptions and methods of applied analysis, RDS inclusion probabilities were not employed in this paper. This, however, means that the multiple regression analysis presented here is not adjusted for interdependence between observations. Furthermore, the multiple regression method used, standard or 'simultaneous' regression, does not account for co-variance between independent variables. Thus, this technique may underestimate the contribution of an independent variable that has a substantial correlation with the dependent variable.[157] In addition, due to the number of relationships explored in bivariate analyses, some statistically significant associations could have occurred by chance. However, most of these associations were significant at a level of <.01.

Finally, this is an exploratory, cross-sectional study which does not establish causality. It suggests that risk environment and non-partner violence are intertwined, but the precise nature of the relationship can only be established through theoretically driven, preferably longitudinal, studies testing relationships that have been hypothesized *a priori.* As with other complicated social phenomena, the relationship between risk environment factors and non-partner violence may be bi-directional[132] and involve a constellation of mediating and moderating factors not encompassed by this preliminary research.

Future research

This research offers some modest groundwork which identifies important future areas of inquiry. Non-partner violence against women needs to be better defined and described. Qualitative in-depth research with drug using women can provide enlightenment regarding the meaning and context of non-partner violence, and help build a better understanding of the situations and relationships involved. For example, when a woman reports physical violence at the hands of a male friend, what makes her assailant a 'friend' despite the assault? Possibilities include the length of the friendship, the circumstances of the attack (eg., inebriation), or lack of a normative expectation that a friend will not harm you. Formative qualitative work could lead to the development of strong, population-relevant constructs for the study of non-partner violence. These could then be applied in quantitative research to better describe the characteristics, severity and frequency of non-partner violence in different groups of marginalized women. In addition, different types of non-partner violence (e.g, physical vs. sexual, stranger vs. acquaintance) may have different health impacts, and need to be explored separately.[142] Longitudinal studies of non-partner violence against women are needed to determine the causal relationships between non-partner violence and negative health and social outcomes. For example, one important question emerging from this research is whether subsistence difficulty, including survival sex, directly leads to increased levels of non-partner violence, and whether there are mediating factors in that relationship. The more this relationship can be elucidated, the better targeted intervention efforts can be. In addition, much could be learned from research examining how individuals and environment interact to increase or reduce health risks. For example, while over half of women in this study were homeless, overall only about 20 percent reported frequent subsistence difficulty. Examining how some women are able to successfully meet basic needs, despite being homeless, could be fruitful in identifying strategies and characteristics that promote resilience.

Non-partner violence against poor women who use drugs is a serious public health issue. Even in the absence of clear causal pathways, this work points to some potential intervention strategies that could address subsistence difficulty and risk of violence simultaneously. For example, programs such as "Ladies Night" in San Francisco[99] provide safe spaces for women to regroup, address their basic needs for food and hygiene, and find respite from violence on the streets. "Housing first" interventions[158] prioritize provision of stable housing for homeless people who use drugs and/or have mental health problems, and could credibly reduce non-partner violence by simply giving women a safer alternative to the streets or shelters.[142] Both of these strategies could concurrently address subsistence needs and reduce non-partner violence against women. In international settings, economic empowerment initiatives designed to reduce HIV risk among women have led to improved livelihoods, lower HIV risk and reductions in violence from

intimate partners and community members.[159-161] The provision of legitimate and safe income-generating opportunities for marginalized women in the U.S. could perhaps have effects. While more research is needed to understand the causes and consequences of non-partner violence, measures such as these could improve the safety of poor women in drug-using communities now.

Conclusion

This work contributes several key findings important to understanding the health risks of women who use methamphetamine. It found that many women who use methamphetamine engage in sexual risk behaviors that put them at risk for HIV and STIs (Paper 1). These include unprotected sex with multiple male partners, "marathon sex," and the exchange of sex for drugs or money. The prevalence of HIV and STIs was low to moderate in this sample, suggesting that these behaviors have not resulted in widespread infection. A precautionary approach would suggest that now is the time to focus on HIV and STI prevention for this group of women. In addition, this work indicates the importance of screening high-risk women for vaginal trichomonas, a bacterial STI that has received scant attention, but is now strongly linked with susceptibility to HIV infection.[66,67] It was the single most common STI in this group of women, with a prevalence of 22 percent.

While it is common for public health researchers to study sexual behavior solely from a paradigm of risk, the mixed methods work in Paper Two pointed out some limitations of this approach. By engaging with the qualitative data, I found that the women themselves presented a substantially different perspective on sex, one in which narratives of risk were largely absent. Rather, many women related sex, particularly sex while high on methamphetamine, with desire, pleasure and agency. This is potentially vital information in terms of developing effective behavioral strategies to reduce disease. For methamphetamine-using women, efforts to improve sexual health should acknowledge the perceived benefits of mixing sex and methamphetamine, and try to incorporate women's feelings of sexual agency to foster the adoption of risk reduction strategies.

Many study participants lived in perilous interpersonal and community environments, as reflected by the high levels of sexual and physical assault experienced at the hands of intimate partners and non-partners alike (Paper Three). A great deal of violence against women in this research was perpetrated by non-partners. This indicates a need to expand the current focus on intimate partner violence and consider the impact of other types of violence on poor, drug-using women. Furthermore, this research found that need and suffering go hand-in-hand, as subsistence difficulty and non-partner violence were strongly correlated. Given the circumstances of drug use, poverty and street life, the relationship of subsistence difficulty and victimization may well overlap and act in a bi-directional manner. An effective public health response would be to mount structural interventions that act both to reduce need (eg., housing, drop-in programs) and to enhance security (eg., community safety campaigns, changes in policing practices) among marginalized women.

Among the surprising findings in this work was a lack of evidence for the hypothesis that the relationship between frequency of stimulant use and vaginal trichomonas was mediated by sexual risk behavior. Clearly, drug use cannot cause STI infection directly -- there must be a sexual component for infection to occur. While alternative explanations for this relationship were carefully considered, it is still possible that the association between stimulant use and trichomonas infection was spurious. In future research with other samples of stimulant users, it will be enlightening to see whether a similar association is discovered, and, if so, what particular sexual mechanism may link stimulant use and sexually transmitted infections.

An unanticipated methodological challenge – and ultimately, a serious limitation -- of this research was presented by the use of respondent driven sampling (RDS) in the source study. Sampling has been a perennial challenge in drug use research. Because drug use is illegal and stigmatized, it is largely hidden, making it challenging to develop a sampling frame with any confidence. Different strategies have been developed to address this limitation, such as sampling from drug treatment centers (which have a census), or drawing on ethnographic information and secondary data sources to create 'targeted' samples.[162] In the early 2000's, RDS emerged as a new methodology for sampling 'hidden' populations was rapidly and widely adopted.[24,26] RDS is essentially a method of snowball sampling that uses mathematical methods to account for differential recruitment and network size. In theory, inclusion probabilities can be calculated and incorporated into data to make findings generalizable to the larger target population.[69,88] However, RDS is still very much a work in progress. There are many unanswered questions regarding the assumptions used to calculate inclusion probabilities,[90,91,156] as well as a lack of commonly accepted, peer-reviewed methods of applied analysis.[37,73] In particular, there are a number of critical unresolved issues with the use of RDS data for regression analysis.[156] The work presented here follows the current convention of essentially treating the RDS sample as a convenience sample, meaning the generalizability of results to the larger population of methamphetamine-using women in San Francisco is unknown. The absence of adjustment for inclusion probabilities also means that multiple regression models in this work do not account for interdependence between observations. The promise of RDS, as a means of creating representative results from hidden populations, is as yet unrealized.

The results of this study point to several future directions for research regarding the sexual health and safety of women who use stimulant drugs. A major question is whether the prevalence of trichomonas among women 25 and older warrants rethinking public health guidelines for STI screening. This study suggests that screening older, high-risk women for vaginal trichomonas (TV), even when asymptomatic, might be advisable; however, a much more extensive body of evidence is needed to make this assessment, including national prevalence studies. In addition, there are virtually no data regarding the prevalence of TV among heterosexual men who use methamphetamine. Research into the prevalence and correlates of infection among men is needed to better understand, and intercede in, the dynamics of heterosexual transmission.

Another fruitful avenue of research that this study points to is the further use of mixed methods, specifically the integration of qualitative findings into quantitative risk assessment epidemiology.[114] The use of open-ended, qualitative methods of inquiry placed sexual risk among women in a surprising new context – pleasure – and brought forward new ideas for intervention strategies. It appears that simply measuring risk is not enough to fully understand risk. Further research is needed that strives to understand sex as an experience, rather than simply a risk behavior, among women who use drugs.

Finally, additional work is needed exploring the relationship between risk environment,[143] violence and adverse health outcomes. Characterizing risk environment can be challenging with conventional methods. Individual-level variables, such as those used in this paper, have uncertain applicability in terms of describing the social and structural characteristics of an environment. Environmental-level variables, on the other hand, are typically not fine-grained enough to capture characteristics within a community; for example, there is little variation at the

census tract or block group level in high-risk neighborhoods. The gradations of space and place, however, could be measured by ethnographic research conducted at an intensely local level. Research joining street-level ethnography with risk assessment epidemiology could potentially identify both health risks and the environments that enhance those risks, fostering the process of indentifying environment-level characteristics that are most influential and/or most amenable to intervention.

This research identifies several actionable areas for public health intervention to improve the sexual health and safety of women who use methamphetamine. These include STI screening and treatment, the integration of the pleasurable aspects of sex into behavioral risk reduction efforts, and structural measures to make women less susceptible to violence in their daily lives. By contributing to a better understanding of the lives of methamphetamine-using women in San Francisco, it is hoped this research will contribute to improving those lives as well.

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