THE IMPACT OF SOCIAL AND EMOTIONAL ISOLATION ON RISKY BEHAVIORS AMONG WOMEN INJECTION DRUG USERS IN PORTLAND, OR

By
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ABSTRACT

Background: Women injection drug users (IDUs) are at increased risk for infection with blood borne and sexually transmitted diseases, such as HIV and HCV. Their increased exposure is due to high risk practices (e.g. sharing syringes and other injection equipment, exchanging sex for drugs or money, sex with multiple partners and unprotected sex). Preventing the transmission of HIV and HCV among women IDUs requires thorough understanding of all variables that increase risk. Recently investigations suggest that the character and dynamic of social interactions may be important determinants of risk. Social and emotional isolation are facets of social interactions that have not been widely considered with respect to HIV or HCV risk.

Methods: We collected data from 102 women IDUs through a self report questionnaire, to determine if there is an association between social and/or emotional isolation (self report isolation scale) and engagement in HIV/HCV risk behaviors (defined by 15 unsafe sex- and drug-related practices). All subjects were adult women (18 years of age or older) of any race/nationality who spoke English and who by self report had injected drugs at least one time over the past 30 days. Study participants were recruited from existing organizations that provide services to IDUs.

Results: Data were analyzed using Chi-square and T tests and multivariate logistic regression models. We found that 50% of the women had above average or severe levels of isolation. Despite accessing harm reduction services a number of women engaged in high risk practices over the previous 30 days. One third injected with a syringe that had been used by someone else and close to half were either injected by another or used injection paraphernalia that had been used by someone else. Half of the sample had sex with another IDU and one third exchanged sex for money or drugs, of which, only one half always used condoms. An examination of the

association between isolation and risk behaviors revealed that social isolation was positively associated with engagement in injection risk behaviors. In addition, a trend toward a positive association was found between social isolation and sex risk behaviors.

Conclusion: This study provides important epidemiologic data. This population appears to be extremely isolated a factor that has been linked to poor health and health outcomes. In addition, many of these women engaged in high risk behaviors despite interventions and education about the dangerousness of such practices indicating that we can do a better job with prevention activities. Finally, this study adds to the current literature investigating how social network characteristics influence risk behaviors among injection drug users. The purpose of this study was to increase our knowledge about how social network characteristics, in particular social/emotional isolation may be important determinants of risk. This data provides insight into the motivations for risk behaviors allowing researchers to plan interventions that address issues of social isolation in order to combat the spread of HIV and HCV.

Introduction

Women injection drug users (IDUs) are at high risk for infection with blood borne and sexually transmitted diseases (STDs). In 2006, an estimated 300,000 women were living with HIV, and in 26.3% of those cases transmission was through injection drug use [1]. Among IDUs women account for a higher percentage of Acquired Immune Deficiency Syndrome (AIDS) cases. Since the 1980's 57% of all AIDS cases among women can be attributed to injection drug use or sex with a partner who injects drugs, compared to 31% for men [2]. Women who inject drugs are also at high risk of acquiring Hepatitis C (HCV) [3]. It is estimated that 3.2 million people are chronically infected with HCV nationwide making it the most common blood borne infection in the United States[4]. Drug injection accounts for the majority of new HCV infections [5] and infection occurs rapidly with 50-80% of new injectors testing positive within 6 to 12 months of starting to inject [6].

Injection drug users are at increased risk of infection with HIV and HCV due to high risk practices. IDUs become infected with HIV and HCV through using or sharing unsterile syringes and other injecting equipment or by engaging in unprotected sex [2, 7-10]. IDUs often jointly purchase drugs and prepare the drug solution together and are, therefore, exposed to blood contaminated injection paraphernalia such as water, cookers (drug mixing containers), and cotton filters [2, 10]. HCV is more efficient at parenteral transmission then HIV increasing the chance of transmission through the sharing of injection equipment, often referred to as indirect sharing[10]. Drug choice also impacts transmission since the use of speedballs (heroin mixed with cocaine) has been shown to increase risk of HIV infection [11, 12].

Women IDUs may be even more vulnerable then their male counterparts in that they are more likely to borrow needles, share ancillary equipment, and be injected by someone else[13]. Des Jarlias *et al* indicated that women are at higher risk of becoming infected with HIV and HCV in the period soon after drug use initiation[14]. They also engage in high risk sex behaviors such as trading sex for money or drugs and unprotected sex when under the influence [1, 9, 15] as well as having sex with multiple partners and sex with other IDUs[15-17]. Compared to men, women IDUs are more likely to have IDU sexual partners, including main, casual and commercial partners [15-17]. Women injectors are also more likely to share a syringe and less likely to use condoms with primary or steady partners who tend to be other IDUs[18]. This dynamic places women at increased risk since studies indicate that primary male partners have high rates of needle sharing and unprotected sex with non primary partners[18, 19]. Women, therefore, appear to be at increased risk by having an injection partner who is also a sexual partner.

High rates of disease transmission among women in the United States impact our social and health care systems. In 2004, HIV infection was the 6th leading cause of death among all women aged 25–34 years and the 5th leading cause of death among all women aged 35–44 years [1]. The estimated cost to the US health care system to treat HIV infections due to injection drug use from 1996 - 2000 ranged from $287 million to $630 million[20]. The medical and social burden of HCV is also substantial. Each year, 8,000 to 10,000 people die from the complications of liver disease caused by hepatitis C and liver failure due to HCV is the leading reason for liver transplants [3]. Current estimates of medical and work-loss costs of HCV-related acute and chronic liver disease are greater than $600 million annually [3]. By 2010 it is expected that HCV

will kill more people every year than AIDS[20]. There are no vaccines to prevent HIV or HCV.

Injection drug use plays a role in introducing HIV and HCV into the general population. IDUs contribute to the spread of HIV to non-injectors through sex risk behaviors including unprotected sex and multiple sex partners[21, 22]. Many IDUs have primary and casual sex partners with non-injectors and use condoms infrequently[19]. HIV and HCV are also spread from mother to child during pregnancy, labor and delivery, and breastfeeding; known as perinatal transmission [23]. Although the risk of perinatal transmission has decreased over the past decade due to early intervention many women injectors do not seek prenatal care and pass these viruses on to their children [24]. One to two hundred infants in the United States are infected with HIV annually, and many of these infections involve women who were not tested early enough in pregnancy and/or did not receive any medication [25]. Approximately 25 percent of HIV-infected women not receiving treatment pass the virus on to their babies[26]. About 4 out of every 100 infants born to HCV infected women become infected. If an HCV positive mother is co-infected with HIV then the rate of perinatal HCV transmission can be as high as 19% [3, 27]. More effective prevention approaches will not only help women IDUs but society as a whole by reducing transmission to sex partners, children and ultimately the general population. Preventing the transmission of HIV and HCV among women IDUs requires a thorough understanding of all factors that increase the risk of transmission. These factors can involve the biological, behavioral, environmental and societal realms. Historically research has focused on biological and behavioral risk factors. Recently investigators have reported that the character and dynamic of social interactions may also be important

determinants of risk, both for engaging in risk behaviors, and for doing so with high risk persons[11, 28-32]. Social network theory is being used to study social interactions as a way of explaining human behavior. A social network is defined as a person-centered web of social relationships. Networks have both compositional and structural characteristics. Structural characteristics include size, density, interconnectedness or level of reciprocity, turnover, and geographic dispersion, whereas compositional characteristics are defined as support and isolation[33]. The majority of research has focused on the structural characteristics of networks in relation to IDUs risk behaviors. Much less is known about how support and isolation affect women injection drug users [31].

Social network methodology originally suggested that social ties and relationships might play a role in the determination of health status. These studies implied that there was an increased risk of acquiring diseases among those living in situations of social disorganization and poverty[34-37]. In 1979, Berkman et al, discovered a consistent pattern of increased mortality rates associated with a decrease in social connections[38]. One aspect of social connections, support, has continued to be associated with reduced risk of mortality as well as mental and physical illness[39-43]. Social and emotional support have been defined as an exchange, between network members, of emotional concerns (intimacy or sense of belonging), instrumental and financial aide, information (advice and social connections), and appraisal (integration with perceived social norms relevant to self evaluation)[44, 45]. Social and emotional isolation are, therefore, characterized by a lack of social and emotional support.

Social networks, depending on the type of support received may or may not be supportive and can influence both healthy and unhealthy member behaviors[43, 46, 47]. Social support has been linked to less use of illegal substances, decreased injection and sex risk practices, and fewer barriers to condom use[47, 48]. Other studies have found that risk behaviors in relationships with high–risk network members influence disease prevalence and incidence[48-50]. In particular, having a higher proportion of high risk network members has been associated with participation in sex and drug use risk practices[48]. IDU populations may influence drug equipment sharing if this is a common behavior within the cohort[46]. Reduction of drug using individuals in one's social network may result in fewer drug injecting risk behaviors due to lower social pressure[46].

Research on the network characteristics of women IDUs suggests that that these women usually have sex partners who use, often inject with their sex partners, and tend to participate in receptive syringe sharing with intimate others [51]. Women IDUs operate within a world characterized by a lack of resources, isolation from mainstream society, and a male centered street culture[52]. This structure facilitates women's subordination and dependence on men for respect and protection and may lead to exploitation. Women have less control over their bodies. They often rely on men for help during injection as well as obtain drugs by sex tradework, both of which place them at higher risk for HIV and HCV than their male counterparts[53]. A higher percentage of syringe sharing occurs among partners when the sharing partner is female and particularly when a female partner requires help injecting[54]. In addition, younger women are at greater risk due to injection inexperience which requires them to receive help with injecting[10, 54]. Women who choose

not to comply with this subordinate role may find themselves deeply isolated which may also increase risk behaviors[52].

Isolation, both social and emotional, is only one facet of a social network and has not been widely considered with respect to HIV or HCV risk. The assumption has been that individuals choose to voluntarily isolate and therefore do not participate in risk behaviors with others. However, injection drug use is often connected to involuntary isolation which may contribute to risk. As the degree of chemical dependency increases many women express an increased sense of emotional isolation[55]. In addition, many women IDUs have no substantive support person reflecting enormous social isolation [56]. Isolation can cause women to feel deprived and lonely, and consequently participate in sex and drug use behaviors in hopes of escaping loneliness [57]. Women have been found to initiate drug use to escape involuntary social isolation [58] and isolation has been associated with HIV risk among women IDUs and sex workers[59]. Prior studies have documented that the severity of chemical dependency is a key determinant of increased risk behaviors. In 2007, Staton–Tindall et al found that perceptions of social support correlate with a women's severity of substance use by documenting that an increase in alcohol and drug use was associated with smaller the social networks (less social support)[54]. Women with severe drug dependency are also more likely to engage in high risk sex with multiple partners for money or drugs, share needles, and have unprotected sex with an IDU partner[55]. Female IDUs who live alone and have small social networks are also more likely than highly networked women to share injection equipment and use shooting galleries[60]. Social network theory postulates that less social support means a decreased ability to cop with stressful events. Social support is linked to relationships and

relationships are important to women. It is, therefore, reasonable to assume that unstable social support system may contribute to the initiation and continued involvement in, problem behaviors like substance use[61].

HIV and HCV are transmitted through risk behaviors that involve close personal and physical contact between infectious and susceptible individuals. An attempt to better understand disease transmission dynamics and risk factors should, therefore, include analysis of social interactions. Information regarding the emotional, psychological, and social context in which risk behaviors occur will provide data that can give insight into the motivations for continued behavior. The ultimate goal is to use this data to develop effective interventions for decreasing these risk behaviors. The majority of interventions to reduce HIV and HCV risk among IDUs have focused on individual behavior changes many of which have had unsatisfactory results[62, 63]. By examining social network characteristics we may be able to better address risk reduction through social context. In particular the employment of social modeling, explicit persuasion of peers to modify behaviors, may be especially beneficial in impacting negatively influential networks[53].

Material and Methods

In this study we employed a cross sectional design, collecting data from 102 women IDUs through a self report questionnaire. Eligibility criteria included: (a) women 18 years of age or older, (b) who were literate in English, (c) resided in the Portland metro area, and (d) who, by self report, had injected drugs at least one time over the past 30 days. Six subjects did not meet eligibility criteria thus data from 96 of the 102 subjects were analyzed.

Subjects were recruited using a facility-base sampling strategy. This sampling method has been used to recruit hard-to-reach and hidden populations. This strategy has some biases, including the possibility of not providing probability samples that can be considered representative of a given population. [64] However, given time and resource constraints this was the most feasible method to use. Study participants were recruited from Outside In Needle Exchange Program; Multnomah County Needle Exchange; and the OHSU Richmond Clinic, a primary care clinic and Central City Concern's mentor program, an outpatient treatment program.

Recruitment flyers were created advertising the study and stating the time and place the investigator would be available to administer questionnaires. In addition, the flyers provided a phone number that potential subjects could call to set up an appointment to meet with the investigator if they were unable to attend the scheduled sessions. In July of 2006 flyers were distributed to the above agencies who handed them out to potentially eligible women.

Data collection took place between July and September 2006 at two sites: Outside In Needle Exchange and Richmond clinic. The principal investigator and one research assistant collected the data. Each participant met individually with the investigator/research assistant; who explained the study, stated that questionnaire was anonymous, that no identifying information would be recorded, and that the entire interaction was confidential. The researcher then determined whether the participant was eligible. If eligible, oral consent was obtained and the participant was provided with an information sheet. Each participant read and completed the questionnaire on their own,

but the investigator was available to answer questions or clarify anything that was unclear to the participant. Upon completion of the survey the investigator reviewed the document with the participant for possible errors or omission and then the subject received a $15 gift certificate to Fred Meyer.

The questionnaire was developed by collating and modifying existing instruments and included only closed-ended questions. The questionnaire included sections on demographics, drug use history, social and emotional isolation, and engagement in HIV and HCV risk behaviors. The questionnaire was pretested on a sample of 6 subjects drawn from the study population for refinement and validation.

The questionnaire incorporated the Emotional/Social Loneliness Inventory (ESLI) to measure (a) emotional isolation defined as a deficiency in intimacy and attachments in one's current social network (8 items) and (b) social isolation defined as a deficiency in social integration and reassurance of worth in one's current social network (7 items). [65] Subjects rated the 15 statements on a 4-point scale ranging from "rarely true" (0) to "usually true" (3) based on experiences over the past two weeks.

The Risk Behavior Survey (RBS) was used as a guide to formulate questions for measurement of the HIV and HCV risk behaviors. The RBS is an abbreviated version of the Risk Behavior Assessment (RBA) and collects information on drug use, drug injecting patterns, sexual activity, condom use, exchange of sex for drugs, money or both, and HIV-testing history in the 30 days prior to interview.[66] The RBS was developed to be administered by interview; however the lack of availability of self administered HIV risk

assessment tools necessitated the use the RBS questions for the measurement of the dependent variables on the self report questionnaire. The response scale for drug use over the past 30 days utilized a 3 point scale (Yes/No/Don't Know) and an 8 point scale (Never/1-3 times/About once a week/2-6 times a week/ About once a day/ 2-3 times a day/4 or more times per day/ Don't know). Sexual activity over the past 30 days was measured with the same 8 point scale mentioned above and a 5 point scale (Never/Less than half the time/more than half the time/Always/ Don't know).

The questionnaires were reviewed on site, with the participant, to locate and fill in missing values and all data were double entered into the database for quality assurance. The study protocol was reviewed and approved by the OHSU Institutional Review Board.

Statistical procedures:

Demographic variables included the continuous variable age and the categorical variables: ethnicity (0=white, 1=non white); education (0=high school or less, 1= college); marital status (0=married, 1=single); employment (0=employed, 1= unemployed); homeless status (0=homeless, 1=housed); age at first injection (0=20 or younger, 1=21 or older); number of years injecting (0=five or less, 1=six to ten, 2=eleven or more); currently in treatment, on methadone or on buprenorphine (0=no 1=yes); number of times in treatment (0=never, 1=one, 2=twice, 3=three, 4=four or more), number of times on methadone or buprenorphine (0=never, 1=one or more), and living with other drug users (0=no, 1=yes).

The type of drug injected over the past 30 days consisted of cocaine, heroin, speedball (a combination of heroin and cocaine injected together), and amphetamines (0=yes, 1=no). Drug frequency variables included the number of times drugs were used and the number of times drugs were injected over the past 30 days (0=never, 1=1-3times/month, 2=about one a week, 3=two to six times a week, 4=about once a day, 5=two to three times a day, 6=4 or more times a day, 7=don't know/unsure). During preliminary analysis we discovered that 6 subjects had not injected over the past 30 days which was one of the criteria for enrollment in the study. We, therefore, excluded those six cases from subsequent analyses. We also decided to collapse the drug use frequency variables due to insufficient number of respondents reporting drug use of less than one time per day. The categories were dichotomized into 0 =one time per day or less and 1=more than one time per day.

Social and emotional isolation, the primary independent variables of interest, were based on self-reported data from 15 statements from the ECSI that related to feelings and events over the last two weeks. A raw score was totaled for the 8 emotional isolation and 7 social isolation statements producing two continuous isolation variables. The continuous variables were then converted to categorical variables. A raw score of 0-5 indicated little or no isolation, 6-8 indicated an average level of isolation, 9-12 indicated an above average level of isolation, and 13 or greater indicated severe isolation. [65]

A scatter plot comparing the raw social and emotional isolation scores of each participant indicated that the two isolation categories might be correlated. (Figure 1) The Pearson correlation coefficient between continuous social and emotional isolation variables was

0.585, which was significant at the 0.01 level. In addition, the literature indicates that there is a high degree of overlap in the experience of being socially or emotionally isolatied[45, 67]. We, therefore, decided to combine the emotional and social isolation variables. A mean score was calculated from the raw emotional and social isolation responses for each subject. The mean scores were then converted into one of the 4 isolation categories (0=little to none, 1=average, 2=above average, and 3=severe). For the multivariate logistic regression the isolation variable was dichotomized into not isolated and isolated categories (0=little to none and average, 1=above average and severe).

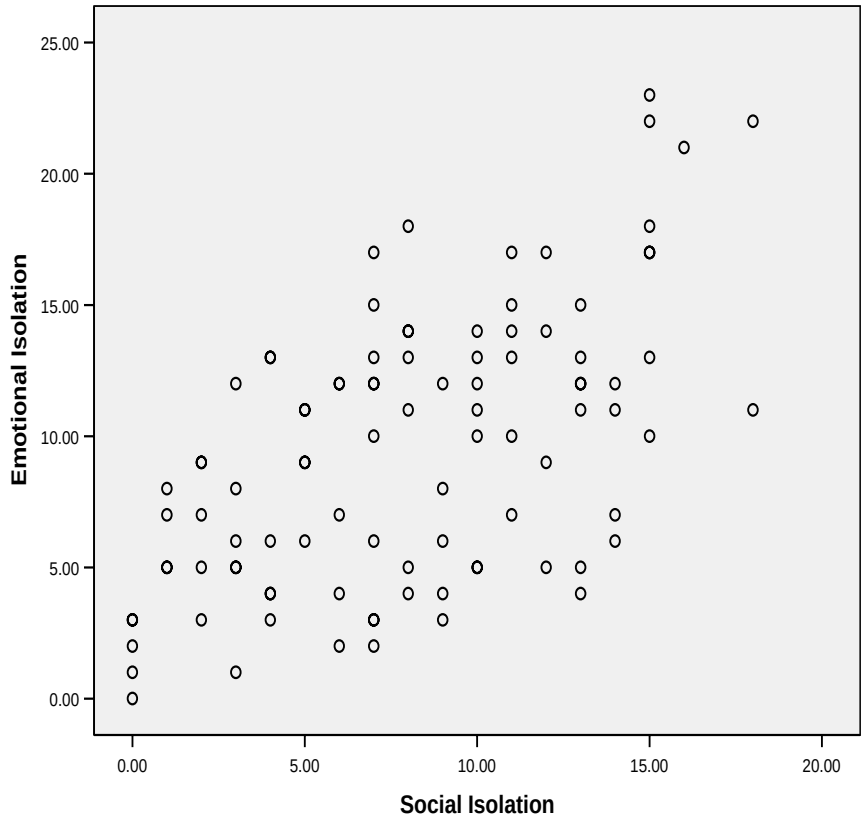

Figure 1: Scatter plot illustrating the correlation between the continuous social and emotional isolation scores (Pearson corr = 0.58)

The dependent variables were limited to 8 out of the 15 original unsafe sex- and drug-related practices based on prior studies analyzing HIV and HCV risk practices[53, 63, 68]. We explored three measures of drug use risk based on behavior over the previous 30 days. These consisted of: injecting with a used syringe, referred to as direct sharing; being injected by another person; and using a cooker/cotton/rinse water used by another injector, known as indirect sharing (0=no, 1=yes). Five measures of sex risk behavior during the prior 30 days were also analyzed. Three variables were categorized as 0=no and 1=yes and included multiple sex partners (sex with two or more individuals), sex with an IDU, and exchanging sex for money or drugs. The use of condoms while exchanging sex for money or drugs and/or during vaginal or anal sex were also evaluated (0=never, 1-inconsistant, 2=always).

We used a multivariate ordination technique creating two outcome measures representing engagement in drug use and engagement in sex risk behaviors. Drug use behaviors were categorized as not risky (0), potentially risky (1), and clearly risky (2). Subjects who indicated that they had never participated in any of the three risk behaviors (direct or indirect sharing and being injected by another) over the past 30 days were categorized as not engaging in any risky behaviors. Subjects who were either injected by another or participated in indirect sharing at least one time (including those who were unsure of how many times) in the past 30 days were categorized as engaging in potentially risky behaviors. Subjects who participated in direct sharing at least one time or were unsure of how many times in the prior 30 days were categorized as engaging in clearly risky behaviors. See table 1.

Table 1: Category definitions for a composite outcome measure for risky injection drug use behavior among IDU women

Past 30 days	Not Risky	Potentially Risky	Clearly Risky
Direct sharing	Never		At least one time
Injected by another	Never	At least one time	
Indirect sharing	Never	At least one time	

Sex behavior was categorized as not risky, potentially risky and clearly risky. Participants who had no sex partners, engaged in sexual activity (IDU or non IDU) but always used a condom during vaginal and anal sex, never exchanged sex for money or drugs, or exchanged sex but always used a condom were designated as not being at risk. The potentially risky category included women who had only one non-IDU sex partner and never used condoms during vaginal or anal sex or women with multiple sex partners or an IDU partner and used condoms inconsistently. Subjects who had multiple sex partners or an IDU partner and never used condoms during vaginal or anal sex or exchanged sex for money or drugs with inconsistent condom use were categorized as engaging in clearly risky behavior. Inconsistent condom use included the responses never, less than half the time, and more than half the time. See table 2.

Table 2: Category definitions for a composite outcome measure for risky sexual behavior among IDU women

Past 30 days	Not Risky	Potentially risky	Clearly risky
1. Sex partners *a. Condom use with vaginal and anal sex*	1. None 2. IDU or non IDU partner/s *a. Always use condom*	1. One non IDU partner *a. Never use condoms* 2. Multiple partners *a. Inconsistent use* 3. IDU partner *a. Inconsistent use*	1. Multiple partners *a. Never use condom* 2. IDU partner *a. Never use condom*
1. Exchange sex for money or drugs *a. Condom use*	1. Never 2. Yes *a. Always use condom*		1. Yes *a. Inconsistent condom use*

The drug use and sex risk behavior outcome measures were dichotomized into binary form, not risky and a risky variable (0=not risky, 1=potentially and clearly risky) to answer the primary research questions posited in this study. Pearson chi-square tests assessed associations between the isolation variable and each composite risk behavior measure as well as each of the 8 individual risk behaviors. In addition, the independent variable, isolation, and potential confounders were placed in a univariate logistic regression model to evaluate magnitude and significance of unadjusted associations between isolation and engagement in risky behaviors. Potential confounders were chosen and entered into logistic regression models based on a review of the literature and results of chi square tests between the independent variables and the demographic, drug choice and drug use frequency variables.

Several studies assessing the prevalence of HCV and HIV in populations of IDUs have found that the duration of injecting and the frequency of injection each day are the factors most consistently associated with infection[69]. Duration of injecting increases with age. Age was, therefore, also identified as a possible confounder. Methadone maintenance and drug treatment decrease the number of lifetime injection episodes so both were included. Younger age and homelessness have been associated with increased syringe sharing among women IDUs[70]. Injecting risk may be greater in young women compared to male IDUs despite equivalent frequency of injecting[13]. Drug choice also impacts transmission. The use of speedballs (heroin mixed with cocaine) has been shown to increase risk of HIV infection [11, 12] and cocaine use alone has been linked to increased use of shooting galleries and needle sharing[46, 71]. Sharing of injection equipment has also been associated with unemployment, low levels of education, heavy drug use, injecting in shooting galleries, younger age, having a sex partner who is also an IDU[72-74]. Therefore, the confounders included age, marital status, education, homelessness, employment, IDU partner, age at first injection, number of years injecting, number of injections in past 30 days, type of drug used, current and past methadone treatment, as well as current enrollment in a drug treatment program. Buprenorphine was not included in the model due to insufficient data points. Variables with a p-value of less than .25 were considered for the multivariable model. The dependent and independent variables as well as the potential confounders are listed in table 3.

Table 3: Dependent, independent, and potential confounding categorical variables used to assess the potential impact of isolation on risk behavior in IDU women

Variable	Codes/Values	Name
Injection Risk	**0 = no risk** **1 = risky**	**INJRSK**
Sex Risk	**0 = no risk** **1 = risky**	**SEXRSK**
Combined Isolation	**0 = not isolated** **1 = isolated**	**ISOLTNDI**
Emotional Isolation	**0 = not isolated** **1 = isolated**	**EMOISODI**
Social Isolation	**0 = not isolated** **1 = isolated**	**SOCISODI**
Age	**Years**	**AGE**
Marital Status	**0 = married** **1= single** **2=other**	**MAR**
Education	**0 = High school or less** **1 = College**	**EDU**
Homeless	**0 = No** **1 = Yes**	**HOMLES**
Unemployed	**0=No** **1=Yes**	**UNEMPL**
IDU sex partner	**0=No** **1=Yes**	**IDUPTNR**
On Methadone	**0 = No** **1 = Yes**	**MET**
Past Methadone use	**0 = Never** **1 = One or more times**	**PASTMET**
Currently in treatment	**0 = No** **1 = Yes**	**CURNTX**
Age at first injection	**0 = 20 or younger** **1 = 21 or older**	**FRSTINJ**
Number of years injecting	**0 = 8 or less** **1= 9 or more**	**YRSINJ**
Number of injections over past 30 days	**0 = one time or less/day** **1 = more than once a day**	**NUMINJDI**
Cocaine use in past 30 days	**0 = No** **1 = Yes**	**COKE**
Heroin use in past 30 days	**0 = No** **1 = Yes**	**HEROIN**
Speedball use in past 30 days	**0 = No** **1 = Yes**	**SPEDBAL**
Amphetamine use in past 30 days	**0 = No** **1 = Yes**	**METH**

We then created two separate fit models using the outcome measures. The multivariable models were built using backward stepwise selection. The isolation variable was forced into the model, followed by each of the next most significant variables. At each step, if a

variable was no longer significant at the p=0.15 level, it was removed from the model. This process continued until all variables with a univariate p-value of less then 0.25 had been considered for the model. Interaction terms were also assessed to determine if there was effect modification by some variables. Confidence intervals for odds ratios were computed for each variable. After the final models were completed we replaced the combined isolation variable with the categorical emotional and social isolation variables to see if this resulted in any significant changes. All analyses were performed using SPSS Version 14 for Windows.

Results

In the sample of 96 women IDUs 75% were white and 25% were nonwhite (Black/African American, Hispanic/Latina, Asian, American Indian/Alaska Native, or multiracial). The average age was 34 with a range of 19 to 63. In the previous 30 days 59.4% had been homeless, 81.3% were unemployed, 28% were currently in a treatment program, 20% were currently on methadone maintenance and 1% on Bupenorphine. Demographic data is presented in table 4. The women exhibited a high level of isolation. In the combined isolation category 30.2% had above average isolation and 25% were severely isolated (Figure 2). 22% of the women were severely socially isolated and 28% were severely emotionally isolated (Figure 3).

Table 4: Demographic characteristics of 96 IDU women in Portland, OR

Variable	N	%
Age (mean) +/- SD	**34 +/-10.3**	
Race/ethnicity		
White	**72**	**75**
Non White	**24**	**25**
Marital status		
Married	**23**	**24**
Single	**64**	**66.7**
Education		
High school or less	**51**	**53.1**
College	**43**	**44.8**
Unemployed	**78**	**81.3**
Homeless	**57**	**59.4**
Currently in Treatment	**27**	**28.1**
# of times in Treatment		
Never	**16**	**16.7**
Once	**9**	**9.4**
Twice	**20**	**20.8**
Three times	**15**	**15.6**
4 or more times	**36**	**37.5**
On Methadone	**19**	**19.8**
# of times on methadone		
Never	**50**	**52.1**
One or more times	**46**	**47.1**
Currently on Bup	**1**	**1.0**
# of times on Bup		
Never	**87**	**90.6**
One or more times	**9**	**9.4**
Age at first injection		
20 or less	**52**	**54.2**
21 or older	**44**	**45.8**
# of years injecting		
5 or less	**31**	**32.3**
6-10	**36**	**37.5**
11 or more	**29**	**30.2**
Living with drug user	**51**	**53.1**

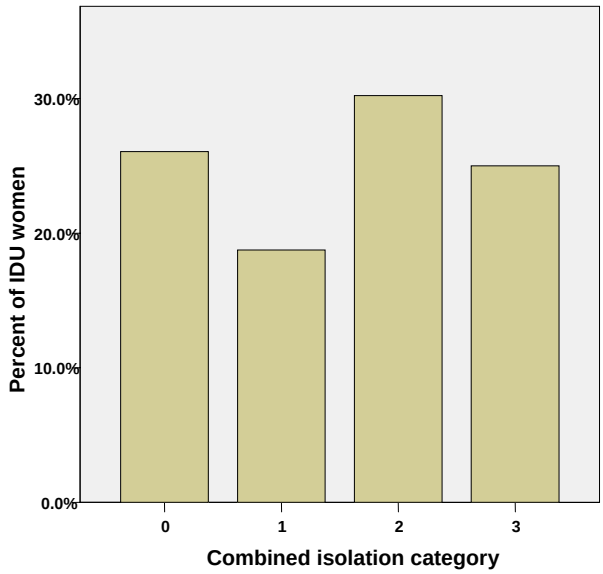

Figure 2: Percent of 96 IDU women in Portland, OR in the combined social and emotional isolation categories
(0=not isolated, 1=average, 2=above average, 3=severe)

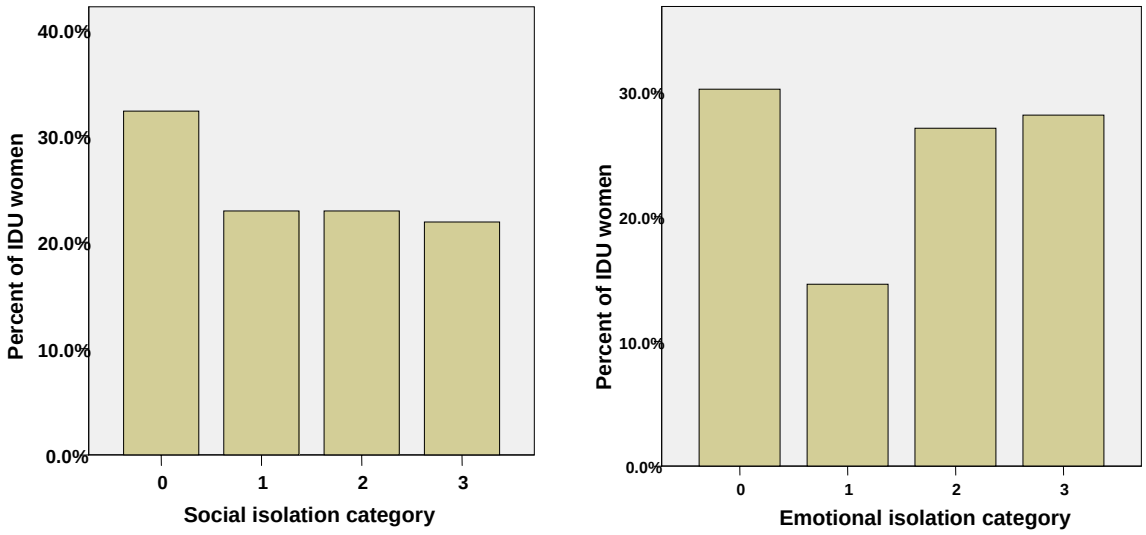

Figure 3: Percent of 96 IDU women in Portland, OR in the individual social and emotional isolation categories
(0=not isolated, 1=average, 2=above average, 3=severe)

Over the past 30 days drug use consisted of cocaine (56%), heroin (76%), heroin and cocaine together (47%), and amphetamines (52%) (Table 5). Two variables were examined regarding the frequency of substance use. The number of times drugs were used varied from 8% of women who used 1-3 times per month to 29% who used 4 or more times per day. The number of times a woman injected was similar to the number of times she used drugs. 10% injected 1-3 times per month, 15% injected 2-6 times per week, 29% injected 2-3 times per day and 28% injected 4 or more times per day.

Table 5: Thirty day history of drug preference and frequency of use among 96 IDU women in Portland, OR

Drug	N	%
Cocaine	**54**	**56.3**
Heroin	**73**	**76**
Speedball	**45**	**46.9**
Amphetamines	**50**	**52.1**
# of times using		
1-3 times/mo	**8**	**8.3**
2-6 times/week	**15**	**15.6**
2-3 times/day	**29**	**30.2**
4 or more times/day	**28**	**29.2**
# of times injecting		
1-3 times/mo	**10**	**10.4**
2-6 times/week	**14**	**14.6**
2-3 times/day	**28**	**29.2**
4 or more times/day	**27**	**28.1**

Over the previous 30 days risk behaviors included: 27% injecting with a syringe that had been used by someone else, 43% being injected by another, 42% using cotton/cooker/or water used by another, 32% had sex with two or more partners, 59% had sex with another IDU, 24% exchanged sex for money, 17% exchanged sex for drugs. 30% exchanged sex for money or drugs and of those 29 subjects, 24% never used condoms, 27% used

condoms some of the time, and 48% always used condoms. 74% of the participants engaged in oral sex, 68% of which never used a condom and 11% always used a condom. 78 women engaged in vaginal sex, of those 27% always used a condom and 59% never used a condom. 20 participants reported engaging in anal sex at least one time in the previous 30 days and 80% never used a condom. Risk behaviors are presented in table 6.

Table 6: Thirty day history of injection and sex risk behaviors among 96 IDU women in Portland, OR

Risk behavior	N	%
Direct sharing	**26**	**27.1**
Injected by another person	**41**	**42.7**
Indirect sharing	**40**	**41.7**
Multiple sex partners	**31**	**32.3**
Sex with IDU	**57**	**59.4**
Trade sex for money or drugs	**29**	**30.2**
Traded sex and always used a condom	**14 out of 29**	**48.3**
Engage in oral sex	**70**	**73.7**
Engaged in oral sex and always used a condom	**8 out of 70**	**11.3**
Engage in vaginal sex	**77**	**81.1**
Engaged in vaginal sex and always used condom	**21 out of 77**	**26.9**
Engage in anal sex	**20**	**21.1**
Engaged in anal sex and always used a condom	**2 out of 20**	**10.0**

Demographic characteristics by isolation category are presented in Table 7. Two variables; number of past treatment experiences and number of years injecting, were collapsed due to scant data. Respondents who were isolated (those in the above average and severe isolation categories) were more likely to be educated, single, homeless, longer term IDUs (injected for 6 or more years), and not currently in treatment versus those who were less or not isolated. Drug use comparisons by isolation categories are reported

in table 8. Women who used heroin (p=.374) and injected 2 or more times per day (p=.545) tended to be more isolated. Risk behavior variables by isolation category are presented in Table 9. Above average and severely isolated participants tended to engage in the sharing of injection equipment (i.e. cottons, cookers, water) and trade sex for money or drugs at a higher percentage then their less isolated counterparts (p=.151 and p=.167 respectively).

Table 7: Demographic characteristics among 96 IDU women in Portland, OR by isolation category

Variable	None %	Average %	Above Ave %	Severe %	*p* value
Age (mean)	30+/- 9.3	35 +/- 9.5	36.6 +/- 10.6	34.9 +/- 10.7	
Race/ethnicity					
White	29	15	33	22	.522
Non White	16	32	21	32	
Marital status					
Married	35	17	30	17	.597
Single	22	22	29	27	
Education					
High school or	21.6	21.6	29.4	27.5	.508
less	32.6	14	32.6	21	
College					
Unemployed	25.6	22	28	24	.685
Homeless	23	19	30	28	.772
Currently in Tx	44	19	22	15	.065
# of times in tx					
2 or less	31	24	27	18	.220
Three or more	22	14	33	31	
On Methadone	21	21	32	26	.955
# of times on methadone					
Never	30	20	24	26	.554
1 or more	22	17	37	24	
Currently on Bup	0	100	0	0	.229
# of times on Bup					
Never	25	15	26	21	.259
Once	0	33	33	33	
Age at first					
injection	33	17	29	21	.425
20 or less	18	20.5	32	30	
21 and older					
# of years injecting					
8 or less	27	15	35	24	.535
9 or more	24	24	24	27	
Living with drug	33	14	29	24	.284
user					

Table 8: Thirty day history of drug preference and frequency of use among 96 IDU women in Portland, OR by isolation category

Drug	None %	Average %	Above Ave %	Severe %	*p* value
Cocaine	**13.7**	**10.8**	**18.6**	**11.8**	
Heroin	**21.6**	**12.7**	**22.5**	**19.6**	**.374**
Speedball	**11.8**	**9.8**	**11.8**	**14.7**	**.487**
Amphetamines	**14.7**	**10.8**	**16.7**	**9.8**	**.612**
# of times using					
Less than 2 x/day	**10.9**	**8.9**	**14.6**	**7.8**	**.719**
2 or more x/day	**14.7**	**9.8**	**15.7**	**15.6**	
# of times injecting					
Less than 2 x/day	**10.8**	**10.9**	**13.8**	**7.8**	**.545**
2 or more x/ day	**13.7**	**7.9**	**16.7**	**15.6**	

Table 9: Thirty day history of injection and sex risk behaviors among 96 IDU women in Portland, OR by isolation category

Risk behavior	None %	Average %	Above Ave %	Severe %	p value
Inject with used syringe	**3.9**	**7.8**	**7.8**	**7.8**	**.330**
Injected by another person	**9.8**	**8.8**	**10.8**	**11.8**	**.714**
Inject with used equipment other than a syringe	**6.9**	**6.9**	**13.7**	**13.7**	**.151**
Multiple sex partners (2 or more)	**4.9**	**8.8**	**9.8**	**8.8**	**.353**
Sex with IDU	**17.6**	**10.8**	**15.7**	**13.7**	**.215**
Trade sex for money or drugs	**2.9**	**4.9**	**10.8**	**10.8**	**.167**
Always use condom when trade sex	**6.7**	**3.3**	**16.7**	**20.0**	**.348**

Out of 96 respondents, 40 did not report engaging in any injection risk behaviors in the thirty days prior to completing the survey (39%), while 34 reported that they engaged in risk behavior that could potentially put them at risk for HIV or HCV (33%) and 28 reported that they participated in behavior that clearly put them at risk (27%) (table 4). Similar categorization of sexual risk behaviors revealed that 38 women reported that they did not engage in any sexual risk behaviors, 19 reported engaging in potentially risky

behavior, and 45 reported engaging in one or more clearly risky sexual behaviors (table 5). The relationship between injection and sex risk behaviors with the four isolation categories are reported in tables 10 and 11.

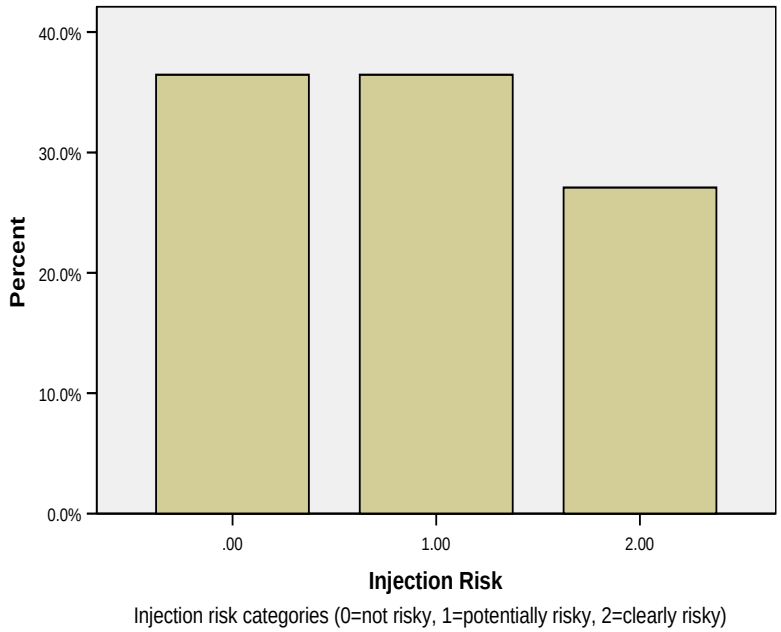

Figure 4: Percent of 96 IDU women in Portland, OR engaging in injection risk behavior

Table 10: Injection risk behavior among 96 IDU women in Portland, OR by isolation category

Risk behavior	None %	Average %	Above Ave %	Severe %
Not Risky	**12.7**	**5.9**	**12.7**	**7.8**
Potentially risky	**9.8**	**5.9**	**9.8**	**7.8**
Clearly risky	**3.9**	**7.8**	**7.8**	**7.8**

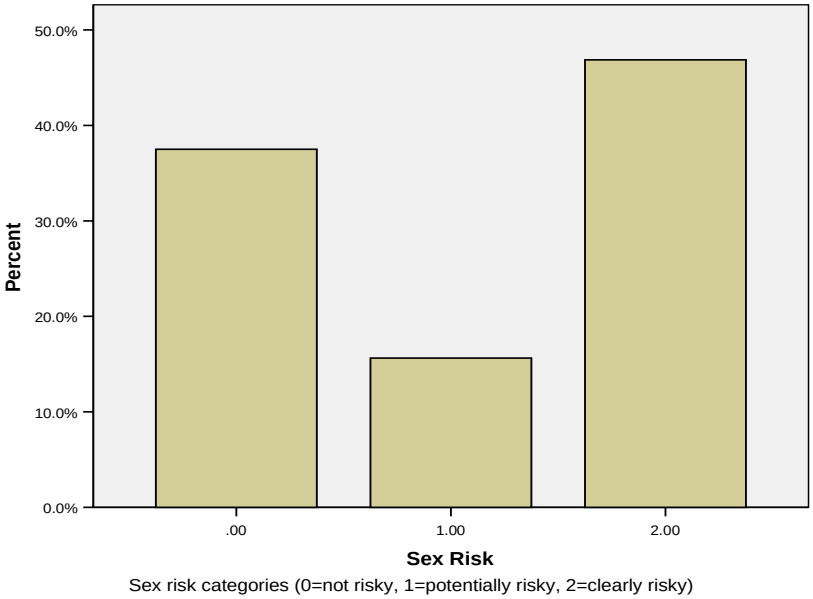

Figure 5: Percent of 96 IDU women in Portland, OR engaging in sex risk behavior

Table 11: Sex risk behavior in 96 IDU women in Portland, OR by isolation category

Risk behavior	None %	Average %	Above Ave %	Severe %
Not risky	**8.8**	**6.9**	**11.8**	**9.8**
Potentially risky	**3.9**	**2.9**	**6.9**	**4.9**
Clearly risky	**13.7**	**9.8**	**11.8**	**8.8**

Tables 12 and 13 demonstrate the relationship between the dichotomized risk behavior and isolation variables. The injection and sexual risk behaviors were collapsed into two variables as follows: not risky (engaging in no risk behaviors) and risky (engaging in potentially or clearly risky behaviors). The isolation variable was also collapsed into two variables: not isolated (none or average isolation) and isolated (above average or severe isolation). Sixty-two women engaged in risky injection behaviors and 64 engaged in risky sex behaviors (61and 63% of the total respondents, respectively). Isolation does not appear to be significantly associated with engagement in injection behaviors (p=.773). Isolation may, however, have a slightly positive association with sex risk behaviors.

While not statistically significant there appears to be a trend showing that less isolated women engage in more risky sexual behaviors (67.4% of women who are not isolated report engaging in risky sexual behavior).

Table 12: Percent of 96 IDU women in Portland, OR by dichotomized isolation and injection risk categories

Risk behavior	Not Isolated %	Isolated %	Chi square p value
Not risky	**34.9**	**37.7**	**.773**
Risky	**65.1**	**62.3**	

Table 13: Percent of 96 IDU women in Portland, OR by dichotomized isolation and sex risk categories

Risk behavior	Not Isolated %	Isolated %	Chi square p value
Not risky	**32.6**	**41.5**	**.368**
Risky	**67.4**	**58.5**	

Tables 14 and 15 display results from logistic models regressing isolation (dichotomous) and other relevant participant characteristics individually on each of the two risk behavior variables (dependent variables). Variables placed in the models for injection risk behavior include having an IDU partner (p=.041) and younger age at first use (p=.013). Variables fit into the sexual risk models include age (p=.079), homelessness (p=.007), IDU partner (p=.000), current methadone use (p=.045), past methadone use (p=.116), age at first injection (p=.141), number of injections over the past 30 days (p=.241), and cocaine (p=.079), speedball (p=.198) and amphetamine (p=.047) drug use. As noted previously, isolation category was not significantly associated with either risky behavior variable, nor were many of the participant characteristics that were examined as potential confounders of the relationship between isolation and risk behavior.

Table 14: Unadjusted associations between isolation and other participant characteristics obtained by univariable logistic regression models with engagement in injection risk behavior as dependent variable

Variable	OR	95% CI	*p*
Isolation			
0=no risk	**1.00**		
1=risk	**1.13**	**(0.49,2.61)**	**.773**
Age (continuous)	**0.98**	**(0.94,1.02)**	**.401**
Marital Status			
0=married	**1.00**		
1=single	**1.60**	**(0.58,4.45)**	**.363**
Education			
0=HS or less	**1.00**		
1=college	**0.69**	**(0.30,1.61)**	**.390**
Homeless			
0=no	**1.00**		
1=yes	**1.04**	**(0.45,2.43)**	**.925**
Unemployed			
0=no	**1.00**		
1=yes	**1.50**	**(0.18,12.78)**	**.711**
2=other	**0.80**	**(0.14,4.64)**	**.803**
IDU partner			
0=no	**1.00**		
1=yes	**0.41**	**(0.18,0.96)**	**.041***
Methadone (MET)			
0=no	**1.00**		
1=yes	**1.35**	**(0.48,3.75)**	**.569**
Past MET			
0=never	**1.00**		
1=one or more	**1.25**	**(0.54,2.87)**	**.602**
Current Tx			
0=no	**1.00**		
1=yes	**1.30**	**(0.58,3.21)**	**.586**
Age 1st injection			
0=20 or younger	**1.00**		
1=21 or older	**3.00**	**(1.27,7.10)**	**.013***
Years injecting			
0=8 or less	**1.00**		
1=9 or more	**0.84**	**(0.36,1.95)**	**.685**
# injections past 30 day			
0=one or fewer time/d	**1.00**		
1= greater than once/d	**1.10**	**(0.46,2.61)**	**.639**
Cocaine			
0=no	**1.00**		
1=yes	**0.98**	**(0.42,2.28)**	**.963**
Heroin			
0=no	**1.00**		
1=yes	**1.10**	**(0.41,2.94)**	**.848**
Speedball			
0=no	**1.00**		
1=yes	**0.82**	**(0.35,1.90)**	**.636**
Amphetamines			
0=no	**1.00**		
1=yes	**1.15**	**(0.50,2.64)**	**.744**

Table 15: Unadjusted associations between isolation and other participant characteristics obtained by univariable logistic regression models with engagement in sex risk behavior as dependent variable

Variable	OR	95% CI	*p*
Isolation			
0=no risk	**1.00**		
1=risk	**1.47**	**(0.64,3.41)**	**.369**
Age (continuous)	**0.96**	**(0.93,1.00)**	**.079***
Marital Status			
0=married	**1.00**		
1=single	**1.15**	**(0.43,3.13)**	**.779**
Education			
0=HS or less	**1.00**		
1=college	**1.44**	**(0.62,3.34)**	**.395**
Homeless			
0=no	**1.00**		
1=yes	**0.31**	**(0.13,0.73)**	**.007***
Unemployed			
0=no	**1.00**		
1=yes	**1.40**	**(0.19,10.03)**	**.738**
2=other	**1.79**	**(0.34,9.45)**	**.495**
IDU partner			
0=no	**1.00**		
1=yes	**0.06**	**(0.02,0.18)**	**.000***
Methadone (MET)			
0=no	**1.00**		
1=yes	**2.86**	**(1.02,8.00)**	**.045***
Past MET			
0=never	**1.00**		
1=one or more	**1.96**	**(0.85,4.53)**	**.116***
Current Tx			
0=no	**1.00**		
1=yes	**0.97**	**(0.39,2.44)**	**.953**
Age 1st injection			
0=20 or younger	**1.00**		
1=21 or older	**1.88**	**(0.81,4.33)**	**.141***
Years injecting			
0=8 or less	**1.00**		
1=9 or more	**1.61**	**(0.70,3.71)**	**.265**
# injections past 30 day			
0=one or fewer time/d	**1.00**		
1= greater than once/d	**0.60**	**(0.26,1.41)**	**.241***
Cocaine			
0=no	**1.00**		
1=yes	**0.47**	**(0.20,1.09)**	**.079***
Heroin			
0=no	**1.00**		
1=yes	**1.51**	**(0.55,4.11)**	**.424**
Speedball			
0=no	**1.00**		
1=yes	**0.58**	**(0.25,1.34)**	**.198***
Amphetamines			
0=no	**1.00**		
1=yes	**0.42**	**(0.18,0.99)**	**.047***

To examine the association between isolation and each risky behavior variable, adjusted for potentially confounding patient characteristics, we employed a backward elimination variable selection technique. Based on this procedure, we found that age at first injection and having an IDU partner were significantly associated with injection risk, and were maintained in the multi-variable model for injection risk along with isolation. We also assessed interaction terms using a marginal statistical association of $\alpha \leq .1$ the interaction term age at first injection and IDU partner was found to be significant at p=.032 and was kept in the model. The final injection risk model is represented in Table 16. Isolated women who did not have a current IDU partner and were older at the age of first injection were less likely to engage in injection risk behavior compared to isolated women who had an IDU partner and started to inject at an older age or who did not have an IDU partner and started to inject at a younger age. The sex risk and isolation model included the variables IDU partner and past methadone use. The final sex risk and isolation model is presented in table 17. Women who were isolated and had a current IDU sex partner were 16 times more likely to engage in sex risk behavior whereas past methadone use was protective of engagement in sexual risk behavior.

Table 16: Multivariable model assessing the potential relationship between isolation and engaging in injection risk behavior among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not Isolated	**1.00**		
Isolated	**1.21**	**(0.50, 2.92)**	**.679**
No IDU partner / 20 or younger at 1st injection	**1.00**		
No IDU partner / 21 or older at 1st injection	**.118**	**(0.03, 0.47)**	**.002***
IDU partner / 20 or younger at 1st injection	**1.06**	**(0.30, 3.82)**	**.927**
IDU partner / 21 or older at 1st injection	**0.71**	**(0.20, 2.70)**	**.618**

Table 17: Multivariable model assessing the potential relationship between isolation and engaging in sex risk behavior among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not Isolated	**1.00**		
Isolated	**1.12**	**(0.38, 3.29)**	**0.83**
No IDU partner	**1.00**		
IDU partner	**16.86**	**(5.22, 51.13)**	**0.00***
No past methadone use	**1.00**		
Past methadone use	**0.36**	**(0.12, 1.07)**	**0.07***

To check whether certain components of isolation were more highly associated with engagement in injection and sexual risky behaviors, we replaced the combined isolation variable with similarly-dichotomized versions of the 4-category social and emotional isolation variables. We found that social isolation was significantly associated with injection risk (Table 18), with those reporting above average or severe social isolation having 4 times higher odds of engagement in the behavior than those reporting none or average social isolation ($p = .010$). There was no relationship between emotional isolation and injection risk (Table 19). Women who did not have a current IDU sex partner and started to inject at an older age compared to women who either did not have an IDU partner but started to inject at a younger age or who had an IDU partner and started to inject at older age were 8 to 10 times less likely to engage in injection risk behaviors if they were socially isolated.

Table 18: Final multivariate model assessing the potential relationship between social isolation and engaging in injection risk behavior among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not socially isolated	1.00		
Socially isolated	4.06	(1.40, 11.71)	.010*
No IDU partner / 20 or younger at 1st injection	1.00		
No IDU partner / 21 or older at 1st injection	.099	(0.02, 0.43)	.002*
IDU partner / 20 or younger at 1st injection	1.64	(0.42, 6.40)	.476
IDU partner / 21 or older at 1st injection	.776	(0.19, 3.13)	. 721

Table 19: Final multivariate model assessing the potential relationship between emotional isolation and engagement in injection risk among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not emotionally isolated	1.00		
Emotionally isolated	1.11	(0.46, 2.70)	.814
No IDU partner / 20 or younger age 1st injection	1.00		
No IDU partner / 21 or older age 1st injection	0.12	(0.03, 0.47)	.002*
IDU partner / 20 or younger 1st injection	1.05	(0.29, 3.78)	.939
IDU partner / 21 or older 1st injection	.724	(0.19, 2.75)	.635

There also appears to be a trend toward a significant association between social isolation and engagement in sexual risk behaviors at p=.110 (Table 20). Emotional isolation, however, does not appear to be associated with risky sex behavior (Table 21). Having a current IDU sex partner increased the odds of engaging in sex risk behavior by 27 if a woman was also socially isolated and by 17 if she was emotionally isolated. Past

methadone use was protective of engagement in sexual risk behaviors in women who were both socially and emotionally isolated.

Table 20: Final multivariate model assessing the potential relationship between social isolation and engagement in sex risk behaviors among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not socially isolated	**1.00**		
Socially isolated	**2.76**	**(0.79, 9.56)**	**.110**
No IDU partner	**1.00**		
IDU partner	**27.03**	**(7.47, 97.72)**	**.000***
No past methadone use	**1.00**		
Past methadone use	**0.35**	**(0.12, 1.05)**	**.061***
Constant	**0.32**		**.059**

Table 21: Final multivariate model assessing the potential relationship between emotional isolation and engagement in sex risk behaviors among 96 IDU women in Portland, OR

Variable	OR	95% CI	p value
Not emotionally isolated	**1.00**		
Emotionally isolated	**0.75**	**(0.26, 2.20)**	**.604**
No IDU partner	**1.00**		
IDU partner	**17.00**	**(5.70, 50.69)**	**.000***
No past methadone use	**1.00**		
Past methadone use	**0.38**	**(0.13, 1.15)**	**.086***
Constant	**0.71**		**.513**

Summary:

In the sample of 96 women IDUs 75% were white, 59.4% homeless, 81.3% unemployed, 28% currently in a treatment program and 20% were on methadone. Drug use consisted of cocaine (56%), heroin (76%), heroin and cocaine together (47%), and amphetamines (52%) and over half injected one or more times per day. The women in this study are characterized by a high degree of isolation with 30% exhibiting above average isolation and 25% being severely isolated. During the thirty days prior to responding to the survey 62 women had engaged in one or more risky injection behavior and 64 had engaged in

one or more risky sex behavior. These risk behaviors included: injecting with a used syringe (27%), being injected by another (43%), using a cotton/cooker/or water used by someone else (42%), having sex with two or more partners (32%), having sex with another IDU (59%), exchanging sex for money or drugs (30%) and of those who exchanged sex only 48% always used condoms.

Social isolation was significantly associated with injection risk ($p = .010$) and there was a trend toward an association with sex risk ($p=.110$). Emotional isolation, however, did not appear to mediate injection or sex risk behavior. Having an IDU sex partner increased the risk of engagement in sex risk behavior among socially isolated IDU women. In addition, socially isolated women who did not have a current IDU sex partner and started to inject at an older age had an 8 to 10 times lower odds of engaging in risk behaviors compared to women without an IDU sex partner who had started to inject at a younger age or women with an IDU sex partner who started to inject at an older age. Having a current IDU sex partner increased the odds of engaging in sex risk behavior whereas past methadone use was protective among emotionally isolated women.

Discussion

The extent of isolation exhibited by women IDUs in Portland, Oregon can be compared to the general population despite the paucity of studies examining community prevalence of isolation. One Australian study found that 9% of the population reported some social isolation, 5% were isolated and 2% very isolated [45]. In this study perceived social isolation was assessed using the friendship scale, a 6 item instrument that measures the ease of relating to others, feeling isolated, having someone to share feelings with, finding it easy to get in touch with others, feeling separate from other people and being alone and

friendless. The response categories were: almost always, most of the time, about half of the time, occasionally, and not at all. The final isolation categories included: very socially isolated (report at least one isolating condition most of the time or almost always), isolated or low level support, some social support, socially connected and very socially connected. Another United States based study evaluated social and emotional support utilizing the Behavioral Risk Factor Surveillance System which in 2005 added the question, "How often do you get the social and emotional support that you need?" Possible responses included always, usually, sometimes, rarely, and never which were then grouped into 3 categories; always/usually, sometimes, and rarely/never[43]. This study documented that 8.6% of U.S adults rarely/never received social and emotional support, 13.5% sometimes received support, and 7% of adults in Oregon rarely/never received support[43]. These percentages are similar to those reported in other community surveys[45]. Our study and these community prevalence studies did not employ the same isolation instrument so we can not directly compare isolation levels; however, conceptually we can conclude that women IDUs exhibit substantially higher percentages of isolation then the general population.

As expected, women IDUs sampled for this study, exhibited a high degree of social and emotional isolation, as measured by the ESLI. Furthermore, these results, likely underestimate the true prevalence of severe and above average isolation among women IDUs, since participants in this study were recruited while accessing resources at needle exchange sites, and would therefore be less isolated than their counterparts who did not.

A consideration for future research would be to use a respondent driven sampling (RDS) technique which has been used effectively with IDUs and is viewed as a reliable and bias-free method to recruit, "hidden" populations [75, 76]. RDS is a sampling method that uses referrals among peers within social networks to recruit study volunteers. The process begins with research staff selecting initial participants from the target population, referred to as "seeds". Seeds then recruit a set number of peers, who in turn recruit other peers. The process continues until the target sample size is attained. This technique has been effective in recruiting hard to reach populations that do not participate in public venues and may provide more accurate estimates of the prevalence of women IDUs who are socially and/or emotionally isolated [77].

The foundation of social network theory has focused on social linkages and not the attributes of the people in a network[38]. Although this may be valid in non injection drug using populations it may not be relevant in the context of injection drug use. Recent research shows that it is the quality or relationships rather than quantity that is important[29, 46, 47, 63, 68]. In IDU populations it may be more important to assess subject relationships with others rather than only evaluating the number of social contacts. We should consider the quality of interaction, frequency, durability over time, strength, and intensity of mutual drug use[46]. In addition, analysis of social network members in terms of their drug using status and connection to main stream society may be important mediators of risk. For example, having ties to employed people as well as having a partner who does not use has been shown to be protective of current drug use[78]. In this study, we found that women who did not have a current IDU sex partner and had started

to inject at an older age were less likely to engage in injection risk behaviors. This may be an indication of less social integration into IDU social networks. These women may have had no sex partner or a non IDU sex partners either of which could be intecate less social interaction with other IDUs. In addition, having an older age at first injection may have allowed these women to create stronger social ties outside of IDU networks.

Social and emotional support can be defined as the exchange of resources and assistance through social relationships that serves four major functions: emotional (intimacy or sense of belonging), instrumental (financial aide), informational (advice and social connections), appraisal (integration with perceived social norms relevant to self evaluation)[43]. The function of appraisal support can have both positive and negative influences. In 1984, Berkman noted that members of a network often feel obligated to behave like other members to maintain their group identity[44]. This is relevant in evaluating risk behaviors in IDU populations since IDUs may influence drug equipment sharing if this is a social norm[72, 79]. Several studies have shown that a higher proportion of high risk network members are associated with participation in sex and drug use risk practices[80, 81]. Comparing network support based on IDU or non IDU status may be a key factor in finding differences in risk behaviors. Recently investigators have found that increasing support from non drug using individuals may reduce HIV and HCV risk among IDUs[63, 68, 82]. One of the weaknesses of this study was not integrating a measure of IDU and non IDU support into the survey instrument. Future studies should employ the social support measure adapted from Barrera and Anilany's social support scale[83].

This study also illustrates that, despite access to sterile syringes and utilizing harm reduction agencies, women IDUs in Portland, Oregon continue to engage in high risk injection and sex behaviors. This information can be used to help guide improvement of prevention efforts. Women IDUs who engage in high risk practices may be limiting their exposure to HIV and HCV through their own understanding of risk. Women who have a stable partner with a known HIV and/or HCV negative status may be comfortable not using condoms or sharing needles or other injection equipment. There is often an assumption of monogamy or that their partner is practicing safe injection and sex practices. However, research shows that nearly a third of "primary partners" have more than one sexual partner, 75% of those do not always use a condom with their primary partner or other partners, and over a third share needles with someone other than their primary partner while also sharing needles with their partner[18]. This data suggest that women IDUs may have a false sense of security with their primary sex and drug using partners and that this complacency places them at greater risk for acquiring HIV or HCV. It would be beneficial to integrate this information into prevention models.

Social support has long been recognized as an important element of public health. In 1965, based on research showing the importance of social connections, the U.S. congress implemented the Older Americans Act, providing in house services to the elderly[43]. In addition, many public health intervention and prevention projects have utilized models of social support. These include: *promotores* or community health workers who provide diabetes and smoking cessation education and support in the Latino communities; Sisters in Support Together against Substances, which enables African American women to support each other in raising awareness of factors that lead to the use of drugs; and the

Big Brother/Big Sister programs that employ volunteer adult mentors to support at risk children[43].

Reviewing existing prevention/intervention models that have integrated social connection may be helpful in building effective risk reduction models for IDUs. Prior IDU intervention models have proposed complete removal of drug users from their social network. This level of intervention may not, however, be necessary. It may be just as efficacious to simply increase contact with non injection drug users[47]. Researchers now suggest that entire IDU networks can be modified to better the entire unit by using a mixed substance user and nonuser support system. It may not be necessary to completely separate women from substance using friends if a strong support network of nonusers can be provided as well[28, 78, 82]. Prevention efforts should begin to conceptualize interventions that decrease drug using connections while at the same time increasing non user support. Some examples could include: peer and non-peer mentoring, community outreach workers, drop in support groups, and utilizing relationships with harm reduction agency workers.

Limitations:

This was a cross sectional study, therefore causality cannot be determined. Cross sectional studies do not establish the sequence of events and do not yield incidence or true relative risk. In addition, this was a convenience sample of women IDUs in Portland Oregon recruited from several locations. The results are, therefore, not generalizable to other populations of women IDUs. Since we did not track information on individuals who chose not to participate there is also the potential for selection bias. In addition, we

employed a facility based recruitment strategy that recruited from several harm reduction agencies. It is likely that the women we surveyed were less isolated and engaged in fewer risk behaviors. This would lead to an overestimation of the odds ratio. Despite the possibility of this occurrence, we did find that the odds of engaging in injection risk behaviors were quadrupled for socially isolated women versus less socially isolated women. We believe that with a larger sample size, and possibly employing a respondent driven sampling strategy we would obtain a more accurate estimate of an increase in risk related to social isolation.

The data for this study was collected using a self report questionnaire that contained items from a previously validated isolation and risk behavior scales[65 66]. Many of the items in the isolation scale employed double negatives and the risk behavior survey asked sensitive questions about sex and injection behaviors. The double negatives may have been confusing to some participants impacting responses, while questions about risk behaviors might have been underreported. In prior studies researchers have relied on interviews to gather data on risk behaviors of injection drug users. Interviewing is often a better approach for collecting answers to complicated questions that require explanation or guidance. During an interview the researcher can ensure that all the questions are answered completely. Although we did not interview participants the researchers were present to answer questions and provide guidance. This proved to be helpful in completing questionnaires for those with limited literacy and women under the influence of alcohol or drugs. The researchers were also able to clarify confusion surrounding the isolation statements. In addition, self-administered questionnaires eliminate interviewer bias and are often more efficient[84].

We were also concerned about the impact of social desirability when answering some of the sensitive risk behavior questions. One of the data collection sites was a needle exchange facility; participants often confused the researchers with onsite staff and may not have been as willing to answer honestly about risk behaviors, in particular sharing injection equipment. If this bias is non differential then it would bias the result towards no association. Researchers have found, however, that self-reported risk behavior among IDUs is generally valid and accurate although items pertaining to sharing needles and other injection equipment appears to be less reliable than questions about sexual behaviors[85]. Multicenter research with IDUs has also shown that self-reported data is valid when subjects are not recruited in clinical settings[86-88]. It is therefore, likely that in our study that the subjects underreported both direct and indirect sharing.

The results may have been affected by recall bias since the study relied on individuals memories to accurately analyze behaviors over 2 weeks to 30 days. However, it is unlikely that women who are isolated as compared with women who are not would recall their risk behaviors differently. Therefore, we concluded that differential recall bias is not a concern.

Despite these limitations this study provides important findings that add to the body of research on social networks and risk behaviors among injection drug users. It quantifies the extent to which women IDUs are isolated as well as highlights the extent to which women IDUs continue to engage in risk behaviors that increase their chance of infection with HIV and HCV. In particular, we have shown that social isolation may affect both injection and sex risk behaviors among women IDUs.

Summary and Conclusions

Women IDUs are at increased risk for infection with blood borne and sexually transmitted diseases, such as HIV and HCV, due to high risk practices, including sharing syringes and other injection equipment, exchanging sex for drugs or money, sex with multiple partners and unprotected sex. High rates of disease transmission among women have had a detrimental impact on health and well being. In 2001, HIV infection was the 6th leading cause of death among all women aged 25–34 years and the 4th leading cause of death among all women aged 35–44 years[1]. In addition, women have increased risk of transmission to their infants and may be vectors of transmission to their sex or drug injecting partners. More effective prevention approaches will not only help women IDUs but society as a whole by reducing transmission to sex partners, children and ultimately the general population.

Preventing the transmission of HIV and HCV among women IDUs requires a thorough understanding of all variables that increase risk. Women IDUs operate within a world characterized by lack of resources, isolation from mainstream society, and a male centered street culture. This structure facilitates women's subordination and dependence on men for respect and protection which can lead to exploitation[52]. Recently researchers have been employing social network theory to try to better understand HIV/HCV risk behaviors among IDUs. Thus far there has been little research on how social support and isolation, several facets of social networks, affect women injection drug users.

Injection drug use is often connected to involuntary isolation which may contribute to risk. As the degree of chemical dependency increases many women express an increased sense of emotional isolation. In addition, many women IDUs have no substantive support person reflecting enormous social isolation[82]. Isolation can cause women to feel deprived and lonely, and consequently participate in sex and drug use behaviors in hopes of escaping loneliness[57]. This study illuminates the extent to which women IDUs are isolated and that despite prevention efforts continue to engage in risk behaviors that increase their chance of infection with HIV and HCV. In particular, we have shown that social isolation may affect both injection and sex risk behaviors among women IDUs. By adding to this growing knowledge base we can use this information to develop more effective HIV and HCV prevention programs that provide elements of social support.

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Appendix

Isolation and Risky Behaviors Questionnaire

	For Official Use Only:	
Questionnaire number:		
Site recruited from:	__OHSU Richmond Clinic (0) __Hooper Detox Center (1) __Outside In (2) __Multnomah county needle exchange (3)	__Mentor Program (4) __CODA (5) __Other (6)

1. How old are you?

_____

2. Have you been homeless, at any time, during the past 30 days?
__ No (0)
__ Yes (1)

3. How far did you go in school?
__ less then high school graduate (0)
__ High school graduate or equivalent (1)
__ Some college education (2)
__ Do not know/unsure (3)

4. How do you identify yourself?
__ White/Caucasian (0)
__Nonwhite: Black/African Am, Hispanic/Latino, Asian, Am Indian/Alaska Native, Multiracial (1)
__Other (2)

5. What is your employment status?
__Employed (0)
__Unemployed (1)
__Other (2)

6. What is your marital status?
__Married or living as married (0)
__Single (1)
__Other (2)

7. Are you currently in a drug or alcohol treatment program?

__No (0)
__Yes (1)

8. How many times, in your lifetime, have you been in inpatient or outpatient treatment (not including methadone) for more than one week?

_____

9. Are you currently in a methadone maintenance program?

__No (0)
__Yes (1)

10. How many times, in your lifetime, have you been on methadone maintenance for more than one month?

_____

11. Are you currently on Buprenorphine/Suboxone?

__No (0)
__Yes (1)

12. How many times, in your lifetime, have you been on Buprenorphine/Suboxone for more than one month?

_____

The following questions ask about your life over the <u>past 2 weeks</u>. Please respond to each question by circling the number the best describes you.

<u>What is true in your life over the past 2 weeks:</u>	**Rarely True = 0**	**Sometimes True = 1**	**Often True = 2**	**Usually True = 3**	**For official use only Total**
13. Emotional isolation:					
a. I don't have a close friend.	0	1	2	3	
b. People take advantage of me when I'm involved with them.	0	1	2	3	
c. I don't have a mate (boyfriend or girlfriend).	0	1	2	3	
d. I don't want to burden others with my problems.	0	1	2	3	
e. There is nobody in my life who depends on me.	0	1	2	3	
f. I don't have any relationships that involve sharing personal thoughts.	0	1	2	3	
g. There is no one in my life that tries to understand me.	0	1	2	3	
h. Nobody in my life really wants to be involved with me.	0	1	2	3	_____
14. Social isolation:					
a. I spend a lot of time alone.	0	1	2	3	
b. I am not part of a social group or organization.	0	1	2	3	
c. I haven't spoken to anyone today.	0	1	2	3	
d. I don't have much in common to talk about with those around me.	0	1	2	3	
e. When I'm with others I don't disclose much about myself.	0	1	2	3	
f. I don't take social risks.	0	1	2	3	
g. People don't see me as an interesting person.	0	1	2	3	_____

The following questions ask about your drug use. Please write in or mark the appropriate response.

15. How old were you when you first started injecting drugs?

_____

16. For how many years, over your lifetime, have you been injecting drugs?

_____

17. Are you living with any person(s) using illegal drugs?
__No (0)
__Yes (1)

The following questions ask about your drug use over the <u>past 30 days</u>. Please circle the appropriate response.

Drug use over the past 30 days:	**Yes (0)**	**No (1)**	**Don't know (2)**
18. Have you used cocaine by itself?	**Yes**	**No**	**Don't know**
19. Have you used heroin by itself?	**Yes**	**No**	**Don't know**
20. Have you used heroin and cocaine together (speedball)?	**Yes**	**No**	**Don't know**
21. Have you used amphetamines (speed, methamphetamine, crank)?	**Yes**	**No**	**Don't know**

Drug use over the past 30 days:	**Never (0)**	**1-3 times** (1)	**About once a week** (2)	**2-6 time a week** (3)	**About once a day** (4)	**2-3 times a day** (5)	**4 or more times a day** (6)	**Don't know/ Unsure** (7)
22. How many times did you use?	0	1	2	3	4	5	6	7
23. How many times did you inject?	0	1	2	3	4	5	6	7
24. How many times (# of injections) did you inject using needles/ syringes that had been used by someone else?	0	1	2	3	4	5	6	7
25. How many times were you injected by another person?	0	1	2	3	4	5	6	7
26. How many times did you use a cooker/ cotton/rinse water that had been used by another injector?	0	1	2	3	4	5	6	7

The following questions ask about your sexual activity over the <u>past 30 days</u>. Please write in the appropriate number.

27. How many people did you have vaginal, oral or anal sex with? _____

28. How many of the people you had vaginal, oral or anal sex with were injection drug users? _____

Please circle the number that best describes your sexual activity for the <u>past 30 days</u>:

Sexual activity over the past 30 days:	**Never (0)**	**1-3 times** (1)	**About once a week** (2)	**2-6 time a week** (3)	**About once a day** (4)	**2-3 times a day** (5)	**4 or more times a day** (6)	**Don't know/ Unsure (7)**
29. How often did you trade vaginal, oral or anal sex for money?	0	1	2	3	4	5	6	7
30. How often did you trade vaginal, oral or anal sex for drugs?	0	1	2	3	4	5	6	7
31. How often did you perform oral sex on your partner(s)?	0	1	2	3	4	5	6	7
32. How often did you have vaginal sex?	0	1	2	3	4	5	6	7
33. How often did you have anal sex?	0	1	2	3	4	5	6	7

Please circle the number that best describes your condom use over the <u>past 30 days</u>.
If you circled 0 in questions 29-33 above please skip the associated question in 34-37.

Condom use over the past 30 days:	**Never** (0)	**Less then half the time** (1)	**More than half the time** (2)	**Always** (3)	**Don't know/ Unsure** (4)
34. How often did you use a condom when exchanging vaginal, oral or anal sex for money or drugs?	0	1	2	3	4
35. How often did you use condoms when you performed oral sex?	0	1	2	3	4
36. How often did you use a condom when you had vaginal sex?	0	1	2	3	4
37. How often did you use a condom when you had anal sex?	0	1	2	3	4