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Unprotected Sex Among Heterosexually Active Homeless Men: Results from a Multi-level Dyadic Analysis

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INTRODUCTION

HIV/AIDS continues to be a significant public health problem in the United States [1] and worldwide [2]. Although treatment advances have increased the survival rates of those infected, HIV/AIDS treatment expenses and loss in productivity caused by HIV/AIDS represent a significant burden to society [3]. High-risk sexual behavior – sex with partners who have sexually transmitted infections without taking measures to prevent infection – is the second leading contributor to the burden of disease globally [4]. It is generally accepted that male condoms are the most efficient and effective technology against the spread of HIV and other sexually transmitted infections [5]. However, rates of male condom use are much lower than necessary to prevent the spread of infection and improvements in interventions to promote condom use are needed in order for the potential of condoms to be realized [6].

In the United States, certain populations are more at risk for HIV than others, such as homeless populations [7, 8]. Homeless persons typically reside in poor urban areas where rates of HIV infection, drug use, needle use, and sexual risk behavior are high [9–13]. Unprotected heterosexual contact is a key route of HIV transmission in the United States [14] and men who self-identify as heterosexual make up the majority of homeless populations in large urban areas [8]. Both homelessness and HIV disproportionately affect African-American men [15, 16]. African-American women are also far more likely to be HIV+ compared to other women in the United States and HIV infection is a leading cause of their deaths [17]. Heterosexual contact as the source of HIV infection among women has tripled in the United States since 1985 [18]. These facts suggest that developing HIV prevention interventions promoting increased condom use among homeless men is an important public health imperative [19].

It is questionable how relevant existing condom promotion interventions are to the context of heterosexual homeless men's lives. For the most part, interventions targeting increased condom use to prevent sexual transmission of HIV have focused on either men who have sex with men (MSM) or heterosexual women [20]. Many HIV prevention interventions have had limited impact on heterosexual risk behavior, in part because they only focus on individual level characteristics, such as knowledge or attitudes [21], and social contextual factors have been minimally addressed [22, 23]. Recent trends in research and intervention development efforts have attempted to broaden the context of heterosexual HIV risk to include a focus on the impact of cultural conceptions of gender on HIV risk behavior [24]. For the most part, these studies have hypothesized that men are influenced to engage in risky sex with women if they internalize traditional gender roles that promote sexual dominance over women [25, 26]. Some studies have hypothesized that this may be a key mechanism behind high rates of HIV among economically marginalized men, such as African-

Americans, who may compensate for lack of economic power by exerting sexual power [18, 27–29]. The empirical support for these hypotheses has been mixed with some studies showing an association between traditional masculinity and high-risk sex [30–32] and others demonstrating in the opposite effect [26, 33, 34]. Our recent mixed-methods study of heterosexually active homeless men in Los Angeles investigated their culturally agreed upon ideals of masculinity [35]. The findings demonstrated that the most culturally salient gender beliefs were in opposition to traditional masculine ideology. However, men who deviated from the norm and supported beliefs consistent with traditional masculine ideology were more likely to engage in a variety of risky sexual behaviors and have more negative attitudes towards the need to engage in protected sex.

Very few studies have examined other contextual influences on high-risk heterosexual sex among homeless men. For example, very few studies have addressed how relationships influence high-risk sex among homeless men. In general, romantic relationships among homeless populations are neglected in the literature despite the importance of such relationships in the lives of homeless men, women and youth [36]. Relationship dynamics are important factors in condom use because relationship expectations, such as sexual fidelity, often seem contradictory to condom use and couples frequently develop rationalizations to justify their lack of condom use in obvious risk situations [21, 37–39]. Relationship characteristics have been associated with unprotected sex among homeless women and homeless youth [40–42]. Studies with non-homeless men have shown that men are more likely to use condoms with new and casual partners than with steady partners [43], which highlights the importance of understanding the relationship context of condom use among heterosexual men. Two recent analyses from our mixed-methods study of heterosexual homeless men on Skid Row demonstrate the influence of relationships on unprotected sex among homeless men as well. Our qualitative analysis demonstrated that risk was a function of the relationship a man had with a woman. Homeless men discussed their lack of condom use with partners who were “serious” because they were viewed as low risk and trustworthy [44]. Our quantitative analysis of risk during a specific, recent sexual event found that homeless men were less likely to have used a condom if that sexual event occurred with a serious partner and if they communicated with their partners about HIV risk [45].

Other studies have demonstrated non-relationship influences on condom use among homeless men, such as the severity of homelessness [46], drugs and alcohol use [45, 47], attitudes towards condoms [45], and mental health [48]. No published studies to our knowledge have examined the broader social environment of heterosexually active homeless men related to the use of condoms. Characteristics of social networks have been linked to risky sexual behavior in homeless women [40, 49] and homeless youth [50–52]. The social networks of homeless men have been found to be associated with other risky behaviors, including drug and alcohol use [53] and concurrent sexual partnering [48]. This is consistent with the large and growing body of research demonstrating the importance of social networks to homeless and formerly homeless people and the association between social networks and the health behaviors and health outcomes associated with homelessness [54–57].

In this study we address the lack of information about the multiple contextual influences on condom use among homeless men in order to inform intervention development. We use a combination of a personal network and dyadic approach to understanding the correlates of unprotected sex within men’s particular relationships with women, similar to other studies of condom use among homeless women and youth [40, 41]. The multi-level, one-to-many dyadic design [58, 59] allows for simultaneously testing multiple levels of influence (cultural, social network, individual, relationship) on condom use within particular

relationships. Many condom use studies have focused on individual level factors that predict condom use, such as attitudes about protection and risk. However, condom use is a dyadic or relationship behavior. Individual level influences, such as attitudes about condoms, may influence all relationships equally or relationship characteristics may be more influential than individual level factors in particular relationships. This approach is consistent with the ecological approach to health intervention development in which behaviors are influenced by more than individual characteristics [60–63]. The ecological approach acknowledges that: 1) understanding and intervening in health behavior requires a focus on multiple environments (e.g., social, cultural, organizational, physical) in which individual behaviors are nested; and 2) interventions should focus on specific behaviors and address the multiple levels of influence on these behaviors. An ecological framework that focuses on individual characteristics and behaviors within the broader context of relationships and social networks is necessary for more fully understanding and more effectively intervening upon risk behaviors [64].

METHODS

Participants

Participants were 305 homeless men randomly sampled and interviewed in the Central City East region of Los Angeles, a 40-square block area otherwise known as Skid Row, between July and October 2010. This area has the largest concentration of homeless adults in the city. Men were eligible if they were age 18 or older, had vaginal or anal sex with a female in the past 6 months, and experienced homelessness in the past 12 months (defined as spending at least one night on the street, or in a shelter, mission, vehicle, public or abandoned building, or voucher hotel because they did not have a home of their own or of a family member or friend to stay in). Participants were 46 years old, on average, and 73% were African American (see Table 2 for further sample description). Computer-assisted structured interviews were conducted by trained male interviewers.

Sample Design

To obtain a representative sample, we implemented a probability sample of homeless men recruited from meal lines in the study area. The list of meal lines in Skid Row was developed using existing directories of services for homeless individuals and performing interviews with service providers. Our final list contained 13 meal lines offered by 5 different organizations. Each meal line was investigated extensively to obtain an estimate of the average number of men served daily, which was then used to assign an overall quota to each site which was approximately proportional to its size. The second stage of the sampling design consisted of drawing a probability sample of homeless men from the 13 distinct meal lines. Men were selected for eligibility screening by their position in line using random number tables. Ninety-one percent of sampled men completed an interview.

Study Design: Personal Networks

We followed established procedures for conducting personal network interviews [65–67]. Personal networks (also sometimes referred to as “egocentric” networks) encompass the ties that surround a single focal individual, in this case, a homeless man [65, 66]. The personal networks of homeless men, including the network ties determined to be recent sex partners, are the focus of this paper. Personal network interviews are typically divided into three sections: questions designed to generate the names of people in the respondent’s social network (alters), questions about each alter (network composition), and questions about the relationship between each unique pair of network alters (network structure). To generate alter names, we asked respondents to name, by first name or nickname only, 20 individuals that they knew, who knew them, and with whom they had contact sometime during the past

year or so. Contact could be face-to-face, by phone, mail or e-mail. We selected 20 alters because it was a small enough number of alters to reduce respondent burden but large enough to reduce the bias and capture variation in measures of network structure and composition [57, 68]. Immediately after generating names of 20 alters, we asked respondents if they had named each of their recent female sex partners among the 20 alters. If not, we collected the additional names of up to 4 sex partners. To characterize the composition of the network, we asked men to answer a series of questions about each alter, including their background characteristics, behaviors, and relationship with the respondent. To measure the network structure, we asked men whether each unique pair of network alters knew each other and, if so, how often these two people interacted.

These personal network interview procedures provided data for a multi-level analysis of sexual risk behaviors. To measure the inherent relationship characteristic of unprotected sex, while also recognizing the individual level contributions to consistent condom use, we analyzed data at two levels. At the highest level (level 2, individual level), we analyzed variables measuring the men's demographic characteristics, attitudes about condoms and HIV, gender related attitudes, mental health, and social network composition and structure. At the lowest level (level 1, partner/ relationship level) we analyzed variables measuring partner characteristics and characteristics of the relationship between the respondents and their partners. Also at the lowest level is the dependent variable, unprotected sex.

Data Analysis

To test which variables had significant associations with condom use controlling for other variables within and across levels, we built a multivariate, multi-level logistic regression model with a one-to-many personal network design [58, 69]. We used the gllamm procedure in Stata 10.1 [70] with a binomial family, and a logit link to test associations between the independent and dependent variables. To determine which variables were the best candidates for the final model, we first ran each variable alone in a bivariate model testing for an association with the dependent variable. We included variables that were significantly associated with the outcome variables at the 90% confidence level in subsequent multivariate models.

Measures: Level 1 Variables (Partner/Relationship)

Dependent variable—*Unprotected sex* with the individual partner was derived from two items asking how frequently respondents had sex with the partner in the past 6 months and how frequently they used male condoms when they had sex. Responses were dichotomized as: 0 = always used condoms vs. 1 = one or more unprotected sex events.

Independent Variables: Perceptions of partner characteristics—Respondents were asked a series of questions about each of the alters they named and additional questions about the four most recent sex partners. In our previous exploratory interviews with homeless men, they indicated that where they met their sex partner and other characteristics were important considerations when deciding whether to use condoms [44]. Respondents indicated where they met their alters and interviewers selected one of a series of response options. We created variables indicating whether the partner was met *on the street, at a bar or club, at a shelter, through someone else, through a job or school, or through a religious organization*. Respondents also indicated whether their partners were *homeless*, whether they considered the partner a *prostitute*, and whether the partner had a *steady job*. We also asked respondents whether they knew the HIV status of their partners and, if so, what was the status. Since very few (n=2) partners named by respondents were known to be HIV+, we created a variable indicating whether the partner was either HIV+ or had unknown HIV

status (vs. known to be HIV-). We created dichotomous variables for each of these partner characteristics (1=yes, 0=no).

Independent Variables: Relationship characteristics—Respondents were also asked questions about their relationships with their sex partners. We derived relationship level variables from these questions, including their relationship status, measures of communication with the partner about risky sex, sex exchange, strength of their relationships, drinking and/or using drugs during sex with the partner, and the connectedness of the partner to the rest of the network. Respondents indicated if they considered their partners to be a *wife or fiancé* and if their relationship was *monogamous* (neither the respondent nor the partner were having sex with anyone else during this relationship). *History of sex exchange* was determined by asking men whether they had ever given this partner money, food, a place to stay, drugs, or something else in exchange for sex. Relationship strength was measured with several variables. First, *relationship length* was measured by asking respondents how long they had known the partner (converted to number of years). Respondents also indicated the *frequency of contact* with the partner over the past 6 months on average with a four point scale ranging from 0=never to 4=daily or almost daily. Respondents also indicated if they felt *emotionally close* to the partner (1=yes, 0=no) and if the partner had provided them with *tangible support*, such as food, money, clothes, or a place to stay (1=yes, 0=no) over the past 6 months. *Relationship commitment* was assessed with a three-item relationship commitment scale ($\alpha = .64$), modified from scales used in previous studies of romantic relationships, including with homeless women [42, 71–74]. Respondents were asked how much they agreed or disagreed (strongly disagree = 1, strongly agree = 4) with statements characterizing their relationships, such as “Your life would be (was) very disrupted if (when) this relationship ended,” and “You are (were) extremely committed to this relationship.” These ratings were averaged for each partner. Communication about risk was assessed with two questions: respondents were asked if they or their partner had ever *discussed condoms* and *discussed HIV prevention* with the partners (1=yes, 0=no). *Respondent’s and partner’s frequency of alcohol and drug use before/during sex* was assessed with four separate items asking about behavior during the past 6 months. Response options were converted to percentages: “never” = 0%, “less than half the time” = 25%, “half the time” = 50%, “more than half the time” = 75%, and “always” = 100%.

Partner connectedness with the respondent’s network was measured with a variable that was constructed from a series of questions we asked about the relationships among all of the network alters. Respondents were asked if each unique alter-alter pair had any contact with each other in the past year. Based on these answers, we calculated the partners *closeness centrality* [75], which is a continuous measure of how directly or indirectly connected a particular alter is to all the other members of a network. The closeness centrality measure ranges from 0 (not connected at all) to 100 (directly connected to the whole network).

Measures: Level 2 Variables (Individual)

Demographic variables included *age*, *race* and *ethnicity*, *income* in \$100 dollars per month, and *homeless severity*. We calculated the age of the respondent in years by asking the respondent’s birth date and comparing that with the date of the interview. Homeless severity was measured by asking the number of days the respondent has been homeless in the past 6 months. Separate questions asked about ethnicity and race, and men were classified into one of four groups for analysis: African American, Hispanic, non-Hispanic White, and Other.

Mental health variables that have been associated with risky sexual behavior among poor and homeless men included a general measure of mental health and a measure of PTSD. General mental health was measured with the MHI-5, a five-question, five-point Likert-type

screening scale [76, 77]. The MHI-5 consists of 5 questions asking respondents to rate the frequency of recent (past month) emotional experiences, such as how often they felt “calm and peaceful”, “downhearted and blue”, and “a happy person.” Items were rated on a 5 point scale from “None of the time” to “All of the time.” All answers were re-coded so that higher numbers represented positive moods producing raw scores from 5 to 25. The scores were standardized with a linear transformation from 0 to 100 with 100 representing maximum positive moods experienced in the past month and 0 representing maximum negative moods (a cut-off point of 60 or below is recommended for screening potential mood disorders) [77]. PTSD was measured with the Primary Care PTSD Screen [78], a 4-item screener originally designed for use in primary care settings. The four items reflect four underlying factors specific to PTSD: re-experiencing, numbing, avoidance, and hyper-arousal. Respondents in this study are defined as screening positive for PTSD if they answer Yes to at least three items. A cut point of 3 on the Primary Care PTSD Screen has been shown to maximize sensitivity and specificity of this measure in primary care patients [79]. In a primary care setting, persons identified as having at least three of the four PTSD symptoms would then be administered a structured interview to formally diagnose PTSD [78].

Respondent recent sexual experiences were measured with two variables: the *number of recent (6 months) female sex partners* and the *number of recent male sex partners*.

Attitudes about pregnancy, condoms, HIV were assessed with separate measures. *Concern about pregnancy* was measured with a single item asking the respondent how important it was to avoid getting a woman pregnant right now (1= very important, 2=somewhat important, 3=a little important, 4=not at all important). *Negative attitudes towards condoms* (4 items; sample item: “Using condoms makes sex less enjoyable” [80]; $\alpha = .74$), *condom use self-efficacy* (4 items; sample item: “It is too much trouble to carry around condoms” [81]; $\alpha = .54$), and *HIV susceptibility* (3 items; sample item: “You worry about getting infected with HIV or AIDS” [41, 74]; $\alpha = .65$) were rated on a 4-point scale (1 = strongly disagree to 4 = strongly agree).

Gender-related beliefs were assessed with four measures, using items adapted from existing scales to increase their relevance to homeless men [35]: (a) general *traditional masculine ideology* or “machismo” (11 items; sample item: A man should not show emotions or weakness [82]; $\alpha = .69$); (b) *traditional masculine beliefs about sexual relationships* (10 items; sample item: The man should be more sexually experienced than the woman in a relationship [83]; $\alpha = .75$); (c) *sexual relationship power* in men’s typical relationships with women (5 items; sample item: I always need to know where she is when she isn’t with me [84]; $\alpha = .62$); and (d) *general distrust of women* (4 items; sample item: It is generally safer not to trust women too much [85]; $\alpha = .75$). All gender-related belief items were rated from 1 = strongly disagree to 4 = strongly agree. We also used an additional measure of the correspondence to *culturally agreed upon masculinity ideals* among homeless men on Skid Row [35]. We developed this measure specifically for homeless men on Skid Row. It ranges from 1 (perfect correspondence to the group consensus) to -1 (perfect deviation from the group consensus). Low scores on this measure correspond with beliefs in traditional masculinity, rejection of the importance of romantic relationships, and behaviors and attitudes consistent with high-risk sexual behavior [35].

Overall network characteristics—We assessed men’s perceptions of *normative sexual risk behaviors in their social networks* because these have been associated with risky sexual behavior in previous research [86]. This was measured by asking men to rate how likely each of their network alters were to have done any of the following things in the past 6 months: had multiple sex partners, had sex with someone they did not know, or did not use a condom with a new partner (1 = unlikely, 2 = somewhat likely, 3 = very likely). From this

information we calculated for each respondent the percentage of the non-sex partners named in the respondent's network whom the respondent rated as either somewhat likely or very likely to engage in risky sexual behavior. Men were also asked if they *discussed HIV prevention with each network alter* and we created a measure of the percentage of non-sex partners with whom they had these discussions. We also created a measure of the *percentage of their network alters who were homeless*.

RESULTS

Tables 1 and 2 present descriptive statistics for the independent variables included in bivariate logistic regression tests of association with unprotected sex. Tables 1 and 2 also include the odds ratios and 95% confidence intervals for these models. Table 1 presents partner/relationship level variables and Table 2 presents respondent level variables. The 305 respondents discussed 665 relationships with female sex partners: 25% named 4 partners, 12% named 3 partners, 21% named 2 partners and 43% named 1 partner. Three partner characteristics were associated with unprotected sex in a bivariate model: unprotected sex was more likely with homeless partners and partners met on the street and less likely with partners who were either HIV+ or had unknown HIV status. Meeting the partner in other locations, such as at a bar or club or at a shelter, was not significantly associated with unprotected sex at the bivariate level. Other partner characteristics, such as if the partner had a steady job, if the partner was a prostitute or if the respondent knew that the partner had tested positive for HIV were also not significantly associated with unprotected sex.

Seven relationship level variables were associated with unprotected sex in bivariate models. A respondent was significantly more likely to report engaging in unprotected sex with a female partner if he saw the partner frequently, felt emotionally close to the partner, received tangible support from the partner, and felt highly committed to the relationship. Respondents were significantly less likely to engage in unprotected sex if they discussed condoms and HIV risk with their partners. The overall connectivity of the partner with the rest of the respondent's network was also significantly associated with higher odds of unprotected sex. Condom use was unrelated to relationship length, as well as whether the partner was a wife/fiancé, the relationship was monogamous, the partner had been given something in exchange for sex, or either partner engaged in substance use before/during sex.

Ten respondent characteristics were significantly associated with unprotected sex with particular partners in bivariate tests. PTSD was associated with increased odds of unprotected sex while overall mental health was associated with lower odds of unprotected sex. Higher numbers of female and male sex partners were each associated with greater odds of unprotected sex. Pregnancy concerns, positive condom beliefs, and beliefs about HIV susceptibility were significantly associated with increased odds of unprotected sex while greater condom efficacy was significantly associated with lower odds of unprotected sex. The measure of correspondence to culturally relevant masculinity ideals was marginally associated with decreased odds of unprotected sex. Other measures of traditional masculine ideology and relationship power were not bivariately associated with unprotected sex. One measure of social network norms was associated with condom use: higher proportions of non-sex partner network members who were rated as likely to engage in risky sex was associated with higher odds of unprotected sex. None of the demographic variables (age, race/ethnicity, income, homeless severity) were significantly associated with unprotected sex in bivariate models.

Table 3 presents the results of the multi-level multivariate model testing associations with unprotected sex for a particular partner. The model included all variables that were significant in bivariate tests at the 90% confidence level and demographic controls (age,

race/ethnicity, income and homeless severity). The model identified significant correlates of unprotected sex with a particular partner at both the individual and partner/relationship level. None of the demographic characteristics were significantly associated with unprotected sex at the 95% confidence level. The MHI-5 scale (but not PTSD) was correlated with unprotected sex at the 95% confidence level: each additional point on the scale towards a more positive mood was associated with a 3% reduction in the odds of engaging in unprotected sex ($p=.034$). Because the raw scale ranged from 5 to 25, any one-point change in an answer to any one raw scale item (e.g. changing from “most of the time” to “all of the time”) represented an 12% reduction in the odds of engaging in unprotected sex. The number of male sex partners in the past 6 months (but not the number of female sex partners) was also associated with unprotected sex with a female sex partner: each additional male sex partner was associated with a 2.18 times increase in the odds of engaging in unprotected sex ($p=.026$). The measures of condom efficacy and negative condom beliefs were also correlated with unprotected sex: an increase in 1 point on the condom efficacy scale was associated with a 69% reduction in the odds of unprotected sex with a female partner and the odds of unprotected sex with a partner increased 2.16 times with each 1 point increase in the negative condom beliefs scale. All other respondent level variables (e.g., concern about pregnancy, HIV susceptibility, normative network risky sex, masculinity beliefs) were not significantly associated with unprotected sex at the 95% confidence level.

Several partner and respondent level variables were associated with unprotected sex. Odds of unprotected sex were 2.64 times higher if the respondent met the partner on the street, and the odds of unprotected sex increased by 53% for each incremental increase in frequency of contact between the respondent and the partner (e.g. from “once a week” to “twice a week”). The odds of unprotected sex were 3.94 times higher if respondents felt emotionally close to their partners and each point increase on the relationship commitment scale increased odds of unprotected sex by 84%. Respondents were much less likely to engage in unprotected sex with partners with whom they discussed HIV risk/protection (the odds of unprotected sex was reduced by 90%) and condoms (odds reduced by 95%). The more central the partner was to the respondent’s network, the more likely they were to engage in unprotected sex: each one point increase in closeness centrality corresponded to a 2% increase in the odds of unprotected sex. However, condom use was not significantly associated with whether the partner was homeless, HIV-positive or of unknown serostatus, or had provided tangible support to the respondent.

DISCUSSION

This study presents findings from an extensive investigation of the multiple levels of influence on unprotected sex among homeless men who are heterosexually active. Our findings are consistent with an ecological approach to understanding health behavior and demonstrate that condom use decisions are the result of factors beyond individual level attitudes about condoms and knowledge about the risks associated with unprotected sex [21]. Our findings especially confirm research demonstrating that understanding the context of risk decisions, especially the relationship context, is essential to understanding decisions about engagement in high risk sexual behavior [38]. Similar to multi-level dyadic analyses of unprotected sex among homeless women [74] and homeless youth [41], relationship commitment was strongly associated with unprotected sex among homeless men. Several other aspects of homeless men’s sexual relationships also were associated with unprotected sex, including meeting the partner on the street, frequent contact, feeling emotionally close, and the centrality of the partner to the respondent’s social network.

Although the finding that relationship factors are associated with unprotected sex is not novel, the finding that several of these relationship factors were significant indicators of

unprotected sex controlling for each other was novel. High relationship commitment, frequency of contact, feelings of emotional closeness, and being central in the respondent's social life were not highly correlated, and were each independently associated with having unprotected sex with female partners. Based on our exploratory interviews with homeless men on Skid Row, we did not anticipate that they would be more likely to engage in unprotected sex with women they met on the street, or that there would be a lack of association with factors such as the partner's HIV status, meeting her in a bar or club, having a monogamous relationship, sex exchange/history of prostitution, employment status, meeting her through a religious organization. In our exploratory study of the perceptions of risk among homeless men [44], respondents described heuristics they used to determine the riskiness of partners, including evaluations of partner and relationship characteristics that would make them more likely to use condoms. These characteristics included where they met their partners (e.g. on the street, in bars/clubs), the infection status of the partner (e.g. knowing the results of her STI test), whether the woman was respectable (e.g. had a good reputation, had a job, met her at church, knows that she engaged in prostitution), and if they trusted the partner to be faithful. However, none of these factors were associated with unprotected sex in our multi-level analysis. This may be an indication that men may describe rules of thumb for assessing partner risk that they do not necessarily follow for particular partners.

Several recent exploratory studies suggest that understanding the impact of homelessness on romantic relationship formation and maintenance is key to understanding the relationship context of risk behavior among homeless men [35, 36, 44]. In our exploratory interviews, men described the difficulties they experienced in developing committed relationships with women while being homeless [35]. They discussed many barriers to forming and maintaining stable adult relationships with women on the street, such as shelter policies that separate men and women, yet many men also believed that relationships with women were important and worth pursuing despite these challenges. Men also described how feelings of trust developed within partnerships for difficult to articulate reasons (e.g. "Like you can feel it, you know?...with her I didn't use a rubber. I trusted her." [44]), as well as how these feelings of trust lead to a natural progression towards unprotected sex, even sometimes in short-term relationships or with partners who they knew were having sexual relations with other men. These qualitative findings together with the quantitative results from the present study suggest that homeless men may have a variety of indicators for identifying relationships worthy of trust. The barriers to forming stable relationships and men's desire for intimacy may lead men to broaden their criteria for which partners were worthy of trust. Men may develop a sense of familiarity, emotional closeness, or commitment to women they interact with frequently on the street or who are connected to the same people that they know and these feelings may make them ignore potential signs of risk. Another important relationship factor in their relationships with female sex partners is their communication with these partners about risk and protection. Men who communicated with their partners about risk and protection were much less likely to engage in unprotected sex with these partners, suggesting that men who are engaging in unprotected sex with their partners are not discussing the consequences of these behaviors. Unfortunately, having multiple short-term relationships involving unprotected sex are key ingredients in the spread of HIV. This pattern of sexual relationships due to economic constraints may explain many of the racial-ethnic disparities in heterosexual HIV transmission [87].

These findings support recent research that has identified a link between the lack of stable housing and increased HIV risk [19, 88, 89]. Studies have linked unstable housing to increased HIV risk in many different populations, including women who are living in low-income housing developments [90] or are homeless [91], female sex workers [92], injection drug users [9, 93, 94], and men who have sex with men [95]. Housing is also a factor in the

risk behaviors of people living with HIV [12, 96, 97]. Our study is one of the only studies to address the relationship between HIV risk through unprotected sex and homelessness among heterosexual men. The collection of significant relationship level associations, together with our qualitative findings, suggest that homelessness likely erodes heterosexual relationships among homeless men, causing an indirect effect on HIV risk by limiting men's ability to fulfill their desire for intimacy with a romantic partner to short-term, unstable relationships. Also, the lack of a direct association between homeless severity and unprotected sex suggests that the immediate condition of homelessness is the dominant factor shaping relationship outcomes. Other studies have also identified homelessness as a dominant factor in shaping the quality of sexual relationships [56]. Homelessness is often the main context in which risk factors for HIV risk take place for homeless people [19] and there have been arguments that housing assistance to those who are homeless or precariously housed offers the best and most direct form of HIV prevention [88].

Several of our findings suggest that interventions beyond the provision of stable housing could have a positive impact on reducing unprotected heterosexual sex among homeless men. There were several individual level associations with unprotected sex that remained significant after controlling for relationship level factors. We found that mental health was a factor in unprotected sex: men who had better overall mental health were less likely to engage in unprotected sex. This suggests that mental health treatment could have an indirect effect in reducing HIV risk behavior among homeless men. We also found that men who were homosexually active and had a greater number of male sexual partners were more likely to engage in unprotected heterosexual sex. However, the total number of female partners was not significantly associated with unprotected sex. This suggests that men who have sex with men and women (MSMW) may have patterns of risky behavior separate from exclusively heterosexual homeless men. More in depth research is required to better understand the differences between homeless MSW and MSMW in order to determine if there is a need for interventions customized for homeless MSMW. Finally, men who had more negative feelings about condoms or who felt that using condoms was a challenge were less likely to engage in unprotected sex. These findings are similar to studies of unprotected sex among homeless women [74] and youth [41], and suggest that existing intervention approaches for improving condom availability and condom use skills and efficacy are likely to have some positive effects on improving rates of condom use among homeless MSW [6].

We did not find support for the hypothesis that heterosexual men are more likely to engage in unprotected sex if they hold traditional masculine beliefs. We explored this hypothesis with several different measures of traditional masculine ideals, both generally and within their relationships with women. Only one measure was marginally significant in bivariate associations with unprotected sex: men who had beliefs that deviated from the group masculinity beliefs tended towards unprotected sex. However, this association was weak and was not even marginally significant in the multivariate multi-level model. These findings call into question the assumptions about gender ideals and high risk sex among heterosexual men, especially the assumption that men who are economically marginalized would develop hyper-masculine beliefs regarding their relationships with women and that these beliefs would drive sexual risk behavior with women [18, 27, 28]. If this hypothesis was correct, the respondents in this study – homeless and primarily African-American men – would seem to be the most likely men to compensate for their economic marginalization by cultivating traditional masculine attitudes towards their relationships with women and these attitudes would drive risky sexual behavior. Although HIV prevention interventions for women have had some success incorporating a focus on gender and confronting traditional masculine roles [18, 24], other factors appear to be more relevant correlates of unprotected sex for homeless men.

However, it is premature to conclude from this study of homeless men that gendered beliefs are irrelevant to heterosexual risky sex. Although this study provides some of the strongest evidence of the multiple influences of unprotected sex among homeless men in Los Angeles's Skid Row area, it is not without limitations. Our sample consisted entirely of homeless men and did not include a comparison sample of non-homeless men. A more comprehensive test of this hypothesis would include a comparison between homeless men and men who are less economically marginalized. Also, gendered ideals are cultural and are situated in particular populations at particular points in time. Our sample was selected to produce findings generalizable to homeless men in Skid Row, Los Angeles. We cannot assume that these data are representative of homeless men in other geographic areas. Thus, it is possible that other populations of economically marginalized men may be more likely to endorse traditional masculine ideology and compensate for their marginalization through high-risk sex with women. If this is the case, under these cultural circumstances it may be beneficial to craft HIV prevention interventions with traditional gender roles in mind.

This study had a few other limitations worth noting. First, the study is cross-sectional and the interpretation of our findings is limited to identifying associations rather than causation. In order to demonstrate causation, future studies would need to collect longitudinal data in order to establish temporal order in addition to variable associations. Also, without longitudinal data, we cannot disaggregate the within-person effects from the between-person effects [98]. Nearly half of our respondents only had one partnership to report which limits our ability to test if some men tend to have certain types of relationships in which they do or do not engage in unprotected sex. Also, the data are based on self-reports of respondent's own characteristics and behaviors as well as the characteristics and behaviors of their social network ties. The social network data are also based on respondents' perceptions of their personal networks rather than self-reports of the connections by network alters themselves [99]. Although such perceptions are important predictors of behavior, these perceptions may not match the actual behavior or social network characteristics of network alters.

CONCLUSIONS

This study presents strong evidence that there are multiple factors at different levels of analysis that shape HIV risk among homeless men through unprotected sex. Our study demonstrates that, similar to other populations, homeless men are influenced by their relationships to engage in unprotected sex. Romantic relationships of homeless populations are often ignored in the public health literature despite the importance of romantic relationships for a range of health outcomes and behaviors [36]. This study demonstrates that HIV prevention interventions should include a focus on relationships and their effect on risk behaviors. The study also demonstrates that characteristics of homeless men, such as their mental health and attitudes towards condoms, influence their risk behavior with particular partners. These multi-level influences on unprotected sex reinforce arguments that health behavior interventions should be ecologically based, should incorporate multiple levels of influence, and should not focus exclusively on individual level characteristics, such as HIV knowledge or condom use attitudes and skills. Finally, we suggest that our findings are best interpreted in light of the growing literature identifying the lack of stable housing as a key contributor to health risk among homeless men. Homeless men's relationships and behaviors with their partners are shaped dramatically by their housing status. Although behavioral interventions targeting HIV risk behaviors of homeless men may have some effect on their HIV risk, interventions that include the provision of affordable housing in addition to support for behavioral change are likely to have the greatest impact on reducing the spread of HIV among homeless men and their partners.

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References

- Centers for Disease Control and Prevention. HIV/AIDS surveillance report, 2005. Vol. 17. Atlanta: US Department of Health and Human Services, CDC; 2007. Rev. ed
- UNAIDS. Global report: UNAIDS report on the global AIDS epidemic. 2010.
- Schackman BR, Gebo KA, Walensky RP, Losina E, Muccio T, Sax PE, et al. The lifetime cost of current human immunodeficiency virus care in the United States. *Med Care*. 2006; 44(11):990–7. [PubMed: 17063130]
- Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJL. Selected major risk factors and global and regional burden of disease. *The Lancet*. 2002; 360(9343):1347–60.
- UNAIDS. Condoms and HIV prevention: Position statement by UNAIDS, UNFPA and WHO. Geneva: UNAIDS; 2009.
- Warner L, Gallo MF, Macaluso M. Condom use around the globe: How can we fulfil the prevention potential of male condoms? *Sex. Health*. 2012; 9(1):4–9.
- Zolopa AR, Hahn JA, Gorter R, Miranda J, Włodarczyk D, Peterson J, et al. HIV and tuberculosis infection in San Francisco's homeless adults: Prevalence and risk factors in a representative sample. *The Journal of the American Medical Association*. 1994; 272(6):455–61.
- Robertson MJ, Clark RA, Charlebois ED, Tulsy J, Long HL, Bangsberg DR, et al. HIV seroprevalence among homeless and marginally housed adults in San Francisco. *Am J Public Health*. 2004; 94(7):1207–17. [PubMed: 15226145]
- Aidala A, Cross J, Stall R, Harre D, Sumartojo E. Housing status and HIV risk behaviors: Implications for prevention and policy. *AIDS Behav*. 2005; 9(3):251–65. [PubMed: 16088369]
- Wenzel SL, Tucker JS, Elliott MN, Hambarsoomians K, Perlman J, Becker K, et al. Prevalence and co-occurrence of violence, substance use and disorder, and HIV risk behavior: A comparison of sheltered and low-income housed women in Los Angeles county. *Prev Med*. 2004; 39(3):617–24. [PubMed: 15313103]
- Gorbach PM, Murphy R, Weiss RE, Hucks-Ortiz C, Shoptaw S. Bridging sexual boundaries: Men who have sex with men and women in a street-based sample in Los Angeles. *Journal of Urban Health-Bulletin of the New York Academy of Medicine*. 2009; 86:S63–S76.
- Kidder DP, Wolitski RJ, Pals SL, Campsmith ML. Housing status and HIV risk behaviors among homeless and housed persons with HIV. *J AIDS-Journal of Acquired Immune Deficiency Syndromes*. 2008; 49(4):451–5.
- Kipke MD, Weiss G, Wong CF. Residential status as a risk factor for drug use and HIV risk among young men who have sex with men. *AIDS Behav*. 2007; 11(6):S56–S69.
- Centers for Disease Control and Prevention. HIV/AIDS in the United States. 2008. Available from: <http://www.cdc.gov/hiv/resources/factsheets/us.htm>
- Hall HI, Song R, Rhodes P, Prejean J, An Q, Lee LM, et al. Estimation of HIV incidence in the United States. *JAMA: The Journal of the American Medical Association*. 2008; 300(5):520–9. [PubMed: 18677024]
- National Coalition for the Homeless. Who is homeless?. Washington, D.C: 2009.
- Centers for Disease Control and Prevention. HIV among women. Atlanta: US Department of Health and Human Services, CDC; 2011.
- Dworkin SL, Fullilove RE, Peacock D. Are HIV/AIDS prevention interventions for heterosexually active men in the United States gender-specific? *Am. J Public Health*. 2009; 99(6):981–4.
- Wolitski RJ, Kidder DP, Fenton KA. HIV, homelessness, and public health: Critical issues and a call for increased action. *AIDS Behav*. 2007; 11(6):S167–S71.
- Higgins JA, Hoffman S, Dworkin SL. Rethinking gender, heterosexual men, and women's vulnerability to HIV/AIDS. *Am J Public Health*. 2010; 100(3):435–45. [PubMed: 20075321]

21. Corbett AM, Dickson-Gomez J, Hilario H, Weeks MR. A little thing called love: Condom use in high-risk primary heterosexual relationships. *Perspect Sex Reprod Health*. 2009; 41(4):218–24. [PubMed: 20444176]
22. Bryan A, Fisher JD, Fisher WA. Tests of the mediational role of preparatory safer sexual behavior in the context of the theory of planned behavior. *Health Psychol*. 2002; 21(1):71–80. [PubMed: 11846347]
23. Logan TK, Cole J, Leukefeld C. Women, sex, and HIV: Social and contextual factors, meta-analysis of published interventions, and implications for practice and research. *Psychol Bull*. 2002; 128(6):851–85. [PubMed: 12405135]
24. Wingood GM, DiClemente RJ. Application of the theory of gender and power to examine HIV-related exposures, risk factors, and effective interventions for women. *Health Educ Behav*. 2000; 27(5):539–65. [PubMed: 11009126]
25. Campbell CA. Male gender-roles and sexuality - implications for womens AIDS risk and prevention. *Soc Sci Med*. 1995; 41(2):197–210. [PubMed: 7667682]
26. Kaufman MR, Shefer T, Crawford M, Simbayi LC, Kalichman SC. Gender attitudes, sexual power, HIV risk: A model for understanding HIV risk behavior of south african men. *AIDS Care*. 2008; 20(4):434–41. [PubMed: 18449820]
27. Poehlman J. Masculine identity and HIV/AIDS risk behavior among African-American men. *Pract Anthropol*. 2008; 30(1):12–7.
28. Whitehead TL. Urban low-income African American men, HIV/AIDS, and gender identity. *Med Anthropol Q*. 1997; 11(4):411–47. [PubMed: 9408898]
29. Aronson RE, Whitehead TL, Baber WL. Challenges to masculine transformation among urban low-income African American males. *Am J Public Health*. 2003; 93(5):732–41. [PubMed: 12721134]
30. Pleck JH, Sonenstein FL, Ku LC. Masculinity ideology: Its impact on adolescent males' heterosexual relationships. *Journal of Social Issues*. 1993; 49(3):11–29. [PubMed: 17165216]
31. O'Sullivan LF, Hoffman S, Harrison A, Dolezal C. Men, multiple sexual partners, and young adults' sexual relationships: Understanding the role of gender in the study of risk. *Journal of Urban Health-Bulletin of the New York Academy of Medicine*. 2006; 83(4):695–708. [PubMed: 16758335]
32. Seal DW, Wagner-Raphael LI, Ehrhardt AA. Sex, intimacy, and HIV -- an ethnographic study of a Puerto Rican social group in New York City. *Journal of Psychology & Human Sexuality*. 2000; 11(4):51– 92.
33. Harrison A, O'Sullivan LF, Hoffman S, Dolezal C, Morrell R. Gender role and relationship norms among young adults in South Africa: Measuring the context of masculinity and HIV risk. *Journal of Urban Health-Bulletin of the New York Academy of Medicine*. 2006; 83(4):709–22. [PubMed: 16758334]
34. Shearer CL, Hosterman SJ, Gillen MM, Lefkowitz ES. Are traditional gender role attitudes associated with risky sexual behavior and condom-related beliefs? *Sex Roles*. 2005; 52(5–6):311–24.
35. Kennedy DP, Brown R, Golinelli D, Wenzel S, Tucker JS, Wertheimer S. Masculinity and HIV risk among homeless men in Los Angeles. *Psychol Men Masculinity*. 2012 E-pub ahead of publication.
36. Rayburn R, Corzine J. Your shelter or mine? Romantic relationships among the homeless. *Deviant Behavior*. 2010; 31(8):756–74.
37. Sobo EJ. Inner-city women and AIDS - the psychosocial benefits of unsafe sex. *Cult Med Psychiatr*. 1993; 17(4):455–85.
38. Afifi WA. Harming the ones we love: Relational attachment and perceived consequences as predictors of safe-sex behavior. *The Journal of Sex Research*. 1999; 36(2):198–206.
39. Thomsen S, Stalker M, Toroitich-Ruto C. Fifty ways to leave your rubber: How men in mombasa rationalise unsafe sex. *Sex Transm Infect*. 2004; 80(6):430–4. [PubMed: 15572608]
40. Kennedy DP, Wenzel SL, Tucker JS, Green HD, Golinelli D, Ryan G, et al. Unprotected sex of homeless women living in Los Angeles county: An investigation of the multiple levels of risk. *AIDS Behav*. 2010; 14(4):960–73. [PubMed: 19876728]

41. Kennedy DP, Tucker JS, Green HD, Golinelli D, Ewing BA. Unprotected sex of homeless youth: Results from a multilevel analysis of individual, social network, and relationship factors. *AIDS Behav.* 2012 E-print ahead of publication.
42. Tucker JS, Elliott MN, Wenzel SL, Hambarsoomian K. Relationship commitment and its implications for unprotected sex among impoverished women living in shelters and low-income housing in Los Angeles county. *Health Psychol.* 2007; 26(5):644–9. [PubMed: 17845116]
43. Seal DW, Ehrhardt AA. HIV-prevention-related sexual health promotion for heterosexual men in the United States: Pitfalls and recommendations. *Arch Sex Behav.* 2004; 33(3):211–22. [PubMed: 15129040]
44. Brown RA, Kennedy DP, Tucker JS, Wenzel S, Golinelli D, Wertheimer S, et al. Sex and relationships on the street: How homeless men judge partner risk on Skid Row. *AIDS Behav.* 2011; 16(3):774–84. [PubMed: 21630015]
45. Tucker J, Wenzel S, Golinelli D, Kennedy D, Ewing B, Wertheimer S. Understanding heterosexual condom use among homeless men. *AIDS Behav.* 2012:1–8. E-pub ahead of publication. [PubMed: 21476006]
46. Stein JA, Nyamathi AM, Zane JJ. Situational, psychosocial, and physical health-related correlates of HIV/AIDS risk behaviors in homeless men. *American Journal of Mens Health.* 2009; 3(1):25–35.
47. Forney JC, Lombardo S, Toro PA. Diagnostic and other correlates of HIV risk behaviors in a probability sample of homeless adults. *Psychiatr Serv.* 2007; 58(1):92–9. [PubMed: 17215418]
48. Wenzel S, Rhoades H, Hsu H-T, Golinelli D, Tucker J, Kennedy D, et al. Behavioral health and social normative influence: Correlates of concurrent sexual partnering among heterosexually-active homeless men. *AIDS Behav.* 2012:1–9. E-pub ahead of publication. [PubMed: 21476006]
49. Green HD Jr, Tucker JS, Wenzel SL, Golinelli D, Kennedy DP, Ryan GW, et al. Association of childhood abuse with homeless women's social networks. *Child Abuse & Neglect.* 2012; 36(1): 21–31. [PubMed: 22265902]
50. Rice E, Milburn NG, Rotheram-Borus MJ. Pro-social and problematic social network influences on HIV/AIDS risk behaviours among newly homeless youth in Los Angeles. *AIDS Care.* 2007; 19(5):697–704. [PubMed: 17505933]
51. Ennett ST, Bailey SL, Federman EB. Social network characteristics associated with risky behaviors among runaway and homeless youth. *J Health Soc Behav.* 1999; 40(1):63–78. [PubMed: 10331322]
52. Tyler KA. Social network characteristics and risky sexual and drug related behaviors among homeless young adults. *Social Science Research.* 2008; 37(2):673–85. [PubMed: 19069065]
53. Rhoades H, Wenzel SL, Golinelli D, Tucker JS, Kennedy DP, Green HD, et al. The social context of homeless men's substance use. *Drug Alcohol Depend.* 2011; 118(2–3):320–5. [PubMed: 21601380]
54. Hawkins RL, Abrams C. Disappearing acts: The social networks of formerly homeless individuals with co-occurring disorders. *Soc Sci Med.* 2007; 65(10):2031–42. [PubMed: 17706330]
55. Irwin J, LaGory M, Ritchey F, Fitzpatrick K. Social assets and mental distress among the homeless: Exploring the roles of social support and other forms of social capital on depression. *Soc Sci Med.* 2008; 67(12):1935–43. [PubMed: 18930571]
56. Davey-Rothwell MA, Latimore A, Hulbert A, Latkin CA. Sexual networks and housing stability. *Journal of Urban Health-Bulletin of the New York Academy of Medicine.* 2011; 88(4):759–66. [PubMed: 21465331]
57. Tucker JS, Kennedy D, Ryan G, Wenzel SL, Golinelli D, Zazzali J. Homeless women's personal networks: Implications for understanding risk behavior. *Hum Organ.* 2009; 68(2):129–40. [PubMed: 20351796]
58. Kenny, DA.; Kashy, DA.; Cook, WL. *Dyadic data analysis.* New York, NY: The Guilford Press; 2006.
59. Snijders TAB, Sprenen M, Zwaagstra R. The use of multilevel modeling for analysing personal networks: Networks of cocaine users in an urban area. *J Quant Anthropol.* 1995; 5(2):85–105.
60. Fisher JD. Possible effects of reference group-based social influence on AIDS risk behavior and AIDS prevention. *American Psychologist.* 1988; 43(11):914–20. [PubMed: 3214003]

61. Sallis JE, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. *Annu Rev Public Health*. 2006; 27:297–322. [PubMed: 16533119]
62. Sallis, JF.; Owen, N.; Fisher, EB. Ecological models of health behavior. In: Glanz, K.; Rimer, BK.; Viswanath, K., editors. *Health behavior and health education: Theory, research and practice*. 4. San Francisco, CA: Josey-Bass; 2008. p. 465-82.
63. Bronfenbrenner, U. *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press; 1979.
64. Stokols D. Establishing and maintaining healthy environments - toward a social ecology of health promotion. *Am Psychol*. 1992; 47(1):6–22. [PubMed: 1539925]
65. Campbell KE, Lee BA. Name generators in surveys of personal networks. *Social Netwks*. 1991; 13(3):203–21.
66. McCarty C. Measuring structure in personal networks. *JoSS*. 2002; 3(1) <http://www.cmu.edu/joss/content/articles/volume3/McCarty.html>.
67. McCarty C, Bernard HR, Killworth PD, Shelley GA, Johnsen EC. Eliciting representative samples of personal networks. *Social Netwks*. 1997; 19(4):303–23.
68. McCarty C, Killworth PD, Rennell J. Impact of methods for reducing respondent burden on personal network structural measures. *Social Netwks*. 2007; 29(2):300–15.
69. Snijders T, Spreen M, Zwaagstra R. The use of multilevel modeling for analysing personal networks: Networks of cocaine users in an urban area. *J Quant Anthropol*. 1995; 5(2):85–105.
70. StataCorp LP. *Stata statistical software*. College Station, TX: StataCorp LP; 2007. Release 9.2 ed
71. Drigotas SM, Rusbult CE. Should I stay or should I go - a dependence model of breakups. *J Pers Soc Psychol*. 1992; 62(1):62–87.
72. Rusbult CE, Johnson DJ, Morrow GD. Predicting satisfaction and commitment in adult romantic involvements - an assessment of the generalizability of the investment model. *Soc Psychol Q*. 1986; 49(1):81–9.
73. Castañeda D. The close relationship context and HIV/AIDS risk reduction among mexican americans. *Sex Roles*. 2000; 42(7–8):551–80.
74. Kennedy DP, Wenzel SL, Tucker JS, Green HD, Golinelli D, Ryan GW, et al. Unprotected sex of homeless women living in Los Angeles county: An investigation of the multiple levels of risk. *AIDS Behav*. 2010; 14(4):960–73. [PubMed: 19876728]
75. Wasserman, S.; Faust, K. *Social network analysis: Methods and applications*. New York: Cambridge University Press; 1994.
76. Ware JE Jr, Sherbourne CD. The mos 36-item short-form health survey (sf-36): I. Conceptual framework and item selection. *Med Care*. 1992; 30(6):473–83. [PubMed: 1593914]
77. Rumpf H-J, Meyer C, Hapke U, John U. Screening for mental health: Validity of the mhi-5 using DSM-IV axis I psychiatric disorders as gold standard. *Psychiatry Res Psychiatry Res*. 2001; 105(3):243–53.
78. Prins A, Ouimette P, Kimerling R, Cameron RP, Hugelshofer DS, Shaw-Hegwer J, et al. The primary care PTSD screen (pc-PTSD): Development and operating characteristics. *Primary Care Psychiatry*. 2003; 9(1):9–14.
79. Calhoun PS, McDonald SD, Guerra VS, Eggleston AM, Beckham JC, Straits-Troster K. Clinical utility of the primary care - PTSD screen among u.. Veterans who served since September 11, 2001. *Psychiatry Res Psychiatry Res*. 2010; 178(2):330–5.
80. Mutchler MG, Bogart LM, Elliott MN, McKay T, Suttrop MJ, Schuster MA. Psychosocial correlates of unprotected sex without disclosure of HIV-positivity among African-American, Latino, and White men who have sex with men and women. *Arch Sex Behav*. 2008; 37(5):736–47. [PubMed: 18506613]
81. Jemmott LS, Jemmott JB. Applying the theory of reasoned action to AIDS risk behavior - condom use among black-women. *Nurs Res*. 1991; 40(4):228–34. [PubMed: 1857648]
82. Neff JA. A confirmatory factor analysis of a measure of “machismo” among Anglo, African American, and Mexican American male drinkers. *Hispanic Journal of Behavioral Sciences*. 2001; 23(2):171–88.

83. Caron SL, Davis CM, Halteman WA, Stickle M. Predictors of condom-related behaviors among first-year college students. *J Sex Res.* 1993; 30(3):252–9.
84. Pulerwitz J, Gortmaker SL, DeJong W. Measuring sexual relationship power in HIV/STD research. *Sex Roles.* 2000; 42(7–8):637–60.
85. Piggott, ME. Unpublished thesis. Melbourne, Australia: Swinburne University of Technology; 2004. Double jeopardy: Lesbians and the legacy of multiple stigmatised identities.
86. Latkin CA, Forman V, Knowlton A, Sherman S. Norms, social networks, and HIV-related risk behaviors among urban disadvantaged drug users. *Soc Sci Med.* 2003; 56(3):465–76. [PubMed: 12570967]
87. Adimora AA, Schoenbach VJ, Doherty IA. Concurrent sexual partnerships among men in the United States. *Am J Public Health.* 2007; 97(12):2230–7. [PubMed: 17971556]
88. Shubert V, Bernstine N. Moving from fact to policy: Housing is HIV prevention and health care. *AIDS Behav.* 2007; 11(6):S172–S81.
89. Aidala AA, Sumartojo E. Why housing? *AIDS Behav.* 2007; 11(6):S1–S6. [PubMed: 17546495]
90. Sikkema KJ, Heckman TG, Kelly JA, Anderson ES, Winett RA, Solomon LJ, et al. HIV risk behaviors among women living in low-income, inner-city housing developments. *Am J Public Health.* 1996; 86(8):1123–8. [PubMed: 8712272]
91. Wenzel SL, Tucker JS, Elliott MN, Hambarsoomians K. Sexual risk among impoverished women: Understanding the role of housing status. *AIDS Behav.* 2007; 11(6):S9–S20.
92. Reed E, Gupta J, Biradavolu M, Devireddy V, Blankenship KM. The role of housing in determining HIV risk among female sex workers in andhra pradesh, india: Considering women's life contexts. *Soc Sci Med.* 2011; 72(5):710–6. [PubMed: 21306811]
93. Des Jarlais D, Braine N, Friedmann P. Unstable housing as a factor for increased injection risk behavior at us syringe exchange programs. *AIDS Behav.* 2007; 11(0):78–84. [PubMed: 17447132]
94. German D, Davey M, Latkin C. Residential transience and HIV risk behaviors among injection drug users. *AIDS Behav.* 2007; 11(0):21–30. [PubMed: 17486437]
95. Kipke M, Weiss G, Wong C. Residential status as a risk factor for drug use and HIV risk among young men who have sex with men. *AIDS Behav.* 2007; 11(0):56–69. [PubMed: 17265143]
96. Friedman MS, Marshal MP, Stall R, Kidder DP, Henny KD, Courtenay-Quirk C, et al. Associations between substance use, sexual risk taking and HIV treatment adherence among homeless people living with HIV. *AIDS Care.* 2009; 21(6):692–700. [PubMed: 19806485]
97. Kidder DP, Wolitski RJ, Campsmith ML, Nakamura GV. Health status, health care use, medication use, and medication adherence among homeless and housed people living with HIV/AIDS. *Am J Public Health.* 2007; 97(12):2238–45. [PubMed: 17971562]
98. Curran PJ, Bauer DJ. The disaggregation of within-person and between-person effects in longitudinal models of change. *Annu Rev Psychol.* 2011; 62(1):583–619. [PubMed: 19575624]
99. Krackhardt D. Cognitive social-structures. *Social Netwks.* 1987; 9(2):109–34.

Table 1

Descriptive statistics for characteristics of respondents' partners and relationships ($n=665$) and odds ratios (95% confidence intervals) of bivariate associations between variables and unprotected sex

Partner/Relationship Level Variables	Mean (SD)	%	OR (95% CI)
Dependent Variable			
Any unprotected sex		50.83	
Partner Characteristics			
Partner is homeless	37.14		2.26 (0.92, 5.55) #
Respondent met partner on the street	39.40		1.80 (0.90, 3.60) #
Respondent met partner at a bar or club	8.42		1.05 (0.26, 4.28)
Respondent met partner in a shelter	9.77		1.62 (0.42, 6.25)
Respondent met partner through someone else	18.65		0.42 (0.13, 1.34)
Respondent met partner through a job or at school	6.62		1.11 (0.30, 4.15)
Respondent met partner through a religious organization	1.95		1.11 (0.07, 18.98)
Partner is a prostitute	25.71		0.92 (0.41, 2.07)
Partner has a steady job	32.03		0.67 (0.29, 1.56)
Partner is either HIV+ or has unknown HIV status	63.91		0.46 (0.20, 1.07) #
Relationship Characteristics			
Partner is respondent's wife/fiancé	5.41		3.36 (0.61, 18.40)
Monogamous relationship	31.28		1.11 (0.50, 2.48)
Sex exchange	30.23		1.26 (0.54, 2.91)
Relationship length in years	4.32 (6.87)		0.99 (0.93, 1.05)
Frequency of contact between respondent and partner	2.4 (1.36)		1.89 (1.38, 2.61) **
Respondent feels emotionally close to partner	46.77		3.65 (1.66, 8.05) **
Respondent received tangible support from partner	29.17		2.29 (1.17, 4.50) *
Relationship commitment	1.69 (.79)		1.94 (1.17, 3.24) *
Communication about Risk			
Partner and respondent talked about HIV risk and/or protection	27.82		0.31 (0.13, 0.74) **
Partner and respondent talked about condoms	56.39		0.06 (0.03, 0.14) **
Substance Use Before or During Sex			
% of partner alcohol use before/during sex	37.7 (43.2)		1.16 (0.44, 3.02)
% of respondents alcohol use before/during sex	43.5 (44.2)		1.15 (0.45, 2.94)
% of partner drug use before/during sex	36.3 (44.6)		1.31 (0.51, 3.37)
% of respondent drugs use before/during sex	38.4 (44.2)		1.21 (0.49, 2.96)
Partner's Social Network Connections			
Centrality (closeness) of partner	31 (32)		1.03 (1.01, 1.04) **

Note.

$p < .10$,

* $p < .05$,

** $p < .01$

Table 2

Descriptive statistics for characteristics of respondents ($n=305$) and odds ratios (95% confidence intervals) of bivariate associations between variables and unprotected sex

Respondent Level Variables	Mean (SD)	%	OR (95% CI)
Demographics			
Age	45.79 (10.55)		1.01 (0.97, 1.06)
Respondent ethnicity – Black		73.11	1.54 (0.50, 4.72)
Respondent ethnicity – Hispanic		11.15	0.47 (0.10, 2.19)
Respondent ethnicity – White		9.84	
Respondent ethnicity – Other		5.90	0.22 (0.02, 2.94)
Income (\$100 dollars per month)	4.48 (4.27)		.99 (0.86, 1.13)
Days homeless in the past 6 months	140.43 (58.47)		1.00 (0.99, 1.01)
Mental Health			
PTSD		42.95	6.17 (2.21, 17.19) **
MHI-5 (mood disorder screener)	58.19 (22.11)		0.97 (0.94, 0.99) **
Recent Sexual Experience			
Total female partners in past 6 months	3.68 (5.75)		1.06 (0.99, 1.14) #
Total male partners in past 6 months	0.23 (1.04)		2.23 (1.23, 4.04) **
Attitudes about Protection and Risk			
Concern about getting woman pregnant	1.58 (1.07)		1.57 (0.94, 2.63) #
Condom efficacy	3.31 (.65)		0.10 (0.05, 0.21) **
Negative condom beliefs	2.10 (.83)		4.73 (2.61, 8.56) **
HIV susceptibility	2.50 (.99)		1.74 (1.03, 2.95) *
Gender Ideology			
Machismo Scale	2.3 (.50)		1.36 (0.47, 3.90)
Double Standard Scale	2.0 (.58)		1.06 (0.44, 2.57)
Sexual Relationship Power Scale	2.1 (.68)		1.29 (0.59, 2.82)
Distrust of Women Scale	2.4 (.81)		1.38 (0.72, 2.63)
Culturally Relative Masculinity Beliefs	.51 (.17)		0.09 (0.01, 1.48) #
Social Network Norms			
% of non-sex partners in social network rated as likely to engage in risky sex	20 (27)		7.81 (1.26, 48.31) *
% of non-sex partners in social network with whom respondent discussed HIV	14 (27)		0.22 (0.03, 1.43)
% of non-sex partners in social network who are homeless	21 (26)		1.63 (0.30, 8.77)

Note.

$p < .10$,

* $p < .05$,

** $p < .01$

Table 3

Odds ratios (95% confidence intervals) from multi-level multivariate logistic regression models predicting unprotected sex with a particular partner

Variable	Unprotected Sex (<i>n</i> = 305 respondents, 665 partners)
	OR (95% CI)
Individual characteristics	
Age	0.96 (0.91, 1.01)
Respondent ethnicity – Black (vs. White)	1.08 (0.29, 4.02)
Respondent ethnicity – Hispanic (vs. White)	0.28 (0.04, 1.84)
Respondent ethnicity – Other (vs. White)	0.22 (0.02, 2.05)
Income (\$100 dollars per month)	1.01 (0.91, 1.13)
Months homeless lifetime	1.00 (0.99, 1.01)
PTSD	1.72 (0.58, 5.09)
MHI	0.97 (0.95, 1.00) *
Total female partners in past 6 months	1.02 (0.97, 1.08)
Total male partners in past 6 months	2.18 (1.10, 4.33) *
Concern about getting a woman pregnant	0.97 (0.58, 1.61)
Condom efficacy	0.31 (0.12, 0.78) *
Negative condom beliefs	2.16 (1.07, 4.36) *
HIV susceptibility	1.38 (0.77, 2.48)
Proportion of non-sex partners in social network rated as likely to engage in risky sex	1.01 (0.99, 1.03)
Culturally Relevant Masculinity Beliefs	3.23 (0.19, 55.82)
Partner/Relationship Level Variables	
Partner is homeless	1.17 (0.46, 2.96)
Respondent met partner on the street	2.64 (1.17, 5.92) *
Partner is HIV+ or had unknown HIV status	0.51 (0.20, 1.32)
Frequency of contact between respondent and	1.53 (1.01, 2.29) *
Respondent felt emotionally close to partner	3.94 (1.43, 10.83) **
Respondent received tangible support from the partner	1.12 (0.47, 2.66)
Relationship commitment	1.84 (1.17, 2.89) **
Partner and respondent talked about HIV risk and/or protection	0.10 (0.04, 0.29) **
Partner and respondent talked about condoms	0.05 (0.02, 0.14) **
Centrality (closeness) of partner in respondents network	1.02 (1.00, 1.04) *

Note.

$p < .10$,

* $p < .05$,

** $p < .01$