

Substance Use and Other Risk Factors for Unprotected Sex: Results from an Event-Based Study of Homeless Youth

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Published online: 17 August 2011
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Abstract This study used an event-based approach to understand condom use in a probability sample of 309 homeless youth recruited from service and street sites in Los Angeles County. Condom use was significantly *less likely* when hard drug use preceded sex, the relationship was serious, the partners talked about “pulling out”, or sex occurred in a non-private place (and marginally less likely when heavier drinking preceded sex, or the partnership was monogamous or abusive). Condom use was significantly *more likely* when the youth held positive condom attitudes or were concerned about pregnancy, the partners talked about condom use, and the partners met up by chance. This study extends previous work by simultaneously examining a broad range of individual, relationship, and contextual factors that may play a role in condom use. Results identify a number of actionable targets for programs aimed at reducing HIV/STI transmission and pregnancy risk among homeless youth.

Keywords Homeless · Youth · Condom use · Event-level

Introduction

National data suggest that the sexual health of adolescents and young adults in the US is declining [1], and youth who

are homeless may be among the most vulnerable. Homeless youth are more likely than housed youth to be sexually active, as well as engage in sexual risk behaviors such as multiple partnerships and trading sex [2, 3], which heighten their risk of HIV and other sexually transmitted infections (STIs). Pregnancy among homeless girls is common as well, with lifetime rates estimated at 35–45% [4, 5]. Condom use can be an effective means of protection against both STIs and pregnancy, yet 40–70% of homeless youth report engaging in unprotected sexual intercourse [3, 6, 7]. Given the widespread use of alcohol and drugs among homeless youth [7–12], including substance use during sex [13], it might seem reasonable to conclude that substance use is an important determinant of unprotected sex among homeless youth through one or more of its cognitive, affective, and physiological effects on the individual [14]. However, studies of sexual risk behavior among homeless youth have not conducted the types of analyses that are necessary to better understand whether this is the case.

Over the past two decades, numerous studies have examined the association between substance use and unprotected sex using a variety of research designs and levels of analysis [15]. Among these studies, the most common approach has been to examine the global association between substance use and condom use. Global association studies ask individuals to report on their substance use and condom use behaviors either in general or over a specific period of time (e.g., past 6 months). These studies typically find that individuals who are more likely to engage in substance use are also more likely to engage in unprotected sex [16, 17]. A drawback of global association studies is that they cannot determine whether substance use tends to precede unprotected sex and thus establish the temporal pairing between these behaviors that is a

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necessary condition for inferring a causal link. Event-level studies address this limitation by asking respondents to report on their substance use and condom use during a specific sexual event (e.g., first time intercourse; last episode of intercourse). Although event-level studies cannot establish causality, investigating whether these behaviors tend to co-occur during a specific sexual event provides greater insight into whether substance use before sex decreases the likelihood that protected sex will occur.

A review of the event-level literature on youth substance use and sexual behavior indicates that drinking is strongly related to the decision to have sex and indiscriminate forms of risky behavior such as having multiple or casual sex partners. The evidence linking substance use to unprotected sex is less consistent [16, 18], but most studies have been of school-based samples, particularly college undergraduates. The small number of event-level studies conducted with at-risk youth, although not entirely consistent, suggest that alcohol and drug use may be stronger predictors of condom use behavior among these youth than in the general population. For example, a study of adolescents with substance use disorders found that both alcohol and drug use during the event predicted condom use; however, these associations weakened to nonsignificance after adjusting for partner type and other factors [19]. Another study of homeless youth indicated that marijuana use during the sexual event was associated with unprotected sex, whereas crack use was associated with protected sex (alcohol use was unrelated to condom use); crack use remained a significant predictor of condom use in multivariate analyses [20]. A third study of criminally involved adolescents, which focused exclusively on alcohol use, found that drinking at the event was associated with unprotected sex in both between- and within-subjects analyses [21].

A limitation of many existing event-level studies in this area is that they devote insufficient attention to a host of factors other than substance use that may contribute to unprotected sex. Accounting for these other factors is important both in terms of better understanding the effect of substance use on unprotected sex in different populations, as well as identifying additional risk and protective factors that may be important targets for intervention. Event-based research by Tortu, McMahon and colleagues identifying the determinants of condom use in high-risk populations are exemplars in terms of collecting detailed information on: (a) the respondent; (b) the respondent's sexual partner and their relationship; and (c) the context of the sexual event. For example, their analysis of women's sex events with sex trading partners found an association between drug use and unprotected sex [22], whereas an analysis of women's most recent sex events with non-trading partners did not [23]; however, both analyses identified individual and contextual factors that were

relevant to condom use such as the respondent's attitudes about condoms and HIV risk, characteristics of the sexual partner, where the sexual event took place, whether the couple talked about condom use prior to sex, and the types of sexual behaviors in which they engaged. A recent event-based study of at-risk women living in temporary shelters took a similar approach, finding that condom use was more likely among women who consumed alcohol at the event, as well as for those who held more positive attitudes towards condoms, had sex with a casual or need-based partner, discussed condoms with the partner, and felt less sexually pressured by the partner during the event [24]. Not all studies taking this approach have found evidence for the importance of contextual factors in predicting condom use; for example, a study of gay and bisexual men found that condom use was more likely with casual partners and among HIV-negative men, but that the social setting and whether sex was expected did not matter [25]. Together, however, these studies demonstrate the potential usefulness of gathering rich information on specific sexual events to better understand the determinants of sexual risk behavior at multiple levels of influence and how they may differ across diverse populations.

This study significantly extends the literature on whether youth substance use is a risk factor for unprotected sex in three important respects. First, it examines these associations among homeless youth, a population that has been understudied in this context but has high rates of substance use and elevated risk for pregnancy and STIs. Second, it takes an event-based approach in examining the association between unprotected sex and multiple types of substance use (alcohol, marijuana, hard drugs). Finally, based on findings from prior event-level studies and our own formative research with homeless youth, it takes into account characteristics of the youth (e.g., relevant attitudes about condoms and pregnancy), the sexual partner and their relationship (e.g., partner type, history of relationship abuse), and the sexual event itself (e.g., location, planning) that may be relevant to understanding engagement in unprotected sex within this vulnerable population.

Methods

Study Participants

Data come from a larger study of 419 homeless youth in Los Angeles County examining the social context of substance use and HIV risk within this population. Youth were eligible for the study if they: (a) were between the ages of 13–24; (b) were not currently living with a parent or guardian; (c) were not getting most of their support for food and housing from family or a guardian; (d) spent the

previous night in a shelter, outdoor or public place, hotel or motel room rented with friends (because of no place else to go), or other place not intended as a domicile; and e) were English speaking. Interviews were conducted between October 2008 and August 2009. Of the 446 youth who initially screened eligible for the study, 437 were interviewed. Of those interviewed, 18 were later found to be ineligible and excluded from the sample because they were too old ($n = 2$), or were suspected to be not homeless ($n = 1$), or a repeater ($n = 15$). This resulted in a study sample of 419 and a response rate of approximately 98%. Our analytic sample consists of the 309 youth who reported being sexually active in the past 3 months (see Table 1 for characteristics of this sample). After providing informed consent, computer-assisted face-to-face structured interviews were conducted by trained interviewers. These interviews lasted an average of 60 min, and youth were paid \$25. The research protocol was approved by the institution's internal review board and a Certificate of Confidentiality was obtained from the National Institutes of Health.

Study Design

To obtain a representative sample of homeless youth from the greater Los Angeles area, we designed and implemented a probability sample of homeless youth recruited from shelters, drop-in centers, and street venues in the study area. Specifically, we adopted a two-stage design that involved first developing a list/sampling frame of sites used by homeless youth and then sampling youth within the selected sites. We developed two sampling frames of sites: one for eligible service sites (shelters and drop-ins) and the other for street venues in the study area. The first sampling frame was developed using existing directories of services for homeless individuals. Service sites were considered eligible if they were located in the study area and the majority of their clientele was ages 13–24 and English speaking. Service sites not limited to that age group were eligible if they had a specific program geared toward youth. In addition, for short-term transitional housing programs the average length of stay had to be 1 year or less. Our final list of service sites consisted of 22 eligible sites: 15 shelters and seven drop-in centers. All the eligible service sites in the study area that agreed to participate in the study were selected with certainty and thus the sites can be considered strata. The second sampling frame, for street venues, was developed with the assistance of service providers and outreach agencies. We ultimately identified 19 street venues in the study area where homeless youth congregate. All of these street sites were included in the study and thus can be considered as strata. Each of the 41 service and street sites were investigated intensively with the purpose of

Table 1 Descriptive statistics for study variables

Variable	Mean (SE) or Percent
<i>Respondent demographic covariates</i>	
Biological sex = male	63.67
Race/ethnicity	
Non-Hispanic white	37.09
African American	23.16
Hispanic	18.34
Mixed/other	21.40
Education	
No high school diploma/GED	49.80
High school diploma/GED	29.06
Some college or higher	21.13
Age (in years)	20.40 (2.62)
<i>Respondent attitudes</i>	
Positive condom attitudes (range = 1–4)	3.08 (0.04)
Pregnancy concerns (range = 1–4)	3.08 (1.06)
<i>Relationship characteristics</i>	
Partner type	
Serious	55.27
Casual or need-based	44.73
First time they had sex	17.83
Relationship length (in months)	24.91 (2.74) (Median = 11.51)
Monogamous relationship	54.44
Trust partner wouldn't transmit STI	58.57
History of abuse	39.71
Same-sex partner	11.47
<i>Substance use at the most recent sexual event</i>	
Maximum number of drinks by either partner	2.17 (6.69)
Marijuana use, but no hard drug use	25.98
Any hard drug use	7.60
<i>Context characteristics</i>	
Chance meeting	35.25
Event was special in some way	41.55
Sex was in a non-private place	38.16
Talked about "pulling out"	23.13
Talked about condoms	25.59
Respondent felt emotionally good	65.54
Respondent felt extremely aroused	27.06
Respondent felt pressured by partner	11.68

obtaining an estimate of the average number of youth served daily by the service sites and the average number of youth that congregate at the street venues in a given day. This information was used to assign an overall complete quota to each site which was approximately proportional to the size of a site. The second stage of the adopted sampling design consisted of drawing a probability sample of

homeless youth from the 41 study sites. Strategies specific to the type of sites were developed to select randomly the youths to be approached, screened and interviewed.

The proposed sampling design deviates from a proportionate-to-size stratified random sample (where a constant proportion of the population is sampled from every site) because of: changes in the sampling rates during the fielding period; differential response rates of youth across sites; and variability in how frequently youth access shelters, drop-ins and street venues. This last factor means that some youth are more likely than others to be included in the sample for a given site. We accounted for the differential frequency of using sites by asking respondents how often they had gone to a shelter, drop-in or street venue in the study area during the past 30 days and using this information to correct the respondent's sampling probability. We corrected departures from a proportionate-to-size stratified random sample with sampling weights.

Study Variables

Condom Use

The outcome variable was whether a condom was properly used at the most recent sexual event. This event was defined as the most recent time the youth had vaginal or anal intercourse. All reported events occurred within the past 3 months. Respondents were asked whether they used a condom at the event, whether the condom was taken off before they were done having intercourse, and whether a new condom was used if they had intercourse more than once during the event. The event was coded as one where condoms were used if they couple used a condom, did not take it off until they were done having intercourse, and (if applicable) used a new condom for each insertive act.

Attitudes About Condoms and Pregnancy

A scale assessing condom use attitudes was comprised of four items asking whether condoms interfere with the enjoyment of sex, condoms can be used without ruining the mood, you can stop before sex to use a condom, and it would be okay if a partner suggested that a condom be used [26, 27]. Each item was rated on a 4-point scale (1 = *strongly disagree* to 4 = *strongly agree*; $\alpha = 0.56$) and these ratings were averaged, with higher scores indicating more positive attitudes towards condom use. We used two items to assess attitudes towards pregnancy, with slightly different wording for female and male respondents: how they would feel if they found out today that they were pregnant/got a girl pregnant (1 = *very pleased* to 4 = *very upset*) and thinking about their life right now, how important is it to avoid getting pregnant/getting a girl

pregnant (1 = *not at all important* to 4 = *very important*). These items were correlated $r = 0.38$ and responses were averaged.

Partner and Relationship Characteristics

Seven variables were used to characterize the partner and the youth's relationship with this partner at the time of the most recent sexual event. Partner type was assessed by asking youth whether the partner was a spouse/boyfriend/girlfriend, a casual partner, or a need-based partner (defined as someone they had sex with because they needed money, food, a place to stay or something else). About 5% of the most recent sex partners were characterized as need-based and these cases were combined with casual partners for all analyses. Youth reported whether the event involved the first time that they had sex with this partner, how long they had known the partner (converted to number of months), whether it was a monogamous relationship at the time of the event, and (for males) whether it was a same-sex partnership. They also rated how much they trusted, at the time of the event, that their partner would not give them any kind of STI (0 = *less than completely* to 1 = *completely*). Finally, the relationship was classified as having a history of abuse if the respondent endorsed any of the following four items: the partner had ever hit, slapped, or physical hurt the respondent, called the respondent names or swore at them, or made them feel unsafe in the relationship, or the respondent had ever hit, slapped, or physically hurt the partner.

Context of the Sexual Event

In an earlier stage of this project, we conducted qualitative interviews with a separate sample of 30 youth recruited from five shelters and drop-in centers to identify important contextual features of sexual events that are relevant to youth's engagement in unprotected sex. Based on results from these qualitative interviews, we developed the following closed-ended questions for the present study (each coded as 0 = *no*, 1 = *yes*): Did they talk about using a condom just prior to having sex that time; was it a chance meeting or had they planned to meet up; was there something different or special about this event (e.g., had not seen each other in a long time, one of them was going away for awhile, one of them had just gotten paid); did they have sex in a place where they felt a need for more privacy or were concerned that others might see, hear or interrupt them during sex; and did they talk before or while having sex about "pulling out" before ejaculation. Additional items asked about the extent to which youth felt good emotionally before they had sex, felt so physically aroused that they could not think about anything else, and felt

pressured by their partner to do anything sexually that they did not want to do (1 = *not at all* to 4 = *quite a bit*). These items were dichotomized due to their skewed distribution (felt good and felt aroused: 0 = *somewhat or less* vs. 1 = *quite a bit*; felt pressured: 0 = *not at all* to 1 = *somewhat or more*).

Alcohol and Drug Use Before the Event

Respondents were asked four separate questions about whether they or their partner had drunk alcohol or used drugs within an hour or so before having sex that time (0 = *no*, 1 = *yes*). If a respondent indicated that substance use occurred, s/he was asked follow-up questions about the approximate number of drinks that were consumed and the type of drug that was used by each partner. We derived measures that combined respondent use and partner use to avoid multicollinearity in our models due to significant overlap in these reports: corresponding alcohol use (i.e., both partners used, both partners did not use) was reported in 91% of events, and corresponding drug use was reported in 89% of events. Further, there was a strong correlation ($r = 0.86$) between the number of drinks consumed by the respondent and the partner. We assessed alcohol use in terms of the maximum number of drinks consumed by either partner during the event (with nondrinking couples receiving a score of 0). We used two dummy-coded variables to assess drug use: whether the event involved marijuana use only (vs. no drug use) and whether the event involved any hard drug use (vs. no drug use) by either partner. Alcohol use was not considered in the derivation of the drug use variables. Respondents were also asked, in cases where respondents indicated that alcohol or drugs were consumed by either partner, the extent to which they thought that the substance use influenced whether a condom was used during the event (1 = *not at all* to 4 = *quite a bit*). Separate questions were asked with reference to the respondent's use of alcohol and drugs, and the partner's use of alcohol and drugs.

Demographic Covariates

These variables included biological sex, age, race/ethnicity, and educational attainment.

Statistical Methods

The use of a disproportionate random sampling technique and differential nonresponse rates require the use of design and nonresponse weights to represent the target population from the sample of respondents. All analyses incorporate these weights and account for the modest design effect that they induce, using the linearization method [28]. The small

amount of missing data for some variables (generally <1%) was accounted for by mean or modal value imputation. We conducted a series of logistic regression models, using the statistical package SAS 9.2, to identify predictors of unprotected sex at the last event. The base model included the three variables assessing alcohol and drug use at the event, as well as the four demographic characteristics. To this base model we then added each of three sets of variables (attitudes about condoms and pregnancy; relationship characteristics; and context characteristics) to examine how adjusting for each variable set affected the strength of associations between substance use and condom use.

Results

All sexual events occurred within the past 3 months, with 89% of most recent events occurring within a month of the interview. When asked how well they remembered the most recent event, 74% reported “very well,” 19% “fairly well,” and 7% “not very well.” Protected sex during the most recent sexual event was reported by 40.0% of the 309 youth. Nearly one-third (30.8%) of the events involved alcohol use. Overall, the maximum number of drinks consumed by either partner averaged 2.17 (SD = 6.69); only considering the events where alcohol was used, the maximum number of drinks consumed averaged 7.04 (SD = 7.44). Twenty-six percent of the events involved marijuana use only (i.e., no other drug use) and 7.6% involved any hard drug use. Of the 90 youth and 79 partners who used drugs at the event, marijuana was the drug most commonly used (respondents: 86.3%; partners: 77.0%), followed by speed or methamphetamine (respondents: 8.1%; partners: 14.6%), heroin (respondents: 3.3%; partners: 4.7%), cocaine (respondents: 2.8%; partners: 3.3%), and ecstasy (respondents: 2.1%; partners: 0.7%). See Table 1 for characteristics of the sexual events.

The analyses predicting condom use during the youth's most recent sexual event are presented in Table 2. Considering only the three indicators of substance use at the event, condoms were less likely to be used during sexual events involving hard drug use (OR = 0.30, 95% CI = 0.10, 0.89). Condom use was not significantly associated with marijuana use only or the maximum number of drinks consumed. The association between hard drug use and unprotected sex remained significant (OR = 0.31, 95% CI = 0.11, 0.92) after adding the attitudinal variables; in addition, having more positive attitudes towards condoms and being more concerned about pregnancy increased the likelihood that homeless youth would use condoms. The next model shows that the association between hard drug use and unprotected sex remained significant (OR = 0.17, 95% CI = 0.04, 0.75) after controlling for relationship

Table 2 Logistic regression analysis predicting condom use at most recent sexual event ($N = 309$)

Predictor variable	Substance use only	Substance use + attitude variables	Substance use + partner/relationship variables	Substance use + context variables	Full model
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Maximum number of drinks	0.98 (0.92, 1.05)	0.96 (0.89, 1.03)	0.95 (0.88, 1.02)	0.96 (0.89, 1.03)	0.92 (0.83, 1.01) [#]
Marijuana use, no hard drugs	0.91 (0.46, 1.77)	0.97 (0.48, 1.97)	0.65 (0.31, 1.36)	0.77 (0.36, 1.64)	0.65 (0.27, 1.60)
Any hard drug use	0.30 (0.10, 0.89)*	0.31 (0.11, 0.92)*	0.17 (0.04, 0.75)*	0.18 (0.04, 0.77)*	0.18 (0.04, 0.84)*
Positive condom attitudes		2.34 (1.45, 3.75) [‡]			2.37 (1.40, 4.04) [†]
Pregnancy concerns		1.69 (1.17, 2.44) [†]			1.50 (1.00, 2.25)*
Casual or need-based partner			3.63 (1.68, 7.85) [†]		3.00 (1.20, 7.50)*
First time they had sex			0.77 (0.30, 1.96)		0.80 (0.26, 2.44)
Relationship length (in mos)			1.00 (0.99, 1.01)		1.00 (0.99, 1.01)
Monogamous relationship			0.59 (0.30, 1.14)		0.52 (0.24, 1.13) [#]
Trust partner wouldn't give STI			0.95 (0.51, 1.74)		0.96 (0.46, 2.03)
History of abuse			0.57 (0.31, 1.05) [#]		0.52 (0.27, 1.02) [#]
Same-sex partner			0.72 (0.30, 1.76)		0.50 (0.16, 1.50)
Chance meeting				2.97 (1.57, 5.61) [‡]	2.78 (1.32, 5.86) [†]
Event was special in some way				1.28 (0.69, 2.39)	1.22 (0.59, 2.53)
Sex was in a non-private place				0.40 (0.21, 0.78) [†]	0.45 (0.21, 0.99)*
Talked about pulling out				0.41 (0.17, 0.98)*	0.27 (0.11, 0.69) [†]
Talked about condoms				5.60 (2.68, 11.72) [‡]	6.76 (2.69, 17.02) [‡]
Subject felt good emotionally				0.76 (0.39, 1.49)	0.89 (0.40, 1.95)
Subject felt extremely aroused				0.63 (0.32, 1.22)	0.78 (0.40, 1.55)
Subject felt pressured sexually				1.09 (0.37, 3.17)	1.05 (0.27, 4.05)

Note. All models control for gender, race/ethnicity, age, and education

[#] $p < 0.10$; * $p \leq 0.05$; [†] $p < 0.01$; [‡] $p < 0.001$

characteristics; in addition, condom use was more likely with a casual partner and marginally less likely ($p < 0.10$) if there was a history of relationship abuse. The second to last column shows that the association between hard drug use and unprotected sex remained significant (OR = 0.18, 95% CI = 0.04, 0.77) after controlling for the context of the sexual event. Several of these contextual factors were associated with condom use in their own right: homeless youth were more likely to use a condom if the sexual event was a result of a chance meeting or the couple talked about condom use prior to sex, but were less likely to use a condom if sex was in a non-private place or the couple talked about “pulling out” prior to sex.

When all of the variables shown in Table 2 were included in the same model, condom use remained less likely when the event involved hard drug use and was marginally less likely as the maximum number of drinks increased ($p < 0.10$). In addition, condom use was more likely if the youth held a more positive attitude about condoms, had greater concern about pregnancy, were with a casual partner, met up with the partner by chance, or talked about condoms prior to the event. Condom use was less likely if sex occurred in a non-private place or the couple had talked prior to sex about “pulling out,” as well as marginally less likely if the

relationship was viewed as monogamous or the couple had a history of abuse ($ps < 0.10$).

Given the significant association between hard drug use and unprotected sex, we examined whether youth who used hard drugs, or had a partner who used hard drugs, believed that the drug use affected whether a condom was used during the event. Among youth who used hard drugs, 20.62% believed that their drug use had at least some effect on whether a condom was used; 35.85% of those with a hard drug-using partner believed that his/her drug use had at least some effect on whether a condom was used.

Discussion

Forty percent of homeless youth in this study reported condom use during their last episode of sexual intercourse, compared with rates ranging from 55% (among 12th graders) to 64% (among 9th graders) in a national school-based sample [29]. One explanation for the relatively low rate of protected sex among homeless youth is that the disinhibiting effects of substance use impair their inclination or ability to use condoms. This explanation might seem reasonable given that two-thirds of homeless youth

are current drinkers or drug users [12]. However, demonstrating an event-level association between youth substance use and condom use has been surprisingly elusive in the literature, although few existing studies have focused on high-risk youth.

Similar to the results of Bailey and colleagues [20], substance use prior to sex was common in our sample, with one-third of events involving alcohol or drug use. Most of the drug use events involved methamphetamine which, along with alcohol, has received considerable attention for its disinhibiting effect on sexual behavior [30]. A key finding from this study is that condom use was less likely when hard drug use and, to a lesser extent, heavier drinking occurred prior to sex. In the case of hard drug use, a small number of prior event-based studies have reported a similar association [31, 32], but they have tended to include far fewer controls than the present study. Results from this study provide some of the strongest evidence to date that hard drug use increases the risk of unprotected sex, at least in certain populations. It is interesting to note that the majority of youth who reported on an event involving hard drug use did not perceive any connection between this behavior and whether a condom was used at the event, suggesting a need to target both the risk behavior (i.e., reducing hard drug use) and attitudes about the risk behavior (i.e., emphasizing its association with unprotected sex) in outreach efforts to homeless youth. In terms of alcohol use, the event-based literature has been mixed and several studies have not found the expected association with unprotected sex among youth in general [33, 34] or homeless youth in particular [20]. We found some evidence that heavier drinking prior to sex increases the likelihood of unprotected sex, but with two caveats: the association was marginally significant and it only emerged in the full multivariate model.

Our analyses controlled for individual, relationship, and contextual factors in evaluating the association between substance use and condom use. However, we were also interested in examining whether these other factors might predict condom use in their own right. In terms of attitudinal factors, youth were more likely to use a condom if they held more positive attitudes about condoms and were more concerned about pregnancy, similar to other studies of adolescents and young adults [19, 35]. The finding on pregnancy beliefs is particularly interesting given the high rate of pregnancy among homeless female youth [4, 5], qualitative data from this project indicating that pregnancy is sometimes viewed as a means of improving their lives (e.g., by becoming eligible for transitional housing, forming a closer bond with a partner, motivating them to make positive changes, and results from a national sample of runaway and homeless girls showing that pregnancy is related to a longer absence from family and feelings of abandonment [36]. These studies suggest that some

homeless youth may seek out parenthood because they view it as a panacea for the many challenges that they face, including feelings of disenfranchisement from their family of origin. Efforts to encourage condom use among homeless youth may need to address attitudes about pregnancy and parenthood, in addition to discussing the risk of HIV/STI associated with unprotected sex. In addition, the association we found between condom attitudes and protected sex indicates that helping youth find ways to use condoms without ruining the mood may encourage engagement in protected sex by increasing youth's positive attitudes towards condoms.

In terms of relationship characteristics, we found that condom use was significantly less likely if the most recent sex partner was a boyfriend/girlfriend and marginally less likely if the relationship was perceived to be monogamous. Similar results have been reported in other studies of unprotected sex among adolescents and young adults [19, 37] and thus not unique to homeless youth. While this is encouraging in that it suggests that these youth are basing their decisions about condom use at least partly on the perceived "riskiness" of their partner, it is also the case that some youth misjudge their partners and underestimate their risk of HIV/STIs. For example, slightly more than half of youth believed that they were in a monogamous relationship, but research on sexual concurrency indicates that individuals are often unaware when their partner has other partnerships [38]. It is likely that at least some of the youth who reported that their most recent partner was steady or exclusive should have been using a condom with this partner. We also found high rates of relationship abuse among homeless youth, and that being in such a relationship was marginally associated with a decreased likelihood of condom use. The inverse relationship between abuse and condom use is similar to what we have found in studies of homeless women [24, 39], and likely reflects the fact that individuals in abusive relationships are more fearful than those in non-abusive relationships that their partner will respond violently if asked to use a condom [40]. These results suggest that homeless youth may benefit from better understanding how they can protect themselves in different types of relationships—for example, ways to protect themselves (both physically and sexually) when a partner is prone to abuse, making sure that both partners get regularly tested for STIs if they decide to not use condoms, and how to re-introduce condoms into a relationship with a steady partner if the situation warrants it.

Finally, one of the most unique aspects of this study is our examination of contextual factors that might be useful in understanding condom use among homeless youth. Consistent with the existing literature [41], communication about condoms was an important predictor of actually using them. Perhaps more surprising is that one in four

couples talked about “pulling out” prior to having sex, and couples who had this conversation were significantly less likely to use a condom. Although this indicates some attention to pregnancy prevention on the part of homeless youth, the withdrawal method is not a reliable strategy for avoiding pregnancy (or STI transmission). Given that conversations about the use of this ineffective method appear to be relatively commonplace among homeless youth, sexual health promotion programs for this population may need to include a stronger focus on the withdrawal method in order to educate youth about its limitations.

Two other contextual factors emerged as predictors of condom use: whether the event involved a chance meeting and having sex in a non-private place. We expected that chance meetings would be associated with unprotected sex because of the unanticipated nature of the sexual event; indeed, other research has found that adolescents are more likely to use condoms when the sexual encounter was expected [34]. However, we found the opposite and further research is needed to understand this finding given that it remained after controlling for the various demographic, attitudinal, relationship, and contextual factors. Nearly one in three youth reported that their most recent sexual event occurred in a setting where they lacked privacy, and having sex in a non-private place decreased the likelihood of using a condom. The high rate of non-private sex is not surprising given that youth typically stay in settings that afford little privacy such as abandoned buildings/squats, outdoors, or a motel room rented with others [10]. We did not collect more detailed data to understand the ways in which the living environments of homeless youth, including the lack of privacy, impact their condom use and other aspects of sexual behavior. This seems to us a critically important direction for future research. Nonetheless, results from this study suggest that lack of privacy is a risk factor for unprotected sex that is unique to this population and important to address in programs aimed at encouraging condom use. This finding additionally reinforces the need to help youth create more stable living situations. Depending on the age and needs of the youth, avenues for enhancing living situations may include re-unification with family or guardians or permanent housing with supportive services as necessary.

An important strength of this study is the large probability-based sample of homeless youth recruited from shelters, drop-in centers, and street venues. The rigorous sampling design used for this study bolsters our confidence in the generalizability of these results to the population of homeless youth in the Los Angeles area (although not necessarily to other geographic areas). Examining the association of substance use with unprotected sex within the context of other individual, relationship, and contextual factors is an additional strength of this study. However, the

study also has some notable limitations. Measurement limitations include the low reliability of the condom attitudes scale, as well as reliance on retrospective self-report for information on the events. In the latter case, however, we attempted to minimize social desirability biases by assuring youth that their responses would be held confidentially, and to minimize memory biases by focusing on the most recent sexual event. Our confidence in the accuracy of these reports is bolstered by the fact that the majority of most recent events occurred within 1 month of the interview and were remembered “very well.” In terms of the associations between substance use and unprotected sex, it is a limitation that we cannot completely rule out that these are due to unmeasured third variables (e.g., propensity towards risk-taking), despite the wide range of individual, relationship and contextual factors that we examined. Finally, sampling multiple sexual events through a diary approach [19, 33, 34], although perhaps prohibitively challenging in studies of homeless youth, would have allowed us to investigate the co-occurrence of substance use and condom use over an extended period of time.

Efforts to reduce substance use among homeless youth, and educate them on the potential impact of their use on the ability to practice safe sex, may lower the risk of HIV/STIs and pregnancy by increasing the use of condoms. In addition, our results suggest that programs to encourage condom use should include a focus on helping youth form more positive attitudes about condoms, correcting erroneous beliefs about pregnancy and the withdrawal method, helping youth develop skills to negotiate condom use in different situations, and addressing the barriers to using condoms in the context of a living environment which affords little privacy. In the long-term, helping homeless youth to create more stable living situations may itself be an effective strategy for reducing HIV/STIs and teen pregnancy in this vulnerable population.

Acknowledgments This research was supported by Grant R01DA020351 from the National Institute on Drug Abuse. We thank the youth who shared their experiences with us, the service agencies that collaborated in the study, and the RAND Survey Research Group for their assistance in data collection.

References

1. Centers for Disease Control and Prevention. Sexual and reproductive health of persons aged 10–24 years—United States, 2002–2007. *Surveillance Summary* (July 17, 2009): MMWR, 58 (No. SS-6); 2009.
2. MacKellar DA, Valleroy LA, Hoffmann JP, et al. Gender differences in sexual behaviors and factors associated with nonuse of condoms among homeless and runaway youths. *AIDS Educ Prev*. 2000;12(6):477–91.

3. Tevendale HD, Lightfoot M, Slocum SL. Individual and environmental protective factors for risky sexual behavior among homeless youth: an exploration of gender differences. *AIDS Behav*. 2009;13(1):154–64.
4. Halcón LL, Lifson AR. Prevalence and predictors of sexual risks among homeless youth. *J Youth Adolesc*. 2004;33(1):71–80.
5. Ringwalt CL, Greene JM, Robertson MJ. Familial backgrounds and risk behaviors of youth with throwaway experiences. *J Adolesc*. 1998;21(3):241–52.
6. De Rosa CJ, Montgomery SB, Hyde J, Iverson E, Kipke MD. HIV risk behavior and HIV testing: a comparison of rates and associated factors among homeless and runaway adolescents in two cities. *AIDS Educ Prev*. 2001;13(2):131–48.
7. 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.
8. Baer JS, Ginzler JA, Peterson PL. DSM-IV alcohol and substance abuse and dependence in homeless youth. *J Stud Alcohol*. 2003;64(1):5–14.
9. Johnson KD, Whitbeck LB, Hoyt DR. Substance abuse disorders among homeless and runaway adolescents. *J Drug Issues (Fall)*. 2005;35(4):799–816.
10. Kipke MD, Montgomery SB, Simon TR, Unger JB, Johnson CJ. Homeless youth: drug use patterns and HIV risk profiles according to peer group affiliation. *AIDS Behav*. 1997;1(4):247–59.
11. Salomonsen-Sautel S, Van Leeuwen JM, Gilroy C, Boyle S, Malberg D, Hopfer C. Correlates of substance use among homeless youths in eight cities. *Am J Addict*. 2008;17(3):224–34.
12. Wenzel SL, Tucker JS, Golinelli D, Green HD Jr, Zhou A. Personal network correlates of alcohol, cigarette, and marijuana use among homeless youth. *Drug Alcohol Depend*. 2010;112(1–2):140–9.
13. Kral AH, Molnar BE, Booth RE, Watters JK. Prevalence of sexual risk behaviour and substance use among runaway and homeless adolescents in San Francisco, Denver and New York City. *Int J STD AIDS*. 1997;8(2):109–17.
14. Bryant KJ. Expanding research on the role of alcohol consumption and related risks in the prevention and treatment of HIV/AIDS. *Subst Use Misuse*. 2006;41(10–12):1465–507.
15. Leigh BC, Stall R. Substance use, risky sexual behavior for exposure to HIV. Issues in methodology, interpretation, and prevention. *Am Psychol*. 1993;48(10):1035–45.
16. Halpern-Felsher BL, Millstein SG, Ellen JM. Relationship of alcohol use and risky sexual behavior: a review and analysis of findings. *J Adolesc Health*. 1996;19(5):331–6.
17. Weinhardt LS, Carey MP. Does alcohol lead to sexual risk behavior? Findings from event-level research. *Annu Rev Sex Res*. 2000;11:125–57.
18. Cooper ML. Alcohol use and risky sexual behavior among college students and youth: evaluating the evidence. *J Stud Alcohol*. 2002;14(Suppl):101–17.
19. Bailey SL, Gao W, Clark DB. Diary study of substance use and unsafe sex among adolescents with substance use disorders. *J Adolesc Health*. 2006;38(3):297. e13–20.
20. Bailey SL, Camlin CS, Ennett ST. Substance use and risky sexual behavior among homeless and runaway youth. *J Adolesc Health*. 1998;23(6):378–88.
21. Bryan A, Ray LA, Cooper ML. Alcohol use and protective sexual behaviors among high-risk adolescents. *J Stud Alcohol Drugs*. 2007;68(3):327–35.
22. McMahon JM, Tortu S, Pouget ER, Hamid R, Neaigus A. Contextual determinants of condom use among female sex exchangers in East Harlem, NYC: an event analysis. *AIDS Behav*. 2006;10(6):731–41.
23. Tortu S, McMahon J, Hamid R, Neaigus A. Drug-using women's sexual risk: an event analysis. *AIDS Behav*. 2000;4(4):329–40.
24. Tucker JS, Wenzel SL, Golinelli D, et al. Is substance use a barrier to protected sex among homeless women? Results from between- and within-subjects event analyses. *J Stud Alcohol Drugs*. 2010;71(1):86–94.
25. Gillmore MR, Morrison DM, Leigh BC, Hoppe MJ, Gaylord J, Rainey DT. Does “high = high risk”? An event-based analysis of the relationship between substance use and unprotected anal sex among gay and bisexual men. *AIDS Behav*. 2002;6(4):361–70.
26. Bogart LM, Kral AH, Scott A, et al. Condom attitudes and behaviors among injection drug users participating in California syringe exchange programs. *AIDS Behav*. 2005;9(4):423–32.
27. Jemmott LS, Jemmott JB 3rd. Applying the theory of reasoned action to AIDS risk behavior: condom use among black women. *Nurs Res*. 1991;40(4):228–34.
28. Skinner CJ. Domain means, regression and multivariate analyses. In: Skinner CJ, Holt D, Smith TMF, editors. *Analysis of complex surveys*. New York: Wiley; 1989. p. 59–88.
29. Centers for Disease Control and Prevention. Youth risk behavior surveillance—United States, 2009. *Surveillance Summary (July 17, 2009)*: MMWR, 59 (No. SS-5); 2010.
30. Mansergh G, Purcell DW, Stall R, et al. CDC consultation on methamphetamine use and sexual risk behavior for HIV/STD infection: summary and suggestions. *Public Health Rep*. 2006;121(2):127–32.
31. Leigh BC, Ames SL, Stacy AW. Alcohol, drugs, and condom use among drug offenders: an event-based analysis. *Drug Alcohol Depend*. 2008;93(1–2):38–42.
32. Wilson PA, Diaz RM, Yoshikawa H, Shrout PE. Drug use, interpersonal attraction, and communication: situational factors as predictors of episodes of unprotected anal intercourse among Latino gay men. *AIDS Behav*. 2009;13(4):691–9.
33. Fortenberry JD, Orr DP, Katz BP, Brizendine EJ, Blythe MJ. Sex under the influence. A diary self-report study of substance use and sexual behavior among adolescent women. *Sex Transm Dis*. 1997;24(6):313–9.
34. Morrison DM, Gillmore MR, Hoppe MJ, Gaylord J, Leigh BC, Rainey D. Adolescent drinking and sex: findings from a daily diary study. *Perspect Sex Reprod H*. 2003;35(4):162–8.
35. Crosby R, Salazar LF, Diclemente RJ. Lack of recent condom use among detained adolescent males: a multilevel investigation. *Sex Transm Infect*. 2004;80(6):425–9.
36. Thompson SJ, Bender KA, Lewis CM, Watkins R. Runaway and pregnant: risk factors associated with pregnancy in a national sample of runaway/homeless female adolescents. *J Adolesc Health*. 2008;43(2):125–32.
37. Kiene SM, Barta WD, Tennen H, Armeli S. Alcohol, helping young adults to have unprotected sex with casual partners: findings from a daily diary study of alcohol use and sexual behavior. *J Adolesc Health*. 2009;44(1):73–80.
38. Drumright LN, Gorbach PM, Holmes KK. Do people really know their sex partners? Concurrency, knowledge of partner behavior, and sexually transmitted infections within partnerships. *Sex Transm Dis*. 2004;31(7):437–42.
39. Kennedy DP, Wenzel SL, Tucker JS, 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.
40. Kalichman SC, Williams EA, Cherry C, Belcher L, Nachimson D. Sexual coercion, domestic violence, and negotiating condom use among low-income African American women. *J Women's Health*. 1998;7(3):371–8.
41. Sheeran P, Abraham C, Orbell S. Psychosocial correlates of heterosexual condom use: a meta-analysis. *Psychol Bull*. 1999;125(1):90–132.