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BRIEF REPORT

Substance Use and Sexual Risk Behavior in HIV-Positive Men Who Have Sex With Men: An Episode-Level Analysis

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Abstract Men who have sex with men (MSM) make up nearly half of all people living with HIV in the United States. The prevalence of the epidemic in this population makes it vitally important to understand the transmission of the infection and to develop methods to prevent its spread. The current study uses longitudinal diary methods to examine relationships between substance use and unprotected anal intercourse in a sample of 158 HIV-positive, mostly ethnic minority MSM. Results indicate that both general substance use and use of specific drugs (i.e., inhalants, cocaine, crack, and club drugs) have a substantial impact on the sexual risk behavior of this population.

Keywords HIV · Men who have sex with men · Substance use · Sexual risk behavior · Situational analysis

Background

Men who have sex with men (MSM) make up nearly half of all people living with HIV in the United States, a shockingly high proportion given that they represent less than 5% of the population of the U.S. [1]. A recent study by the Centers for Disease Control and Prevention (CDC) found that nearly one in five MSM in 21 major urban centers were infected with HIV [1]. The prevalence of the epidemic in this population makes it vitally important to understand the transmission of the infection and to develop methods to prevent its spread.

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Several recent studies have shown that high-risk sexual behavior is linked to substance use. MSM are more likely to use multiple substances and are more likely to use substances during and before sexual episodes in an effort to enhance the sexual experience [2]. There is strong evidence that certain substances, such as methamphetamines and/or amyl nitrite ("poppers"), have particular sexual meanings for MSM, and these substances are the ones that may carry the greatest risk of unprotected intercourse and HIV transmission risk in this population [2, 3].

Prospective studies have shown that MSM who have a consistent history of substance use, specifically of amphetamines, amyl nitrite, and cocaine, were more likely to become infected with HIV [4, 5]. Use of these substances may make HIV-positive MSM more likely to have sex with serodiscordant partners, as well as making HIV-negative MSM less likely to determine their partner's HIV status before having sex—a recent study by Hatfield et al. [6] found that the use of amyl nitrite was positively associated with serodiscordant unprotected anal intercourse in MSM, and that MSM who used amyl nitrite also felt less confident about using condoms correctly and less supported by their peers in efforts to have safe sex.

Although the literature has quite extensively studied the links between substance use and sexual behavior in MSM, there have been relatively fewer studies of this link in HIV-positive MSM. An HIV transmission episode necessarily requires unprotected anal intercourse between an HIV-positive person and an uninfected partner. It is thus important to examine the relationship within this more specialized population, in order to develop interventions to reduce their risky behavior. Previous research has shown that although HIV-positive MSM typically attempt to reduce their substance use after being diagnosed with HIV, their substance use nonetheless contributes to high-risk

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sexual behavior, including unprotected intercourse [3, 7]. Substance use can also reduce medication adherence for HIV-positive MSM [8]. This not only threatens their health but also raises their viral load and makes it more likely that they will transmit the virus to others [8].

The following study explores associations between substance use and unprotected sexual intercourse in HIV-positive MSM. This study also uses sexual episodes as the unit of analysis in modeling the relationship between substance use and sexual risk behavior. Previous research has found that models of HIV risk behavior that a focus solely on personal factors, using cross-sectional methods, have been ineffective at explaining risk in and of themselves [9]. It is important that researchers also examine the factors linked to high-risk sexual situations—for instance, substance use within particular sexual episodes as opposed to average levels of substance use.

Methods

Participants

Participants were a convenience sample of 158 HIV positive men recruited in two waves between 2006 and 2009. They were all recruited from New York City, a diverse urban environment. In order to be eligible for the study, potential participants had to have access to a computer with Internet; a working, private e-mail address; and had to have had sex with another man in the 2 months prior to baseline. Participants were recruited mainly from clinics and community-based organizations (48%); others were recruited through participant referrals (39%) and ads placed in local media outlets that are tailored for and marketed towards gay men in the community (13%). Participants ranged in age from 20 to 61 years ($M = 39.3$, $SD = 9.8$). The sample was ethnically diverse, consisting of black (53%), Latino, (20%) and white (17%) men. The sample was also primarily low-income, with 70% reporting an annual income at or below $20,000. The majority of the sample (80%) reported having sex with more than one partner in the two months prior to baseline. The participants were paid $20 for the baseline survey, plus $4 to cover the cost of public transportation to the survey site. For subsequent weeks, participants earned between $5 and $15 per survey completed; the incentive structure was a progressive one, with participants earning larger amounts during the later weeks of the study as an incentive to remain in the study.

Instruments

Participants completed a 6-week Internet-based structured weekly sex diary. The structured diary asked participants about their sexual behavior and substance use in the previous week (e.g., "How many days did you use inhalants in the last 7 days?"; "Have you engaged in sexual intercourse anytime in the last 7 days?"). Those who reported engaging in sexual activity were asked to provide details of their most recent sexual episode, including whether or not they had used substances before or during the sexual episode (e.g., "How many sex partners whose HIV status you did not know have you had in the last 7 days?"; "Did you use drugs before the encounter?") Participants were asked about alcohol, marijuana, inhalants, crack, cocaine, heroin, club drugs, and methamphetamine use. Examples of what were considered "inhalants" (whippets, poppers, etc.) and "club drugs" ("Ecstasy, Special K, GHB") were included parenthetically in the item. Participants were instructed to complete the survey each week on the same day, with a grace period of 3 days. There was a 78% response rate across the 6 weeks of the structured diary, with response rates for individual weeks ranging from 77 to 88%. Participants completed an average of 5.22 weeks; the median number of weeks completed was 6. Participants who left the study after completing the baseline did not differ on risk variables from participants who contributed sexual episodes to the study.

Analyses

Mixed effects logistic regression analysis was used to examine the relationship between substance use during the most recent sexual encounter and unprotected anal intercourse in that same encounter. Mixed effects models allow investigators to treat the episode as the unit of analysis; they also can allow for individual-specific influences through the use of random effects. This technique was also used to examine the relationship between substance use during the most recent sexual encounter and the occurrence of an STI transmission risk episode and/or an HIV transmission risk episode. Mixed effects logistic regression analyses were also used to examine which individual substances were associated with episodes of unprotected anal intercourse (UAI), and to examine whether or not use of multiple substances influenced unprotected intercourse. A separate mixed-effects logistic regression analysis was conducted to determine whether alcohol was associated with UAI. Race and age were used as covariates in all models, as there is evidence in the literature that differing racial/ethnic and age groups have different levels of use for each of the individual substances [10].

Results

Participants reported a total of 405 sexual episodes. Eighteen (18) participants did not report any sexual activity

over the entire 6-week period; these participants and the 140 sexually-active ones did not differ on demographic variables. Each sexual episode was categorized according to whether unprotected anal intercourse (UAI) occurred during the episode; UAI was reported in 47% of sexual episodes. Thirty-three (33%) percent of the episodes were categorized as STI transmission risk episodes, which was defined as an episode of UAI with a non-monogamous partner; 15% of the episodes were categorized as HIV transmission risk episodes, which was defined as UAI with an HIV-negative or unknown status partner.

Alcohol was measured separately from illicit substance use in this sample. Thirty-nine percent (39%) of the sexual episodes involved alcohol use before or during the most recent sexual encounter, and there was no significant association of alcohol use with unprotected anal intercourse, $B = 0.10$, $P = 0.74$.

Substance use was reported before or during 22.6% ($N = 175$) of the sexual 405 episodes collected. Of the episodes with substance use reported, 67.4% of those episodes involved marijuana use, 37.7% involved inhalant use, 12.6% involved cocaine use, 21.7% involved crack use, 2.3% involved heroin use, 12% involved club drug use and 18.9% involved methamphetamine use.

Mixed effects logistic regression analysis revealed that substance use before or during a sexual encounter was significantly associated with unprotected anal intercourse, $B = 0.59$, $P < 0.05$. When participants reported substance use before or during their most recent sexual encounter, their odds unprotected anal intercourse increased by 1.9 compared to when they did not use substances before or during the encounter [95% CI 1.34–2.43]. This corresponds to a 16% increase in the probability of unprotected anal intercourse. Race and age were significant covariates in this model, with white men ($B = 1.29$, $P < 0.01$) and younger men ($B = -0.04$, $P < 0.05$) being more likely to have unprotected anal intercourse.

STI transmission risk episodes, defined as unprotected anal intercourse with a non-monogamous partner, were also significantly associated with substance use before or during the most recent sexual encounter, $B = 0.77$, $P < 0.05$. The odds of an STI transmission risk episode increased by 2.13 when substances were used before or during the most recent sexual encounter, as compared to when substances were not used [95% CI 1.58–2.87]. This corresponds to an 18% increase in the probability of an STI transmission risk episode. Race, measured as non-white versus white racial identity, and age were again significant covariates in this model, with white men ($B = 1.58$, $P < 0.01$) and younger men ($B = -0.04$, $P < 0.05$) being more likely to have unprotected anal intercourse. There was no significant association between substance use and HIV transmission risk episodes, $B = 0.86$, $P = 0.79$.

The odds and 95% confidence intervals for the effects of individual substances are presented in Table 1. On weeks in which individual substances were used before or during the most recent sexual encounter, the odds of unprotected anal intercourse increased for all substances. The increase in probabilities ranged from a 12% increase (marijuana) to a 47% increase (club drugs). Race and age were significant covariates in all of these models, with the coefficients for race ranging from 1.16 to 1.49, and the coefficient for age universally remaining at -0.04, all ps < 0.05.

There was multi-drug use in 49% of the substance use episodes. Of these multi-use episodes, 66% involved the use of just two substances; 20% involved the use of 3 substances; and 15% involved the use of 4 or more substances at once. The use of multiple substances before or during the most recent sexual encounter was significantly associated with unprotected anal intercourse, $B = 0.49$, $P < 0.01$. As more substances were used combined together, participants' odds of having unprotected intercourse increased by 1.62 with each additional substance they used prior to or during their sexual encounter. This corresponds to an increase of 62% per substance used.

Discussion

In this sample, substance use before or during the most recent sexual encounter was associated with unprotected anal intercourse during that encounter. Inhalants, cocaine, crack, and club drug use were also associated with unprotected anal intercourse.

Inhalants are particularly popular among HIV-positive MSM. MSM may use inhalants to enhance sexual experiences or reducing sexual discomfort during anal intercourse episodes [10]. The use of inhalants, however, seems to be strongly associated with unprotected anal intercourse [3]. Given its popularity in the sample—41 percent of the sample had used inhalants in the two months prior to the study—future research should pay specific attention to the use of inhalants among HIV-positive MSM.

There has been a declining focus on crack in studies of HIV-positive MSM and substance use, perhaps because of a perception of declining popularity among MSM. However, almost a quarter of this sample had used crack cocaine during the 2 months prior to baseline, and about 5% of sexual episodes included crack use, more than methamphetamines and club drugs. The prevalence of crack use in this sample could be due to the higher number of African American men in the sample, who were more likely to use crack than white and Hispanic men. The results of this study indicates that crack may have a powerful association with HIV and STI transmission in HIV-positive MSM—particularly African American HIV-positive

Table 1 Individual substances used before most recent sexual encounter and unprotected anal intercourse

Variable	Unstandardized coefficients (*B*)	Odds ratio	95% CI	Probability increase (%)
Marijuana	0.44	1.55	1.13–2.15	12
Inhalants	1.23	3.41	2.16–5.39**	28
Cocaine	1.77	5.85	2.69–12.74*	36
Crack	1.37	3.95	2.23–6.96**	30
Methamphetamines	1.10	3.00	1.68–5.36	26
Club drugs	2.38	10.79	3.57–32.57*	47

* $P < 0.05$, ** $P < 0.01$

MSM—and that researchers would do well to consider that effect when designing studies that include African American men.

The substances that had the strongest association with unprotected anal intercourse were all stimulants, and there has been a connection between stimulant use and sexual risk behavior in past cross-sectional studies of this population [11]. HIV-positive MSM may also use stimulant drugs to mitigate feelings of depression, feelings that may in turn cause them to have unprotected sex. There is support for this in the literature, specifically the McKirnan and Peterson hypothesis that MSM may be finding faulty ways to cope with the stress of having a concealable stigma [12]. MSM, particularly HIV-positive MSM, may also engage in substance use in an effort to escape feelings of shame or alienation from communities [12]. Research is therefore necessary to determine whether substance use, particularly stimulant use, is associated with mental health in this population; this information would be useful in designing interventions to decrease substance use in HIV-positive MSM.

In addition to this, the use of multiple drugs has a significant association with unprotected anal intercourse. As noted in the introduction, MSM are more likely to use multiple substances than heterosexual men, often in an effort to enhance the sexual experience [2]. Occasionally, particular combinations of substances are meaningful in specific subcultures or enclaves. The results presented here suggest that multiple drug use may be quite dangerous for HIV-positive MSM, as it is associated with higher rates of unprotected anal intercourse. Future research into substance use and sexual behavior in this population should examine links between multi-drug use and risk behavior, particularly specific combinations of substances and their connections with sexual risk.

In sum, this study revealed that there is a strong connection between the use of substances and unprotected anal intercourse on an episodic level. This study also demonstrates the value of a situational analysis of health risks in HIV-positive MSM. Previous studies at the person-level have provided evidence for links between substance use and unprotected intercourse; however, few of those studies examine factors specifically linked to each sexual episode rather than to characteristics of a person.

This study is limited by the relatively small sample size recruited through convenience sampling methods. The findings may not be generalizable to all MSM with HIV, given the convenience sample and concentrated urban area from which the participants were recruited. In addition, although longitudinal methods were used to obtain these data, these data do not allow for the establishment of causal links between substance use and unprotected anal intercourse. Further research should continue the use of more sophisticated longitudinal designs to uncover causal links between these variables. Despite its limitations, this research presents a more nuanced understanding of situational risk among MSM with HIV.

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