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Comparison of substance use and risky sexual behavior among a diverse sample of urban, HIV-positive men who have sex with men

Laura A. Hatfield¹, Keith J. Horvath², Scott M. Jacoby³, and B. R. Simon Rosser²

¹Division of Biostatistics, University of Minnesota School of Public Health, Minneapolis, MN

²Division of Epidemiology and Community Health, University of Minnesota School of Public Health, Minneapolis, MN

³Program in Human Sexuality, University of Minnesota Medical School, Minneapolis, MN

Abstract

Aims—To measure substance use across racial and ethnic subgroups of HIV-positive men who have sex with men (MSM), model associations between drug use and unsafe sex, and characterize users of the substances most strongly associated with risky sexual behavior.

Design—Cross-sectional survey at the pre-intervention time point of the Positive Connections behavioral intervention trial.

Setting—HIV-positive men of color who have sex with men living in six US cities.

Participants—675 trial participants.

Measurements—Self-reported drug and alcohol use and sexual behaviors.

Findings—We found high prevalence of substance use in this sample, with differences across racial and ethnic groups. Compared to Hispanic, African American, and men of other or mixed races/ethnicities, Caucasian men were most likely to report use of stimulants (30%), methamphetamines (27%), and amyl nitrite inhalants (“poppers”, 46%) with anal sex. African American men reported crack/cocaine use in the highest proportion (38%) among the four groups. While many drugs were individually associated with serodiscordant unprotected anal intercourse (SDUAI), only alcohol quantity and poppers with sex were retained in a multivariate model. More frequent poppers use was associated with more reported instances of SDUAI, adjusted for increased anal sex. Men who used poppers were more likely to be white, have completed more education, and have slightly higher income than non-users. Poppers users also reported lower peer norms and self-efficacy for condom use. In a multiple logistic regression model including these psychosocial factors, only poppers use (vs non-use OR = 2.46, CI: 1.55, 3.94) and condom self-efficacy (1 sd increase on scale OR = .58, CI: .46, .73) were significantly associated with SDUAI.

Conclusion—These results, from a large sample of HIV-positive MSM of color, highlight the HIV transmission importance of drugs used specifically in conjunction with sex.

Keywords

Homosexuality; Male; Street Drugs; HIV Seropositivity; Sexual Behavior

INTRODUCTION

Substance use is a well-established risk factor for HIV transmission behaviors among men who have sex with men (MSM) [1–3]. Drugs and alcohol may be associated directly and indirectly with high risk sexual behavior by serving as facilitators to increase the frequency of sexual interactions and disinhibit otherwise controlled behaviors, occurring within interpersonal and social contexts (e.g., circuit parties) that support risky behaviors, or via association with a third common factor, such as sensation seeking [4]. For example, HIV-positive MSM report use of methamphetamine to avoid conflict, unwanted emotions, and social pressures, particularly using the drug in sex-seeking environments [5].

In response to initiatives by the Centers for Disease Control and Prevention (CDC) to prioritize risk reduction among HIV-positive MSM (HIV+ MSM) [6], greater efforts to understand correlates of sexual risk behavior, including substance use [7] and psychosocial factors [8], for this population have been made. However, little is known of the prevalence of alcohol and drug use across racial and ethnic subgroups of HIV+ MSM, and studies of the association between substance use and HIV transmission behaviors among HIV+ MSM yield divergent results. The aims of this study are to address both gaps in understanding.

HIV+ MSM report high rates of substance use [9]. Nearly two-thirds (64%) of HIV+ MSM living in San Francisco and New York City enrolled in the Seropositive Urban Men's Study (SUMS) reported alcohol use in the past three months, and 36% marijuana use [10]. Amyl nitrite inhalants ("poppers," 27%), cocaine (13%), and methamphetamine (12%) were also commonly reported substances. Similar rates of drug use were found in the follow-up Seropositive Urban Men's Intervention Trial (SUMIT; alcohol=76%; marijuana=42%; amyl nitrite=26%; cocaine=18%; methamphetamine=10%). The erectile dysfunction medication sildenafil (trade name "Viagra") was used by 12% of men in SUMIT [7].

Recent research has focused on so-called 'club drugs' as risk factors for HIV transmission, but findings on specific drug types are inconsistent. Many show that unprotected sexual intercourse in largely HIV-negative or serostatus unknown MSM samples is associated with illicit drug use [11–17], including ketamine (K) [7], gamma hydroxybutyrate (GHB) [7], methamphetamines [1,2,7], barbiturates/tranquilizers [7], poppers [1,2,7,18,19], cocaine [1,2], and ecstasy [18].

Results specific to HIV+ MSM are sparse. Among those who practice seroconcordant unprotected sex, substance use is reported more commonly than among those who do not [20]. Specifically, the authors noted associations with stimulants, barbiturates, cocaine, ketamine, poppers, and GHB. Drug users in that study reported significantly more acts of SCUAI than non-users (average 6.5 acts vs 2.3 acts in 3 months). HIV-positive injection drug using MSM have been shown to engage in unsafe sex within the context of intimate serodiscordant partnerships as well the drug and sex economy [21]. Significant associations have been reported between substance use and unsafe sex in a sample of HIV+ MSM recruited from an alcohol dependence treatment program [22].

Some studies show an association between UAI and only one drug type. Of particular interest in the context of the present study are those showing associations with amyl nitrite inhalants [23–28]. In one large sample of circuit party attendees ($n=1,169$), only use of poppers was significantly associated with unsafe sex in the previous 12 months among eight party drugs investigated [27]. Results of the SUMS trial also showed that only poppers use was predictive of unprotected anal intercourse with secondary partners, with odd ratios of 4.0 (95% CI: 1.9, 8.3) for receptive serodiscordant unprotected anal intercourse (SDUAI) and 2.1 (95% CI: 1.1, 4.1) for insertive SDUAI [28,29]. Neither of these studies sought to characterize popper users compared to non-drug users or drug users who did not report

poppers. Lampinen and colleagues point to a lack of attention to poppers in contemporary HIV prevention programs [24], despite evidence that use remains common and is associated with increased risk of seroconversion [25,26].

Possible explanations for divergent results are variations in substance use patterns by HIV status, race/ethnicity, and geographic region. Studies of racially diverse samples of predominantly HIV-negative or unknown status MSM show group differences in substance use [30–34]. For example, a recent study by Grov and colleagues found that Asian/Pacific Islander MSM were less likely than their African American, Caucasian, Latino and Multi-racial counterparts to report a lifetime use of cocaine, marijuana, and poppers [35]. In the same study, African American men had the lowest likelihood of ever using methamphetamine, K, and GHB. Variation in drug use among racially and ethnically diverse MSM have not been reported universally [36], and little is known about whether such differences extend to samples of HIV+ MSM.

The Positive Connections study is a six-city, three-arm randomized controlled trial of behavioral interventions designed to reduce unsafe sex in HIV+ MSM. In this paper, we report the baseline substance use, sexual, and psychosocial characteristics of Positive Connections participants. The primary aims of this paper are to 1) examine racial and ethnic differences in substance use, 2) model the relationship between substance use and SDUAI, and 3) characterize the men who use substances strongly associated with unsafe sexual behavior in aim 2. This study is significant in that participants represent one of the largest ethnically diverse, urban samples of HIV+ MSM to be collected.

METHODS

Recruitment

Community-based organizations (CBOs) in each of the study cities (Seattle, WA; Washington, D.C.; Boston, MA; New York City, NY; Los Angeles, CA; and Houston, TX) recruited a convenience sample emphasizing men of color. CBOs utilized printed materials distributed at gay venues and events, referrals through agency service providers, and information-sharing with other HIV/AIDS CBOs in the community in their recruiting efforts.

Participants

Participants were at least 18 years old, self-identified as MSM, and reported at least one instance of unprotected anal intercourse (UAI) with another man in the last year.

Measures

On the baseline questionnaire, participants were asked to report on substance use during the preceding three months. First, they were asked about the frequency of alcohol consumption and the number of drinks consumed on a usual day of drinking. Participants also reported the frequency (on seven-point Likert-type scales) of use of the following drugs: marijuana, cocaine/crack cocaine, stimulants (e.g., methamphetamine), hallucinogens (e.g., LSD, mescaline, PCP), depressants (e.g., barbiturates, tranquilizers), club drugs (e.g., Ecstasy, GHB, rohypnol), opioids (e.g., heroin, methadone, etc.), and Viagra (sildenafil citrate). Separately, participants were asked about the frequency of substance use before or during anal sex. Alcohol, poppers (amyl nitrite inhalants), Viagra, crystal methamphetamine, and ‘other drugs’ (with a blank for participants to specify) were characterized on a four-point scale (never, rarely, sometimes, and always). Two questions dealt with injection drug use (injection drug use yes/no, and number of times sharing a needle). A variable for the count of drugs used (excluding marijuana and Viagra) with one possible additional point for

injection drug use was computed from the individual frequency questions (range: 0 to 8). Participants were asked whether they felt they had a problem with alcohol or drug use (separately), either currently or in the past.

Sexual behavior reporting was done separately for primary and secondary (casual) partners. Participants reported the number of acts of the following types of behavior in the preceding three months: unprotected receptive and insertive anal intercourse, protected receptive and insertive anal intercourse, and “other sex” (oral sex, mutual masturbation, etc.). By combining these data with the reported serostatus of those partners, we calculated the total number of acts of unprotected anal intercourse (UAI) with serodiscordant (i.e., HIV-negative or HIV-unknown) partners, referred to here as SDUAI. Analyses utilized this count measure as well as a dichotomization into zero or at least one act of SDUAI.

A 14-item, Likert-type scale [37] was used to measure Bandura’s [38] concept of self-efficacy with respect to using condoms in multiple situations and settings. High scores indicate more self-efficacy. Peer condom norms were reported using a three-item, Likert-type scale measuring the attitudes of the participants’ friends to using condoms [37]. High scores indicate attitudes that support using condoms in multiple contexts. We used a six-item, Likert-type sexual comfort scale to measure comfort with sexuality and one’s body [37]. High scores indicate more sexual comfort.

Statistical Methods

Comparisons of substance use by race were done by Pearson Chi-square tests of independence in contingency tables. Kruskal-Wallis Chi-square tests were used for comparison of count/continuous variables across levels of a factor. For analysis of the binary SDUAI variable, we utilized logistic regression to model the relationship with drug use variables. Drug use variables were collapsed into any use (=1) or no use (=0) in the last three months. Men who reported no use of any individual drugs were considered “non-users.”

Throughout, we have required case-wise complete data for all variables in a model. Comparison of included and excluded cases indicated significant differences, reported below. Negative binomial regression was used to model the relationship of count of SDUAI acts with substance use. This method proved superior to Poisson regression because of the ability to estimate a separate dispersion parameter for these skewed, over-dispersed count data. Analyses were carried out with SAS 9.1 for Windows (SAS Institute, Cary, NC).

RESULTS

Demographics

Our sample comprised 45% ($n=300$) African American, 23% ($n=157$) Latino/Hispanic, 25% ($n=168$) Caucasian, and 7% ($n=44$) multiple or other race/ethnicity. The average age was 42 years ($SD = 8.2$), and 60% ($n=405$) of the men had completed some post-secondary education, including 23% ($n=152$) with at least a bachelor’s degree. Despite the relatively high educational attainment, men reported low levels of employment; 28% ($n= 185$) were employed full- or part-time, while most ($n= 322$, 48%) were unemployed and collecting disability benefits. Half of the men reported \$10,000 or less in annual income.

Substance Use

Overall substance use—Alcohol use was common ($n=471$, 71%), but half of drinkers ($n=248$, 53%) reported drinking less than weekly (see Table 1). Among those who used alcohol, the median number of drinks was 3 (IQR: 2–5). Most men ($n=499$, 74%) reported drug use in the three months preceding baseline. Prevalence was highest for marijuana

($n=274$, 41%), crack/cocaine ($n=196$, 30%), and Viagra ($n=176$, 26%). More men reported having current problems with drug use ($n=78$, 13%) than problems with drinking ($n=54$, 8%), though the number reporting a problem in the past was similar for drugs ($n=131$, 21%) and alcohol ($n=142$, 22%).

We note significant missing data on questions about substance use with sex, ranging from 155 (23%) on 'other' to 66 (10%) on the alcohol question. Among substances used before or during anal sex, alcohol ($n=297$, 49%) and poppers ($n=182$, 32%) were the most common, followed by Viagra ($n=135$, 24%), 'other' drugs ($n=126$, 24%; usually specified as marijuana, $n=64$, or crack/cocaine, $n=66$), and methamphetamines ($n=91$, 16%).

In the multiple logistic regression of SDUAI on substance use reported below, case-wise complete data requirements resulted in a substantial number of excluded cases ($n=148$ for the full model, $n=131$ for the reduced model). Compared to included men, those excluded from the full model were significantly more like to report meth with sex (45% vs 14%, Pearson's χ^2 22.5, 2 d.f., $p<.001$), poppers with sex (61% vs 30%, Pearson's χ^2 15.6, 2 d.f., $p<.001$), and SDUAI (54% vs 41%, Pearson's χ^2 7.3, 2 d.f., $p<.01$). These differences arise because missing data on drugs with sex questions were the most common reason for exclusion.

Multiple drug use was common in this sample, though the only Pearson correlation greater than 0.5 among the drugs considered in the multivariate model was between the binary meth with sex and the binary stimulant use variable ($r=.76$). The greatest correlations with poppers use were meth ($r=.41$) and meth with sex ($r=.36$).

Substance use by location—Substance use across cities varied significantly for all drugs considered in Table 3 except club drugs and alcohol frequency. The five degree of freedom Pearson chi-square tests below only identify that some difference exists by city. For brevity, we report only the test statistic and the observed proportion in the city with the highest prevalence. Seattle had the highest proportion of men reporting use of marijuana (51%, Pearson's χ^2 12.4, $p<0.05$), stimulants (29%, Pearson's χ^2 28.4, $p<.001$), and meth with sex (34%, Pearson's χ^2 37.4, $p<.001$), while men in Boston reported using crack/cocaine (35%, Pearson's χ^2 13.4, $p<.05$) and poppers with sex (39%, Pearson's χ^2 10.1, $p=.07$) in the greatest numbers. For comparison, the overall drug use percentages are given in the first column of Table 2. City was not a significant predictor or confounder in the multivariate substance use model of SDUAI risk, but we include it in the model adjusted for sociodemographic factors below.

Substance use by race/ethnicity—Prevalence of substance use differed by race/ethnicity (Table 1). Caucasians had higher count of drugs used (median: 1, IQR: 1, 3) and were most likely of any group to report use of stimulants ($n=49$, 30%) and poppers ($n=72$, 46%) and methamphetamines ($n=42$, 27%) before or during sex. African American men reported the greatest prevalence of crack/cocaine use ($n=115$, 38%). Use of methamphetamines with anal intercourse also was commonly reported by men of other/multiple ethnicities ($n=9$, 23%).

Characteristics of poppers users—We sought to further characterize those men who reported using poppers before or during anal sex ($n=182$, 27%) and compare them to those who reported other drug use but no poppers use ($n=288$, 43%), and men who reported no drug use ($n=205$, 30%; see Table 2). Poppers users were more likely to report some college education (Pearson χ^2 16.5, d.f. = 2, $p<0.005$), slightly higher annual income (Kruskal-Wallis χ^2 6.4, $p<0.05$), and white ethnicity (Pearson χ^2 25.5, d.f. = 6, $p<0.001$). In addition, popper users had lower median scores on the condom self-efficacy scale (Kruskal-Wallis χ^2

22.8, $p < 0.001$) and the peer condom norms scale (Kruskal-Wallis χ^2 13.8, $p < 0.002$), but did not differ on the sexual comfort scale from the other groups.

Substance Use and SDUAI

To investigate individual alcohol and drug variables associated with the binary SDUAI outcome, we began with simple logistic regression models that included adjustment for total instances of anal intercourse (AI), $\log_e$ -transformed, with a dummy value of 0.5 for men who reported no anal intercourse ($n=136$, 20%). In these analyses, drug variables significantly associated with SDUAI were alcohol frequency, alcohol quantity, count of drugs used, marijuana, cocaine, stimulants, club drugs, poppers with sex, and methamphetamines with sex (see left columns in Table 3).

A combination of score-based stepwise variable selection methods, likelihood ratio tests, and examination of variable interrelationships yielded a reduced model. In this, poppers with sex and alcohol quantity were significantly associated with SDUAI after adjusting for AI (see middle columns of Table 3). Reducing the sample to exclude men who reported no anal intercourse ($n=435$) yielded similar parameter estimates (popper use with sex: OR=2.17, 95% CI: 1.41, 3.32; alcohol drinks per day: OR=1.08, 95% CI: 1.01, 1.16).

From a combined logistic regression of binary SDUAI on substance use, the sociodemographic factors in Table 2, and city (adjusted for log AI), we used the same model selection techniques to yield a reduced model containing condom self-efficacy, city, and poppers (see right columns of Table 3). The effect of city was driven by the increased risk in Seattle. The estimated odds ratios (and 95% confidence intervals) for each city versus the baseline city, DC, were 4.09 (1.74–9.9) for DC, 1.02 (0.42–2.5) for Boston, 1.06 (0.54–2.1) for NYC, 1.25 (0.62–2.5) for LA, and 1.49 (0.70–3.2) for Houston.

In the full sociodemographic and substance use model, complete data requirements excluded 308 cases, while the reduced model excluded 180. Compared to the analyzed cases, men excluded from the reduced model were significantly less likely to be white (13% vs 29%, Pearson χ^2 17.9, 3 d.f., $p < .001$) and report college education (51% vs 64%, Pearson χ^2 8.8, 1 d.f., $p < .01$), had lower income (median \$10k vs \$11.3k, Wilcoxon W 33106, $p < 0.01$) and were more likely to report unsafe SDUAI (51% vs 42%, Pearson χ^2 3.9, 1 d.f., $p < .05$).

Analyses of Popper Use and Sexual Risk

Because of the strong and significant association between sex-related popper use and SDUAI, more extensive analyses of poppers use were performed.

Frequency of poppers use and SDUAI—Men who reported at least one instance of AI and provided data on poppers ($n=452$, 67%) were analyzed as a subgroup. More frequent use of poppers was associated with greater reported AI (Kruskal-Wallis χ^2 23.8, 3 d.f., $p < 0.001$). We examined sexual behavior across four levels of poppers frequency: never ($n=284$, 63%), rarely ($n=52$, 12%), sometimes ($n=84$, 19%), and always ($n=32$, 7%). Median reported AI in each group was 10 (IQR: 4–20), 10.5 (IQR: 4.5–22), 18 (IQR: 9–31), and 22.5 (IQR: 11.5–29.5), respectively. This pattern of more frequent sexual behavior among men who used poppers more often also held for our benchmark unsafe behavior, SDUAI. Among those men who reported any SDUAI ($n=237$, 52% of this sub-sample), the median numbers of reported SDUAI acts in each poppers use frequency group were: never=4 (IQR: 1–8.5), rarely=5 (IQR: 2–9), sometimes=6 (IQR: 2–14), and always=7 (IQR: 2–13.5).

To isolate the relationship between popper use and unsafe sex, we performed negative binomial regression on the count of SDUAI, adjusted for log AI as an offset term. The 4-level popper frequency factor was significant overall (Likelihood Ratio χ^2 15.1, 3 d.f., $p < 0.002$), with individually significant coefficients for 'rarely' (LR χ^2 0.75, 95% CI: 0.30, 1.24) and 'always' (LR χ^2 0.68, 95% CI: 0.16, 1.27) versus the baseline category, 'never.'

We hypothesized that strategic positioning in this population might skew behavior in favor of participants acting as the receptive partner during unprotected sex with serodiscordant partners, possibly confounding associations of SDUAI with poppers use. We sought to examine whether poppers use was serving as a marker for strategic positioning in our sample. Sixty-five men (10%) reported insertive SDUAI only, 112 (17%) receptive only, 120 (18%) both, and the remaining 378 (56%) no SDUAI. We created separate binary variables for SDUAI as the receptive or insertive partner. Separate logistic regressions of these two new variables onto popper use, adjusted for log AI, yielded similar risk estimates to that obtained in the original logistic regression on SDUAI. That is, poppers use was equally associated with overall SDUAI, receptive SDUAI, and insertive SDUAI.

DISCUSSION

Alcohol and drug use in the past three months was common in this sample of HIV+ MSM, with one-third of men reporting alcohol consumption at least once a week and 30% or more of men reporting powdered/crack cocaine, popper, or marijuana use. These findings add to earlier reports from the SUMS, SUMIT, and other studies showing high rates of alcohol and drug use among HIV+ MSM samples [37]. Similarly, a sample of men recruited by Clatts and colleagues from among attendees of a POZ party (designed to facilitate sex among HIV-positive MSM) showed high proportions of men reporting substance use [39,40]. That sample comprised mostly (70%) White men, with 15% Hispanic/Latino and only 6% Black. Drugs commonly reported being used in the 3 months prior to data collection included powder cocaine (11%), methamphetamines (18%), MDMA (16%) and ketamine (9%). The latter two would be grouped under "club drugs" in the present study. As expected, such a "party and play" sample reported higher use of these substances than ours; however, the meth use percentages are similar. Powder cocaine figures cannot be directly compared to the present results, which combine crack and powder cocaine. A third of men in the POZ party group reported drug use during their last sexual encounter outside of a POZ party.

Few comparisons of substance use rates across racial and ethnic groups using samples of HIV+ MSM have been reported. Drug use was unevenly distributed across race and ethnicity in the current sample, with cocaine/crack reported most frequently by African American men, and popper and stimulant (including methamphetamine) use highest among Caucasian participants. Although studies of MSM show varying rates of drug use across racial and ethnic groups [31,34,35], these results from MSM populations cannot necessarily be extended to HIV+ MSM.

Recent calls for the re-examination of poppers as a risk factor for UAI and inclusion of education regarding risks associated with popper use in HIV prevention programs have been made [24]. In the current study, popper use emerged as the substance use factor most associated with SDUAI, after adjusting for sociodemographic and psychosexual variables and despite evidence that drugs such as methamphetamines are associated with seroconversion [41]. It is important to note that by controlling for level of sexual activity in our analyses, we identified excess risk beyond simply increased sexual activity among poppers users. Results from the SUMS study, which also recruited a large and racially/ethnically diverse sample of HIV+ MSM [28,29], were similar and suggest that HIV+ MSM may be particularly vulnerable to unsafe sexual behavior in the context of popper use.

A comparison of the sociodemographic and psychosexual profiles of HIV+ MSM popper users to groups of men reporting no drug use and non-popper drug use showed the former were more likely to be white, have more education, and higher incomes; however, popper users reported lower condom self-efficacy and peer norms for using condoms than men in the other two groups. Thus, HIV+ MSM popper users have a unique sociodemographic profile compared to other drug users. This group may be vulnerable to engage in unprotected intercourse via unique psychosexual factors. In the final multivariate model, condom self-efficacy significantly modified the association between popper use and SDUAI. It has been suggested that drug use operates on unsafe sex by decreasing condom self-efficacy and thereby decreasing condom use with secondary partners of HIV+ MSM [42]. Given that popper users had lower condom self-efficacy than non-users and non-drug-users in the study, this suggests that interventions are needed to directly heighten self-efficacy of HIV+ MSM who use poppers.

The limitations of this study relate primarily to the design. Cross-sectional, individual-level, observational data are insufficient to directly test causal theories about the relationship between substance use and unsafe sex. Data collection using relatively unsupervised paper questionnaires did not allow for immediate verification of data completeness or consistency. Therefore, complete data requirements resulted in exclusion of large numbers of participants. These men differed significantly from those included in the models, potentially biasing the conclusions. This bias would result if the relationship between substance use and unsafe sexual behavior in men who report higher levels of both the exposure and the outcome differs from that in the analyzed participants. In addition, HIV+ MSM who volunteer to complete a weekend sexual health seminar may not represent the general HIV+ MSM population, particularly since they received compensation for participation.

With such limitations in mind, our results nonetheless raise important questions of the prominence of substances used in the context of sex and how to address their use within interventions targeting HIV+ MSM. Poppers are both similar and unique from other illicit substances. Like ecstasy and methamphetamines, poppers are strongly associated with gay culture and the party scene; however, poppers are unique because they are almost exclusively used in the context of anal intercourse. These results indicate that efforts to address substance abuse broadly in HIV+ MSM may be insufficient to reduce risk behavior. Rather, it is important to address the psychological and social contexts of drugs used specifically to enable anal sex, particularly poppers. Improving condom use self-efficacy in the context of popper use during anal intercourse among HIV+ MSM may be particularly efficacious for reducing sexual risk. The high rates of substance use in this sample point to the continued need to make alcohol and drug treatment services available to HIV+ MSM.

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Table 1
Substance use among racially and ethnically diverse HIV-positive MSM in the past 3 months.

Substance	Overall	Black	White	Hispanic/Latino	Other/Multi-racial	Sig.
	<i>Median (IQR)</i>					
Alcohol quantity ^a	3 (2, 5)	3 (2, 4)	3 (2, 5)	3 (2, 5)	3 (1, 4)	N.S.
Count of drugs used	1 (0, 2)	1 (0, 1)	1 (1, 3)	1 (0, 2)	1 (0, 2)	p < .0001
	<i>N (%)</i>					
Alcohol Frequency						N.S.
Never/unreported	192 (29%)	91 (30%)	36 (22%)	53 (34%)	12 (28%)	
< 1 × per month	88 (13%)	34 (11%)	24 (15%)	20 (13%)	10 (23%)	
1 × per month	60 (9%)	25 (8%)	14 (9%)	16 (10%)	5 (12%)	
2–3 × per month	100 (15%)	47 (16%)	28 (17%)	20 (13%)	5 (12%)	
1–2 × per week	111 (17%)	41 (14%)	36 (22%)	32 (21%)	2 (5%)	
3–4 × per week	60 (9%)	34 (11%)	14 (9%)	8 (5%)	4 (9%)	
Nearly every day	28 (4%)	16 (5%)	5 (3%)	4 (3%)	3 (7%)	
At least once a day	21 (3%)	11 (4%)	7 (4%)	1 (1%)	2 (5%)	
Marijuana	269 (41%)	124 (42%)	77 (47%)	56 (36%)	12 (28%)	N.S.
Crack/cocaine	195 (30%)	115 (38%)	40 (24%)	32 (21%)	8 (19%)	p < .0001
Stimulants ^b	118 (18%)	32 (11%)	49 (30%)	29 (19%)	8 (19%)	p < .0001
Club Drugs ^c	48 (7%)	17 (6%)	17 (10%)	12 (8%)	2 (5%)	N.S.
Meth with sex	87 (16%)	22 (9%)	42 (27%)	14 (11%)	9 (23%)	p < .0001
Poppers with sex	180 (32%)	53 (22%)	72 (46%)	42 (34%)	13 (34%)	p < .0001

Notes:

^a Among those reporting any alcohol consumption;

b Methamphetamines, crystal, crank;

^cEcstasy (MDMA), Gamma hydroxy butyrate (GHB), Special K, rohypnol, rophies

Table 2
Comparison of demographic and psychosocial characteristics by popper and other drug use.

	Non-user (n=205, 30%)	Drug User (No poppers) (n=288, 43%)	Popper User (n=182, 27%)	χ^2
White	31 (15)	65 (23)	72 (40)	25.5**
Other	17 (8)	14 (5)	13 (7)	
African American	99 (48)	148 (52)	53 (29)	
Latino/Hispanic	58 (28)	57 (20)	42 (23)	16.5**
High school or less	100 (49)	116 (41)	52 (29)	
Some college or more	105 (51)	170 (59)	130 (71)	
Employed	61 (30)	71 (25)	57 (31)	ns
On disability	95 (46)	154 (54)	74 (41)	
Other	49 (24)	62 (22)	51 (28)	
	Median (IQR)	Median (IQR)	Median (IQR)	
Annual Income	\$10k (\$3.6k–\$21k)	\$10k (\$6k–\$18k)	\$12k (\$7.5k–\$28k)	6.4*
Age	43 (37–49)	43 (37–47)	41 (37–46)	ns
Condom self efficacy	67 (56–74)	62 (49–72)	59 (45–68)	22.8**
Sex comfort	23 (19–24)	21 (18–24)	22 (19–24)	ns
Peer condom norm	9 (7–12)	9 (7–11)	8 (7–10)	13.8**

* p<.05;

** p<.01;

Table 3

Logistic regression models of SDUAI on substance use and psychosexual variables adjusted for anal intercourse acts.

	Bivariate		Multivariate (Reduced)			
	OR	95% CI	OR	95% CI	Substance Use	Substance Use & Psychosocial
Alcohol Frequency: Never/unreported	reference	--	rm	rm	rm	rm
Less than once a month	2.20	1.22, 3.97	rm	rm	rm	rm
About once a month	2.65	1.34, 5.24	rm	rm	rm	rm
2 or 3 times a month	1.75	0.99, 3.07	rm	rm	rm	rm
1 or 2 times a week	2.18	1.27, 3.75	rm	rm	rm	rm
3 or 4 times a week	2.87	1.47, 5.61	rm	rm	rm	rm
Nearly every day	ns	ns	rm	rm	rm	rm
At least once a day	ns	ns	rm	rm	rm	rm
Alcohol quantity (drinks per day)	1.07	1.02, 1.14	1.07	1.01, 1.14	rm	rm
Count of drugs used	1.31	1.16, 1.48	rm	rm	rm	rm
Marijuana (ever vs never)	1.50	1.05, 2.14	rm	rm	rm	rm
Crack/cocaine (ever vs never)	1.53	1.04, 2.25	rm	rm	rm	rm
Stimulants (ever vs never)	2.11	1.34, 3.32	rm	rm	rm	rm
Club Drugs (ever vs never)	2.31	1.13, 4.70	rm	rm	rm	rm
Meth with sex (ever vs never)	2.17	1.27, 3.69	rm	rm	rm	rm
Poppers with sex (ever vs never)	2.56	1.70, 3.86	2.37	1.55, 3.62	2.46	1.55, 3.9
City (DC vs baseline)					4.09 ^a	1.74, 9.86 ^a
Race/ethnicity	--	--	--	--	rm	rm
Education	--	--	--	--	rm	rm
Income	--	--	--	--	rm	rm
Condom Self-efficacy (scale sum)	--	--	--	--	0.58 ^b	0.46, 0.73 ^b
Sexual Comfort	--	--	--	--	rm	rm
Peer Condom Norms	--	--	--	--	rm	rm

Notes: OR = Odds ratio; CI = Confidence interval; rm = Removed from full model; -- = Variable not in model;

χ^2_{5-df} city factor was significant due to this effect;

b standardized effect of a 1 s.d. increase