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Actor-partner effects of male couples substance use with sex and engagement in condomless anal sex

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Abstract

Few studies have examined actor-partner effects about male couples' substance use with sex. Dyadic data from 361 male couples were used to examine these effects regarding engagement in condomless anal sex (CAS) by type of partner and substance. Couples with one or both partners reported using marijuana, amyl nitrates, party drugs, and/or stimulants with sex in their relationship was positively associated with them having had CAS. Actor-partner effects for stimulant use with sex with the main partner were associated with CAS with a casual MSM partner. Only an actor effect for stimulant use with sex with a casual MSM partner was associated with CAS with that partner type, and an actor effect for marijuana use with sex for both partner types was associated with CAS with both partner types. These findings illuminate the need for further inquiry about male couples' substance use with sex for HIV prevention.

Keywords

Substance use with sex; Male couples; Condomless anal sex; HIV risk; Actor-partner effects

INTRODUCTION

Studies conducted over the past 30 years show substance-using gay, bisexual and other men who have sex with men (MSM) are among the groups at highest risk for HIV infection in the United States [1, 2]. For example, one analysis concludes that about one-third of new HIV infections among MSM can be attributed to their use of substances [3]. Their use of substances often occurs with sex (e.g., following use and/or simultaneously)[1, 2], including condomless anal sex (CAS) - the primary sexual risk behavior for HIV acquisition and transmission among MSM. Within gay male culture, certain drugs have become known as “sex or party drugs” because the side effects experienced by men enhance their sexual

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COMPLIANCE WITH ETHICAL STANDARDS

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent: Informed consent was obtained from all individual participants included in the study.

pleasure and/or prolong their sexual activities, particularly CAS. Of significance, MSM's heavy episodic alcohol use (i.e., 5 or more drinks on a single occasion) and use of crystal methamphetamine, erectile dysfunction medication (EDM) and/or amyl nitrites (e.g., inhalant poppers) have been identified in numerous studies to be significantly and positively associated with CAS and HIV seroconversion [1, 2]. However, this body of research is limited: the majority of HIV prevention and substance use research studies have focused on MSM at the individual- and community-levels. This limits our understanding of the dyadic interaction of how relationship partners influence one another's substance use and potential risk for HIV (e.g., CAS), which is important to examine because a significant proportion of MSM acquire HIV from their main partners while in a same-sex relationship [4].

To address this knowledge gap, researchers have begun to examine the dynamics and behaviors, including substance use with sex, among male couples' relationships. For example, in Mitchell's nation-wide study with 361 male couples, several key findings about substance use with sex have been reported [5, 6]. Whether one or both partners of the couple used substances with sex within the relationship varied by the type of substance used whereas, regardless of the substances type, most couples only had one partner who used substances with sex outside of their relationship [5]. Significantly higher proportions of concordantly HIV-negative and HIV-positive couples had both partners who used substances with sex (all types) within their relationship compared to HIV-discordant couples [5]. Furthermore, Gamarel et al.'s study with 117 HIV-discordant male couples concluded that when stimulant use only occurred with one partner of the couple, the odds of engaging in CAS with one's main partner decreased whereas when both partner's used stimulants, the HIV-negative partner had an increase in odds in engaging in CAS with casual MSM partners [7].

The type of relationship male couples form may also play a role in their use of substances with sex and risk for HIV. For example, with a sample of 161 male couples, Starks and Parsons reported partnered men in monogamous arrangements (i.e., closed sexual agreements) had significantly lower odds of using marijuana and other drugs compared to those with an open sexual arrangement (i.e., agreement) [8]. Partnered men's use of marijuana during sex was positively associated with the odds of having had CAS with a casual MSM partner; this finding was particularly salient for men in an open sexual agreement relationship [8]. Regarding sexual agreements, Mitchell et al. reported that male couples with an established, and recently broken, agreement were more likely to have one or both partners who used amyl nitrites and marijuana with sex within their relationship [6]. This same trend was also noted for alcohol use, but with sex that occurred outside the couples' relationship [6]. Further, male couples with an open agreement – compared to those with a closed agreement – had four-to-five fold greater odds of using EDM or amyl nitrites with sex within their relationship, and nine-fold greater odds of using alcohol outside of their relationship with sex [6]. Findings from these studies suggest a variety of substances are used with sex among male couples, and that differences in their use with sex vary by the couples' HIV-status, partner type (i.e., occurred within or outside relationship), and by certain relationship dynamics. Despite these findings, additional research is needed to assess the extent to which relationship partners' influence one another's use of substances with sex

(e.g., CAS), and whether their influence differs by substance type and engagement in CAS within and/or outside the couples' relationship.

To assess how partners may influence one another's use of substance(s) with sex, the Theory of Interdependence posits behaviors among couples are interdependent because each relationship partner has a certain amount of control and influence on the outcome in their behavioral interactions they have together [9]. This outcome depends on each partner's choice, value and assessment of the particular behavior and whether that behavior is important to their relationship. The interactions and behaviors among male couples, such as their use of substances with sex including CAS, are interdependent because the participation from each relationship partner is required in order for those interactions and behaviors to occur. To detect these influences, the Actor-Partner Interdependence Model (APIM) provides an analytical framework to measure actor-partner effects [10]. Taken into context, an actor effect measures the association of a partner's use of substances with sex to his own engagement in CAS. A partner effect measures how each respondent's partner's use of substances with sex is related to his engagement in CAS. Despite the relevance for HIV and substance use prevention, no studies – to date – have examined actor-partner effects of male couples' use of substances and their engagement in concurrent CAS (i.e., within and outside of their relationship). Furthermore, the aforementioned studies [5, 7, 8] are limited because they have only examined actor-partner effects of male couples' use of substances and CAS with outside MSM partners but not for concurrent CAS nor with a nation-wide US sample. Thus, to extend our understanding of how partners' influence one another's use of substances with sex and engagement in CAS within and outside of their relationship (i.e., concurrent CAS), this secondary analysis uses dyadic data from a parent study consisting of a nation-wide, online convenience sample of 361 US male couples to assess these types of actor-partner effects. Findings from this study could be used to help advance primary and secondary HIV prevention efforts for male couples, including the development of dyadic HIV and substance use preventive interventions.

METHOD

Recruitment and Procedure

The methods used to recruit and collect dyadic data from the sample described in the present study have been described in detail elsewhere [XXX]. Recruitment was conducted through Facebook banner advertising during a ten-week period in 2011. Each advertisement contained a picture of a male couple and provided a brief description of the study. Advertisements were displayed to Facebook members whose profile demographics matched our study eligibility criteria: males living in the US, at least 18 years old, "interested in men," and had a relationship status of "in a relationship, married, or engaged." All Facebook users whose profiles met our eligibility criteria had an equal chance of being shown one of the three banner advertisements. A total of 7,994 Facebook users clicked on at least one of the advertisements and were then directed to the study webpage. Among those who visited our study webpage, 4,056 (51%) potential participants answered our eligibility questions; 722 MSM (18%), representing both men of 361 MSM couples, qualified, enrolled, and completed the survey.

The study webpage described the purpose of the study and eligible participants were informed that they would be asked to invite their main male relationship partner (i.e., that is, someone they felt committed to above all others, someone they would call a boyfriend, life partner, significant, other, fiancé or husband) to participate in the study. To collect dyadic data, a partner referral system was embedded in the survey. The participants' main male partner then received an email inviting him to participate in the study. Each would complete the survey independently. Both men in the couple had to meet the following eligibility criteria to participate: be 18 years of age or older; live in the US; be in a sexual relationship with another male; and, have had oral and/or anal sex with this partner within the previous three months. Every fifth couple that completed the survey received two incentives worth 20USD each via email.

The online survey service provider Survey Gizmo hosted our study webpage, electronic consent form, and confidential, online survey through the use of a secure access portal (i.e., <https://>). Other than email addresses, no personal identifying information was collected and email addresses were deleted after data collection. The Medical College of Wisconsin Institutional Review Board approved the study protocol.

Measures

Participants were asked if they had used any substances with sex with respect to type of substance used, frequency of use, and by partner type during the three months prior to assessment. The survey prompted participants with, "Thinking back to the last three months, please select which drugs and how often you used those drugs before having sex and/or while having sex with your main partner?" Participants were then asked to self-report which of the nine substances they had used prior to and/or while having sex with their main partner during the three preceding months (alcohol – buzzed, alcohol – drunk, cocaine, crystal methamphetamine, ecstasy, GHB, ketamine, marijuana, amyl nitrates (e.g., poppers), and Viagra or similar (i.e., erectile dysfunction medication, EDM)) with the following frequency categories, "Never used this drug", "Less than half of the time", "About half of the time", and "More than half of the time". Using this same measurement item, participants who reported having had sex outside of their relationship were also asked to report their use of substances prior to and/or while having sex with a casual MSM partner during the same timeframe (i.e., preceding three months to assessment). Specifically, participants were asked, "Thinking back to the last three months, please select which drugs and how often you used those drugs before having sex and/or while having sex with another guy (not your main partner)?" The same substance use and frequency use response options as stated above were also used for this item.

Two categories of variables were created for this exploratory study: 1) Substance use with sex, by type of substance as independent variables and 2) engagement of condomless anal sex (CAS) as outcome variables. Each category of variables included items that measured the occurrence with the main partner (within the relationship), casual MSM partner (outside of the relationship), and both types of partners (within and outside of the relationship), respectively.

Participants were not asked to report the exact amount (e.g., number of pills) or frequency of their use of substances with sex for either partner type. Further, the alcohol measure (i.e., buzzed, drunk) was based on participants' perceived level of intoxication from drinking alcohol. Regardless of partner and substance type used prior to and/or while having sex, many chose the response category "Never used this drug" with sex. This yielded small yet varied response sample sizes for each reported type of substance used with sex for both types of partners (main and casual). For purposes of this study, the three remaining response categories, "Less than half of the time", "About half of the time", "More than half of the time" – which all describe some level of substance use with sex – were recoded to create a dichotomous dummy variable for each type of substance used with sex per partner type. These dichotomous dummy variables permit direct comparison between men who reported using a particular substance with sex (e.g., marijuana) with their main partner to those who reported never using this particular substance with sex with their main partner.

Some men also reported using substance with sex with both types of partners (e.g., main and casual). To describe this phenomena, a dichotomous dummy variable was created to capture whether participants had used a particular type of substance with sex with both types of partners (i.e., within and outside of the relationship) compared to those who did not use this type of substance with sex within and outside of their relationship. Thus, three dichotomous independent variables for each type of substance used with sex were constructed for this exploratory study: 1) use of a particular substance with sex with the main partner (vs. did not use particular substance with sex with main partner); 2) use of a particular substance with sex with a casual MSM partner (vs. did not use particular substance with sex with a casual MSM partner); and 3) use of a particular substance with sex with the main partner and a casual MSM partner (vs. did not use this particular substance with sex with the main partner and a casual MSM partner).

Similarly, we also created three types of CAS outcome variables: 1) a participant had engaged in CAS with his main partner (within the relationship); 2) a participant had engaged in CAS with a casual MSM partner (outside of the relationship); and 3) a participant had engaged in CAS with his main partner and with a casual MSM partner (within and outside of the relationship).

Statistical Analysis

Dyadic data from 361 male couples (n=722 men) were analyzed using STATA/MP v13.1 (StataCorp LP, College Station, TX, USA) and SAS v9.3 (SAS Institute, Cary, NC, USA). The intraclass correlation coefficient (ICC), which estimates how correlated cases are within a cluster, was calculated for each type of substance used with sex and engagement in CAS by partner type (i.e., main and casual) [10]. To predict CAS with the main partner at the couple-level, we utilized a Poisson model with robust error variance to directly estimate the risk-ratio and confidence intervals [13]; both Poisson models controlled for couples' HIV status and establishment and type of sexual agreement were controlled for in each actor-partner model as potential confounders; prior work from this dataset reported male couples' use of substances with sex differed by their relationship HIV-status and aspects of their agreements [5, 6]. To predict CAS with a casual MSM partner and CAS with both main

partner and a casual MSM partner, we utilized actor-partner models that included both partners in the analysis. All of the actor-partner analyses accounted for correlations amongst partners as described below.

To analyze for actor-partner effects using the APIM framework, we arranged the data in a pairwise format following recommendations provided by Kenny et al. [10]. Actor and partner effects were then estimated using Generalized Estimated Equations (GEE) algorithm described by Loeys et al. [11] which accounts for the correlation between individuals within a couple by using a robust variance estimate. The Wald test based on robust variance of the GEE models performs quite well in testing actor and partner effects when the number of dyads is more than 50 dyads [12]. Six models were examined for significant actor-partner effects about male couples' use of substances with sex and engagement in CAS. For each outcome (CAS with a casual MSM partner; CAS with both main partner and a casual MSM partner), two actor-partner models were constructed to test the impact of more common substances (Model 1: alcohol and marijuana) separately from the impact of heavier substances (Model 2: party drugs which included ecstasy, ketamine, and GHB; stimulants which included cocaine and/or methamphetamine; amyl nitrates and EDM). To align with the respective outcome variable, independent variables were categorized by 'substance use with sex with main partner', 'substance use with sex with a casual MSM partner', and 'substance use with sex with both partner types.'

In detail, six actor-partner effect models (4 for CAS with a casual MSM partner; 2 for CAS with both main partner and a casual MSM partner) were constructed to examine whether self-reported substance use with sex, by substance and partner type, was associated with CAS, by partner type. First, we assessed whether actor-partner effects of substance use with sex with main partner predicted CAS with a casual MSM partner, by marijuana and alcohol (model 1). We also assessed whether actor-partner effects of substance use with sex with main partner predicted CAS with a casual MSM partner by EDM, amyl nitrates, party drugs, and stimulants (model 2). Using the same procedure, four other actor-partner models were constructed: two actor-partner models of substance use with sex with casual MSM partners to predict CAS with a casual MSM partner; and two actor-partner models of substance use with sex with both partner types to predict CAS with both types of partners. The two actor-partner models that examined whether substance use with sex with the main partner predicted CAS with a casual MSM partner were constructed because little is known about how male relationship partners' may influence one another's use of substance with sex within and/or outside of their relationship. Couples' HIV status and establishment and type of sexual agreement were controlled for in each actor-partner model as potential confounders; prior work from this dataset reported male couples' use of substances with sex differed by their relationship HIV-status and aspects of their agreements [5, 6].

The parameter estimates produced from these models were used to detect the actor-partner effects. To make the interpretation of the actor-partner effects more intuitive, we converted the coefficients and 95% confidence limits to adjusted relative risk ratio (aRR) and corresponding 95% confidence limits for presentation. P-values < 0.05 on two-side tests were considered statistically significant.

Study Sample

The study sample consisted of 361 male couples who primarily identified as gay (N=349, 97%), non-Hispanic (N=308, 85%), White (N=237, 66%), living in a U.S. urban environment (N=308, 85%), cohabitating (N=271, 75%), and having been in their relationship, on average, for about 4.9 years (SD = 5.5) (Table 1). Most couples also had one or both partners who were well educated by having earned at least a Bachelor's degree (N=244, 70%) and employed (N=339, 94%). Approximately three quarters of the couples were concordantly HIV-negative (N=275, 76%), 8% were concordantly HIV-positive (N=28), and 16% were discordant (N=58). A little over half of the sample established a sexual agreement in their relationship (N=207, 57%); among these couples, 84% concurred about their type of agreement (N=174). Condomless anal sex was commonly practiced among couples (N=304, 84%; ICC = 0.74), but less so for those in a HIV-discordant relationship (N=40, 69% vs. 87% in concordant HIV-negative and 93% in concordant HIV-positive couples). Of the 113 male couples who had one or both partners that had sex outside of the relationship, 66% (N=75 dyads) had one or both partners who engaged in CAS with a casual MSM partner (ICC = 0.15); 58% engaged in concurrent CAS (ICC = 0.19).

Table 2 illustrates partnered men's self-reported use of substances prior to and/or while having sex by type of substance used and with which type of partner (main vs. casual). With the exception of alcohol (buzz and drunk), the majority of the sample indicated they never used this drug with their main partner. The ICC ranged from 0.17 (ketamine) to 0.78 (crystal methamphetamine, amyl nitrates) for men's use of substances with sex with their main partner.

Similarly, very few partnered men used substances with sex with a casual MSM partner. However, higher proportions of partnered men used poppers and EDM at least some of time when having sex with a casual MSM partner compared to their usage with their main partner. The ICC for partnered men's use of substances with sex with a casual MSM partner ranged from 0.01 (GHB, ketamine) to 0.69 (crystal methamphetamine).

RESULTS

Simple Poisson Model

Table 3 describes results from the Poisson models that controlled couples' HIV-status and establishment and type of sexual agreement to estimate whether neither, one or both partners of the couples' use of substances with sex in their relationship predicted engagement in CAS within the relationship (i.e., main partner). Couples with both partners reported using marijuana with sex in their relationship was positively associated with the couple having had CAS in their relationship (aRR = 1.13, 95% CI = 1.00 – 1.27, $p < 0.05$). Couples with both partners reported using amyl nitrates with sex in their relationship was positively associated with the couple having had CAS in their relationship (aRR = 1.13, 95% CI = 1.00 – 1.26, $p < 0.05$). In addition, we found that couples with 1 partner reported using party drugs with sex (aRR = 1.41, 95% CI = 1.21 – 1.64, $p < 0.05$), or both partners reported using party drugs with sex (aRR = 1.22, 95% CI = 1.13 – 1.32, $p < 0.05$) in their relationship were more likely to have had CAS within their relationship (i.e., main partner) compared to couples

who did not use party drugs with sex within their relationship. Couples in which 1 partner reported using stimulants with sex within the relationship were more likely to have had CAS within their relationship (aRR = 1.21, 95% CI = 1.05 – 1.40, $p < 0.05$). No other substances used with sex within the relationship were associated with CAS within the relationship.

Actor-Partner Effects

Table 4 describes the results from the actor-partner effect models. After controlling for couples' HIV status, men who used stimulants with sex with their main partner had 2.16 times the risk of having had CAS with a casual MSM partner compared to those who did not use stimulants with sex with their main partner (actor effect: aRR = 2.24, 95% CI 1.41 – 3.56, $p < 0.05$). A partner effect was also noted: those who used stimulants with sex with their main partner had 0.43 times the risk of having had CAS with a casual MSM partner compared to those who did not use stimulants with sex with their main partner (aRR = 0.41, 95% CI 0.22 – 0.79, $p < 0.05$).

In addition, men who used stimulants with sex with a casual MSM partner had 2.02 times the risk of having had CAS with a casual MSM partner compared to those who did not use stimulants with sex with a casual MSM partner (aRR = 1.91, 95% CI 1.20 – 3.07, $p < 0.05$).

Men who used marijuana with sex with both types of partners (i.e., main and casual MSM) had 1.43 times the risk of having had CAS with both types of partners within the same time period (i.e., prior 3 months) compared to those who did not use marijuana with sex with both types of partners (aRR = 1.41, 95% CI 1.01 – 1.98, $p < 0.05$). No other significant actor or partner effects of using substances with sex within and/or outside the relationship were found to predict CAS by partner type.

DISCUSSION

Few studies have examined actor-partner effects of male couples' substance use with sex, including CAS. The present investigation helps to fill this important knowledge gap by assessing whether a relationship partners' use of a substance with sex within and/or outside the relationship influences his own and his partner's engagement in CAS within and/or outside the relationship. After controlling for male couples' HIV-status and establishment and type of sexual agreement, several results from the Poisson and actor-partner effect models noted their use of substances with sex predicted engagement in CAS.

First, our Poisson models noted that male couples with both partners who used marijuana, amyl nitrates, and party drugs used with sex within their relationship were significantly more likely to engagement in CAS within their relationship. Couples with one partner who used party drugs and/or stimulants with sex within their relationship were also more likely to engage in CAS within their relationship. These findings may illustrate that many male couples in the U.S. practice CAS within their relationship [4], and their use of substances with sex within the relationship is fairly common [5], particularly by both partners. However our finding of couples with one partner who used stimulants with sex within their relationship being more likely to engage in CAS within their relationship contradicts what Gameral and colleagues reported with a sample of HIV-discordant male couples residing in

the San Francisco Bay Area [7]. This contrast between their and our studies' findings may be due to geographical/regional differences as well as couples' HIV status. To assess why some couples use substances with sex within their relationship while others do not, the frequency of their usage, and whether their reasons to use certain substances with sex are for medicinal purposes (e.g., marijuana) or for other reasons, warrants additional research.

Furthermore, actor-partner effects of using stimulants with sex within or outside of the relationship positively predicted engagement in CAS with a casual MSM partner. Specifically, partners who used stimulants with sex within or outside of their relationship positively predicted their engagement in CAS with a casual MSM partner. This finding may relate to men's preference for using stimulants with sex regardless of partner type. Prior work has documented party drugs as well as cocaine and methamphetamine as potential "party-n-play" (PnP) substances in which the "party" is the use of a substance to enhance and/or prolong the "play" experience of sex [1]. This phenomenon is of concern for HIV prevention because the use of substances with sex has been linked to partnered men's engagement in CAS with casual MSM partners [7, 8] and in general, HIV seroconversion among MSM [3]. Interestingly, a partner effect of using stimulants with sex within the relationship negatively predicted engagement in CAS with a casual MSM partner. Given that the actor effects were positively associated with CAS with a casual MSM partner, this finding may suggest that some men may know and/or experience how their main partners respond to using stimulants with sex and as such, use this particular knowledge and/or experience to determine whether to engage in CAS outside of the relationship. Other possibilities may exist to help understand and explain these particular actor-partner effects. Due to the cross-sectional and quantitative design of the present study, the context and causal order in which these particular behaviors and events occurred remains unclear. As such, interpretation of these findings must be considered with caution. Further investigation that includes a mixed method, longitudinal study design that collects episodic or event-level data about male couples' use of substances with sex is warranted to help interpret these types of findings.

One additional actor effect of using marijuana with sex within and outside the relationship significantly and positively predicted engagement in CAS with both types of partners. Given the rates of new HIV infections that occur among male couples within the U.S. [4], concurrent engagement in CAS and the use of the substances with sex are cause for concern for HIV prevention. In addition to prior work providing evidence that using certain substances with sex increases one's risk for HIV [1–3], a subgroup in this sample may exist who could be particularly vulnerable to acquiring HIV and transmitting it within and outside of their relationship. The motivating factors and reasons why some partnered men engage in dual risk behaviors that may endanger themselves and their partner for HIV acquisition remains unknown yet are warranted for further inquiry. Thus, additional research is needed to better understand the dynamics of substance-using male couples with particular emphasis on the drivers of using substances with CAS outside of the relationship.

Limitations

The limitations of this secondary analysis are important to consider. The use of a cross-sectional study design with dyadic data from an online convenience sample precludes us from making casual inferences and generalizing our findings to all male couples living in the U.S., as well as those who do not use the Internet and/or Facebook. Although we did not collect identifying information, participation, social desirability, and recall biases may have influenced the participants to inaccurately report information about them, including their engagement in CAS and use of substances with sex. Participants may have completed the survey with their main partners, despite our request for them to complete it independently and separately, thereby potentially causing some bias that could have resulted in underreporting of substance use with sex. The survey did not assess nonmedical use of controlled medications such as prescription anti-anxiety, opioid, stimulant and sleeping medications or record event-level usage of substances with sex, including CAS, by either type of partner (main or casual). Furthermore, the alcohol measure (i.e., buzzed, drunk) used in the survey was based on participants' perceived level of intoxication from drinking alcohol instead of using a more robust measure for actual count and/or volume of type of alcohol drank per episode. Future work should address these limitations to help develop preventive strategies for substance-using male couples.

Limitations notwithstanding, the findings from this analysis provide evidence that among substance-using male couples, partners influence one another's use of substances with sex and engagement in CAS, thereby increasing their risk for acquiring and/or transmitting HIV within and/or outside of their relationship. Future research is needed to better understand the dynamics of male couples who use substances with sex and engage in CAS, and to identify how best to intervene to reduce their risk for HIV and substance use.

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Table 1

Characteristics of the sample: 361 male couples

Couple-level characteristic	N	%
Sexual orientation: Both men in couple identified as gay	349	97
Race		
Mixed	124	34
White	237	66
Education: Had a Bachelor's degree or higher		
Both partners	134	37
Only one partner	110	31
Neither partner	117	32
Employment status		
Both partners employed	235	65
Only one partner employed	104	29
Neither partner employed	22	6
Had health insurance at time of assessment		
Both partners reported yes	227	63
Only one partner reported yes	91	25
Both partners reported no	43	12
HIV serostatus		
Concordant negative	275	76
Concordant positive	28	8
Discordant	58	16
Established a sexual agreement	207	57
Type of sexual agreement		
Open sexual agreement ^a	82	47
Closed sexual agreement ^a	92	53
Practiced condomless anal sex (CAS) within relationship	304	84
One or both men in couple had sex outside their relationship	113	31
One or both men in couple had CAS with a casual MSM partner ^b	75	66
One or both men in couple had concurrent CAS ^b	66	58
	<i>Mean</i>	<i>SD</i>
Individual age [range: 18–68 years]	33.0	10.8
Relationship length [range: 0.25 – 35 years]	4.9	5.5
Cohabitation duration [range: .08 – 31.2 years]	5.2	5.8

Note

^aData reflects couples who concurred about the type of sexual agreement in their relationship (i.e., 174 of 207 dyads)

^bRepresents the proportion of couples who had one or both men having had sex outside of their relationship (e.g., 75 of the 113 couples; 66 of the 113 couples).

Table 2

Partnered men's self-reported use of substances prior to and/or while having sex, by type of substance and partner type

Partnered men's self-reported use of substances prior to and/or while having sex							
	Never used this drug			More than half of the time			ICC ^a
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	
With main partner, n = 722 MSM							N=361 dyads
Alcohol – buzz	29% (208)	59% (426)	10% (71)	2% (17)			0.42
Alcohol – drunk	55% (398)	41% (293)	3% (25)	1% (6)			0.52
Cocaine	95% (689)	4% (29)	1% (4)	0% (0)			0.70
Crystal methamphetamine	96% (693)	2% (15)	2% (12)	<1% (2)			0.78
Ecstasy	96% (691)	4% (28)	<1% (3)	0% (0)			0.64
GHB ^b	98% (709)	1% (9)	<1% (3)	<1% (1)			0.46
Ketamine	99% (714)	1% (7)	<1% (1)	0% (0)			0.17
Marijuana	74% (535)	14% (98)	6% (42)	7% (47)			0.73
Amyl nitrates (e.g., poppers)	86% (621)	7% (50)	4% (28)	3% (23)			0.78
EDM ^c	85% (615)	8% (61)	3% (22)	3% (24)			0.55
With casual partner, n = 178 MSM							N=65 dyads
Alcohol- buzz	49% (87)	33% (59)	10% (18)	8% (14)			0.65
Alcohol – drunk	70% (124)	19% (34)	7% (12)	4% (8)			0.53
Cocaine	93% (166)	6% (11)	1% (1)	0% (0)			0.65
Crystal methamphetamine	95% (169)	2% (4)	3% (5)	0% (0)			0.69
Ecstasy	97% (173)	2% (4)	1% (1)	0% (0)			0.49
GHB ^b	98% (174)	1% (2)	1% (1)	1% (1)			0.01
Ketamine	98% (175)	1% (2)	1% (1)	0% (0)			0.01
Marijuana	75% (133)	10% (17)	5% (9)	11% (19)			0.67
Amyl nitrates (e.g., poppers)	70% (125)	18% (32)	4% (8)	7% (13)			0.41
EDM ^c	76% (136)	11% (20)	3% (6)	9% (16)			0.09

Notes

^aICC, intraclass correlation coefficient

GHB, gamma hydroxybutyrate
EDM, erectile dysfunction medication

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Table 3

Adjusted relative risk ratios and 95% confidence intervals for correlates of CAS with main partner

Substance use with sex with main partner	CAS with main partner	
	aRR	95% CI
Model 1:		
Alcohol		
Neither partner uses	Ref	
1 partner uses	0.91	(0.76 – 1.08)
Both partners use	0.97	(0.84 – 1.13)
Marijuana		
Neither partner uses	Ref	
1 partner uses	1.11	(0.98 – 1.25)
Both partners use	1.13	(1.00 – 1.27)
Model 2:		
Amyl nitrates		
Neither partner uses	Ref	
1 partner uses	0.95	(0.77 – 1.16)
Both partners use	1.13	(1.00 – 1.26)
EDM ^a		
Neither partner uses	Ref	
1 partner uses	0.91	(0.77 – 1.07)
Both partners use	1	(0.84 – 1.17)
Party drugs ^b		
Neither partner uses	Ref	
1 partner uses	1.41	(1.21 – 1.64)
Both partners use	1.22	(1.13 – 1.32)
Stimulants ^c		
Neither partner uses	Ref	
1 partner uses	1.21	(1.05 – 1.40)
Both partners use	0.96	(0.76 – 1.22)

Notes.

Each model controlled for couples' HIV-status, and establishment and type of a sexual agreement. Statistically significant findings are bolded ($p < 0.05$).

^aEDM, erectile dysfunction medication

^bRepresents ecstasy, ketamine, and GHB (gamma hydroxybutyrate)

^cCocaine and/or Methamphetamine

Adjusted relative risk ratios and 95% confidence intervals for actor-partner effects of male couples' use of substances with sex in predicting engagement in condomless anal sex

Table 4

	Actor effect		Partner effect	
	aRR	95% CI	aRR	95% CI
Substance use with sex with main partner				
Model 1:				
Alcohol	0.84	(0.64 – 1.11)	1.04	(0.78 – 1.40)
Marijuana	1.28	(0.91 – 1.81)	0.89	(0.62 – 1.28)
Model 2:				
Any/1 nitrates	0.97	(0.60 – 1.55)	1.02	(0.64 – 1.62)
EDM ^a	0.93	(0.65 – 1.34)	1.34	(0.93 – 1.93)
Party drugs ^b	1.19	(0.67 – 2.10)	0.88	(0.46 – 1.70)
Stimulants ^c	2.24	(1.41 – 3.56)	0.41	(0.22 – 0.79)
CAS with a casual MSM partner				
Model 1:				
Alcohol	1.11	(0.75 – 1.64)	0.9	(0.61 – 1.32)
Marijuana	1.33	(0.90 – 1.95)	1.24	(0.84 – 1.84)
Model 2:				
Any/1 nitrates	1.29	(0.89 – 1.86)	0.77	(0.52 – 1.13)
EDM ^a	0.88	(0.61 – 1.26)	1.23	(0.91 – 1.66)
Party drugs ^b	0.72	(0.34 – 1.50)	1.91	(0.83 – 4.41)
Stimulants ^c	1.91	(1.20 – 3.07)	0.54	(0.27 – 1.09)
CAS with both main and casual MSM partners				
Model 1:				

	Actor effect		Partner effect	
	aRR	95% CI	aRR	95% CI
Alcohol	1	(0.73 – 1.36)	0.87	(0.64 – 1.19)
Marijuana	1.41	(1.01 – 1.98)	1.14	(0.80 – 1.65)
Model 2:				
Amyl nitrates	1.2	(0.82 – 1.76)	1.04	(0.71 – 1.53)
EDM ^a	0.91	(0.63 – 1.33)	1.08	(0.74 – 1.57)
Party drugs ^b	1.38	(0.67 – 2.82)	0.75	(0.35 – 1.60)
Stimulants ^c	1.63	(0.70 – 3.82)	0.66	(0.26 – 1.66)

Notes.

All models controlled for couples' HIV-status, and establishment and type of a sexual agreement. Statistically significant findings are bolded ($p < 0.05$).

^aEDM, erectile dysfunction medication

^bRepresents ecstasy, ketamine, and GHB (gamma hydroxybutyrate)

^cCocaine and/or Methamphetamine