

Substance use and high-risk sex among men who have sex with men: a national online study in the USA

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Abstract *This paper describes drug and sexual risk behaviors during a six-month period in 2001 of 2,916 gay and bisexual men who were recruited online. Bivariate and multivariate analyses examined correlates of unprotected anal intercourse (UAI). Drug and alcohol use were also examined by US region. UAI was associated with using alcohol or drugs, including poppers, crystal methamphetamine, cocaine, marijuana and Viagra before or during sex. Meeting sex partners both online and offline and having multiple sex partners were also predictive of UAI. Significant regional differences were seen in the prevalence of drug use and alcohol use. Findings are discussed in relation to the need to integrate messages about the relationship between drug use and sexual behavior into HIV prevention programs.*

Introduction

A resurgence in HIV transmission among men who have sex with men (MSM) is cause for serious concern as the number of newly diagnosed HIV infections among MSM has increased 17% since 1999 (CDC, 2003). MSM have a considerably higher HIV prevalence than the overall population, and studies have reported continual increases in unprotected anal intercourse (UAI) since the mid-1990s (CDC, 1999; Chen *et al.*, 2002; Ekstrand *et al.*, 1999; Wolitski *et al.*, 2001). Having multiple sex partners (CDC, 2002; Erbeding *et al.*, 2003) and using drugs and alcohol (CDC, 2002; Colfax *et al.*, 2001; Mansergh *et al.*, 2001) continue to be associated with UAI; however, drugs of abuse and ways to meet partners have both expanded. Emerging drugs of abuse include crystal methamphetamine (crystal meth) and Viagra, and the Internet has become an important new venue to meet sex partners.

Among MSM, drugs may be used within a sexual context (Stall & Purcell, 2000). Men who begin having sex with men while on drugs may continue to use drugs during sexual experiences ('party and play'), and certain drugs such as nitrite inhalants (poppers), ecstasy

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and crystal meth may be used specifically to enhance sexual experiences. The use of club drugs such as ecstasy, Gamma Hydroxy Butyrate (GHB), ketamine and crystal meth has been associated with high-risk sexual behaviors (Colfax *et al.*, 2001; Lewis & Ross, 1995; Mansergh *et al.*, 2001; Mattison *et al.*, 2001; Romanelli *et al.*, 2003). Furthermore, the misuse of Viagra, alone and in combination with other substances (Chu *et al.*, 2003; Colfax *et al.*, 2001; Kim *et al.*, 2002; Sherr *et al.*, 2000), has been linked with unsafe sex (Mattison *et al.*, 2001; Woody *et al.*, 1999).

We had the unique opportunity to study non-injection drug use and high-risk sexual behavior among MSM on a national level. The majority of research on HIV and risk behavior has been conducted in small geographic areas or within cities where HIV is endemic (Leigh & Stall, 1993). However, there may be differing levels and correlates of risk, such as substance use, across geographic regions (Leigh & Stall, 1993), contributing to or resulting in changing epidemic trends. The aim of this study was to learn more about the association between substance use and unprotected sex among MSM recruited online.

Methods

We conducted an anonymous, cross-sectional Internet study, inquiring about sexual and drug-using behaviors among MSM between June and December 2001. The banner linking to the survey was posted online between June 3 and July 24, 2002. Overall, 2,284 individuals clicked on the banner and exited the survey without answering any questions; 3,697 clicked on the banner and answered the survey. A total of 2,949 questionnaires were complete enough for statistical analysis (79% completion rate): 2,934 by men (18 of whom were exclusively heterosexual), ten by women and five by transgendered individuals. Analysis was limited to the 2,916 men who reported sex with other men or who self-identified as gay or bisexual.

The online survey included information on demographics (age group, race/ethnicity, education, income and residence) and assessment of risk behaviors, such as type of sexual contact (anal, oral, vaginal—with and without condoms), knowledge of partners' HIV status, type of illicit drug use, frequency of alcohol consumption, whether drugs or alcohol were used before or during sex, how sex partners were met, and HIV testing. No personally identifying information was collected, e.g. only the first three digits of the zip code and year of birth were obtained. Links to STD/HIV prevention and treatment websites and mental health hotlines appeared at the end of the survey. Survey questions were adapted from questionnaires used by the investigators in previous studies.

Study participation was limited to those 18 and older, and all participants clicked on an online consent form before gaining access to the anonymous survey. The general interest, gay-oriented website agreed to host a banner in all US adult chat-rooms, advertising and linking to the survey. Individuals had to be registered with the website in order to enter chat-rooms. The chat-room banner provided the only link to the survey. The survey did not use cookies and neither collected user IP addresses nor stored them with submitted data. The Medical and Health Research Association of New York City, Inc. (MHRA) institutional review board approved the study.

Descriptive statistics, bivariate and multivariate analyses, and factor analyses were conducted using SPSS 11.5 for Windows (SPSS, 2001). Bivariate categorical data relationships were evaluated using χ^2 and odds ratios, and were simultaneously assessed by multiple logistic regression models. Factor analysis was conducted for data reduction purposes for the eight drug variables, poppers, crystal meth, GHB, ketamine, ecstasy, cocaine, marijuana and Viagra. The scree plot (Cattell, 1966) of eigenvalues suggested a two-factor solution, in which

Viagra was found to act as a stand-alone, additional variable. We performed several oblique rotations (using Direct Oblimin rotation) on maximum likelihood extraction solutions, specifying three-factor and then two-factor models with Viagra included in both. The findings suggested that Viagra should not be included in the preferred two-factor model since it did not load on either factor. The two-factor model fit the data substantially better than the three-factor model, provided better interpretability of factor loadings and was more parsimonious. This model accounted for 50% of the common variance. The factors were accordingly labeled Drug Factor 1 (poppers, crystal meth, cocaine, marijuana) and Drug Factor 2 (ecstasy, GHB, ketamine).

Definition of key variables

In this cross-sectional study, respondents were asked how many sex partners they had during two distinct three-month periods. Respondents could only choose one response from a pull-down menu for each time period. Answer choices were none, one, 2–5, 6–10, 11–20, 21–50 and 51 or higher. This variable was collapsed for the entire six-month period; men who reported no partners or one were grouped into the first category. Men who reported 2–5 partners were grouped into the second category; those who reported six partners or more were grouped into the third category. In the bivariate analyses the second and third categories were merged for ease of analysis and considered as multiple sex partners. Regarding unprotected sex, respondents were asked about insertive and receptive sex without a condom. The UAI variable represents men who reported any unprotected receptive and/or insertive anal intercourse.

We did not ask if people had ever been tested, but rather were they tested during the study period or had they ever tested positive. A large proportion of the sample had not been tested during the six-month study period; however, most (95%) reported that they had never tested HIV-positive. Thus, for the analyses in this paper, HIV serostatus was divided into two groups: those who reported testing HIV-positive (at some point) and those who tested negative during the study or who were not tested but never tested positive (HIV-positive versus HIV-negative/unknown).

Results

Demographic and behavioral characteristics

Analysis was limited to men who completed the survey and reported sex with other men or who self-identified as gay or bisexual. Participants resided in all 50 states, roughly in proportion to the population of each state. Less than 1% resided in Guam, Puerto Rico and a few locations outside the US. The sample was predominately white (see Table 1). Nearly half of the sample was between 18 and 29 years of age, with a range of 18 to 60 years or older. Most reported up to \$40,000 income and the majority reported at least some college education or more. Most men (80%) reported having sex only with men, while 20% reported having sex with both men and women. Overall, 8% of the sample reported testing HIV-positive. The HIV prevalence by age group (which included men who were not tested during the study in the denominator) was 2% for 18–24, 6% for 25–29, 12% for 30–39, 10% for 40–49 and 13% for 50 or older.

The number of lifetime sex partners ranged from 0 to over 1,000, with about one-quarter of the participants reporting more than 100 lifetime partners (see Table 2). The majority (80%) reported more than one sex partner (multiple sex partners) during the six-month study

Table 1. Demographic characteristics of men who have sex with men recruited online $N = 2,916$

Demographics	<i>n</i> (%)
Age	
18–29	1356 (46)
30–49	1335 (46)
50+	225 (8)
Race/ethnicity	
White	2425 (85)
Black	63 (2)
Hispanic	164 (6)
Bi/Multiracial	120 (4)
Other race/ethnicity	97 (3)
Education	
High school or less	368 (13)
Some college or enrolled	1239 (42)
College degree or more	1298 (45)
Income	
Up to \$40,000	1600 (61)
More than \$40,000	1033 (39)
HIV status	
Positive	223 (8)
Negative/unknown	2680 (92)
Residence	
North East (NY, NJ, CT, PA, MA, RI, NH, ME, VT)	465 (16)
South Atlantic (DE, DC, MD, VA, WV, NC, SC, GA, FL)	530 (19)
North Central (IN, MI, IA, WI, MN, SD, ND, IL, MO, KS, NE)	579 (20)
South Central (AL, TN, MS, KY, OH, LA, AR, OK, TX)	579 (20)
Mountain (MT, CO, WY, ID, UT, AZ, NM, NV)	268 (9)
Pacific (CA, HI, OR, WA, AK, GUAM)	453 (16)

period. Forty-five per cent of the overall sample reported any illicit drug use, with over a third reporting drinking until drunk at least 1–3 days per week on average. About half reported drinking alcohol before or during sex. Injection drug use was extremely low (<1%). Approximately 68% of those reporting drug use reported drugs before or during sex. Most (91%) used drugs from Drug Factor 1 before or during sex, with less than one-third using drugs from Drug Factor 2 before or during sex.

Regional differences

The drug use data were analyzed by six US regions, North East (NE), South Atlantic (SA), North Central (NC), South Central (SC), Mountain (MTN) and Pacific (PAC). We were able to ascertain which state (and therefore which region) the respondent was from, based on the first three digits of their zip codes. There were significant regional differences among those

Table 2. Behavioral characteristics of men who have sex with men recruited online

Characteristics	n (%)
Overall drug use, past 6 months (<i>n</i> = 2,741)	
No drug use	1520 (55)
One drug	616 (23)
Two or more drugs	605 (22)
Individual drugs	
Poppers	532 (19)
Crystal methamphetamine	161 (6)
Cocaine	204 (7)
Marijuana	815 (30)
Ecstasy	274 (10)
Gamma hydroxy butyrate	88 (3)
Ketamine	102 (4)
Viagra	255 (9)
Drug factors	
Drug Factor 1†	1082 (40)
Drug Factor 2††	294 (11)
Alcohol	
Drunk at least 1–3 days per week (<i>n</i> = 2,870)	989 (35)
Alcohol before or during sex (<i>n</i> = 2914)‡	1412 (49)
Sexual behavior	
Lifetime sex partners:	
0–10	616 (21)
11–50	997 (35)
51–100	481 (17)
Over 100	763 (27)
Sex partners during study, past 6 months	
0	133 (5)
1	432 (15)
2–5	1237 (43)
6–100+	1055 (37)
Unprotected anal intercourse, past 6 months	1637 (56)

†Drug Factor 1: poppers, crystal meth, cocaine, marijuana; ††Drug Factor 2: Ecstasy, GHB, ketamine; ‡alcohol use before or during sex defined as sometimes or on most occasions.

reporting poppers, crystal meth, cocaine or GHB before or during sex, and drinking until drunk at least 1–3 days per week on average (see Table 3). There were no regional differences in reporting of alcohol use before sex. ANOVA and the Bonferroni method were used for each variable to determine whether there was a mean difference in the percentage of reporting of these variables among and between each regional pair. Crystal meth use was most frequently reported in the SC, MTN and PAC regions, compared to the NE (SC mean difference = 0.07, $p < 0.001$; MTN mean difference = 0.07, $p < 0.01$; PAC mean difference = 0.07, $p < 0.001$) and NC regions (SC mean difference 0.05, $p < 0.01$; MTN mean difference 0.06, $p < 0.05$; PAC mean difference 0.06, $p < 0.01$). There was a 7% reporting difference of cocaine use between the SC and NC regions (SC mean difference 0.07, $p < 0.001$). Respondents in the NC and SC regions were significantly more likely to report drinking until drunk several days a week on average compared to the PAC region (NC mean difference 0.09, $p < 0.05$; SC mean difference 0.09, $p < 0.05$). There were no mean differences found by region for poppers or GHB.

Table 3. Regional variation by drug and alcohol use

	North East <i>n</i> = 465	South Atlantic <i>n</i> = 530	North Central <i>n</i> = 579	South Central <i>n</i> = 579	Mountain <i>n</i> = 268	Pacific <i>n</i> = 453	<i>p</i> value
	%	%	%	%	%	%	
Poppers (<i>n</i> = 523)	17	21	16	22	7	17	0.036
Crystal Meth (<i>n</i> = 161)	5	16	12	29	14	24	0.000
Cocaine (<i>n</i> = 201)	15	17	12	31	10	15	0.002
Marijuana (<i>n</i> = 806)	16	19	17	22	8	18	0.07
Ecstasy (<i>n</i> = 271)	15	18	16	23	8	20	0.17
GHB (<i>n</i> = 88)	6	23	16	27	7	21	0.028
Ketamine (<i>n</i> = 102)	18	19	16	28	7	12	0.27
Viagra (<i>n</i> = 251)	15	17	18	22	7	21	0.13
Drunk 1–3 days (<i>n</i> = 975)	16	17	23	22	9	13	0.01

Note. ANOVA test *F*-statistic used.
Categories are not mutually exclusive.

Correlates of unprotected anal intercourse

In the bivariate analyses (see Table 4), significant correlates of UAI included being younger than 50, having less than a college degree, earning less than \$40,000, being HIV-positive, using drugs from Drug Factors 1 and 2 before or during sex, using Viagra before or during sex, drinking until drunk at least 1–3 days per week on average, drinking alcohol before/during sex, meeting sex partners both online and offline, and having 2–5 or 6 or more sex partners during the study. Race was not significantly associated with UAI. By individual drugs in Drug Factors 1 and 2, men who reported UAI, compared to those who did not, were significantly more likely to report poppers (OR 3.2, 95% CI 2.5–3.9, $p < 0.001$), crystal meth (OR 3.7, 95% CI 2.5–5.6, $p < 0.001$), cocaine (OR 2.7, 95% CI 1.9–3.8, $p < 0.001$), marijuana (OR 1.6, 95% CI 1.4–1.9, $p < 0.001$), ecstasy (OR 2.4, 95% CI 1.8–3.1, $p < 0.001$), GHB (OR 11.0, 95% CI 4.8–25.4, $p < 0.001$) and ketamine (OR 2.6, 95% CI 1.6–4.1, $p < 0.001$).

To ensure that men with no sex partners during the study did not bias the overall findings of the multivariate analysis, we ran the analysis with ‘no sex partners’ combined with ‘1 sex partner’ (as the reference group), and then re-ran the analysis excluding men with ‘no sex partners’. Findings were virtually identical, thus we kept the ‘no sex partners’ group in the analysis. Additionally, since the variable, drinking until drunk at least 1–3 days per week, was highly correlated with alcohol use before/during sex, we excluded the former from the multivariate analysis.

In the multivariate analysis (Table 4), the strongest predictors of unprotected anal intercourse were having less than a college degree, using drugs before/during sex from Drug Factor 1, using Viagra, drinking alcohol before/during sex, meeting sex partners both online and offline and having multiple sex partners. Compared to men who reported less than two sex partners, men who reported 2–5 sex partners were not more likely to report UAI, although men reporting six or more partners were. Drug Factor 2, age, income and HIV status were not predictive of UAI in the multivariate analysis.

Table 4. Bivariate and multivariate analyses: correlates of unprotected anal intercourse (UAI)

	Unprotected anal intercourse		Bivariate OR (95% CI)	<i>p</i> value	Multivariate adjusted OR (95% CI)	<i>p</i> value
	Yes	No				
Demographics and behavior <i>n</i> = 2,279	<i>n</i> (%)	<i>n</i> (%)				
Age						
18–29	796 (59)	559 (41)	1.7 (1.3–2.3)	<0.001	1.3 (0.9–1.9)	0.121
30–49	740 (55)	593 (45)	1.5 (1.1–2.0)	<0.001	1.2 (0.9–1.8)	0.225
50+ (reference)	101 (45)	124 (55)	–			
Education						
High school or less	233 (63)	135 (37)	1.7 (1.3–2.1)	<0.001	2.2 (1.6–3.1)	<0.001
Some college or enrolled	741 (60)	496 (40)	1.4 (1.2–1.7)	<0.001	1.5 (1.3–1.9)	<0.001
College degree or more (reference)	659 (51)	638 (49)	–			
Income						
Less than \$40,000	931 (58)	667 (42)	0.8 (0.7–0.9)	0.039	0.9 (0.7–1.1)	0.346
HIV status						
HIV positive	141 (63)	82 (37)	1.4 (1.0–1.8)	0.028	1.4 (0.9–1.9)	0.083
Drug use (<i>n</i> = 2,741)						
Drug Factor 1	735 (68)	346 (32)	2.2 (1.9–2.6)	<0.001	1.5 (1.2–1.8)	<0.001
Drug Factor 2	220 (75)	74 (25)	2.5 (1.9–3.3)	<0.001	1.3 (0.9–1.8)	0.159
Viagra	183 (72)	72 (28)	2.1 (1.6–2.8)	<0.001	1.5 (1.1–2.2)	0.015
Alcohol before/during sex	913 (65)	499 (35)	1.9 (1.7–2.3)	<0.001	1.5 (1.2–1.9)	<0.001
Behavior						
Met partners:						
Offline only (reference)	289 (52)	271 (48)	–			
Online only	377 (50)	373 (50)	0.9 (0.8–1.2)	0.631	1.1 (0.8–1.4)	0.515
Online and offline	957 (65)	521 (35)	1.7 (1.4–2.1)	<0.001	1.4 (1.1–1.8)	0.016
Sex partners:						
0–1 (reference)	215 (38)	349 (62)	–			
2–5	667 (54)	569 (46)	1.9 (1.5–2.3)	<0.001	1.1 (0.8–1.4)	0.546
6–100+	729 (69)	326 (31)	3.6 (2.9–4.5)	<0.001	1.9 (1.4–2.5)	<0.001

OR = odds ratio; CI = confidence interval; UAI = receptive or insertive unprotected anal intercourse.

Drug Factor 1: poppers, crystal methamphetamine, cocaine, marijuana; Drug Factor 2: ecstasy, GHB, ketamine.

Multivariate model adjusted for age, education, income, HIV status, Drug Factors 1 and 2, Viagra, alcohol before or during sex, how partners were met, and number of sex partners in the past 6 months.

Additional analyses

In an analysis of drug use by HIV status, HIV-positive men were significantly more likely to report using two or more drugs before or during sex than HIV-negative/unknown men (OR 2.1, 95% CI 1.5–2.9, $p < 0.001$), but there were no differences with the use of only one drug before or during sex. We used ANOVA to further investigate differing levels of drug use by UAI. The number of drugs used significantly affected the risk of UAI $F(2, 2735) = 52.59$, $p < 0.001$. A trend analysis indicated that the data were well fit by a linear model ($F = 105.15$, $p < 0.001$). The more drugs a respondent reported, the more likely he was to engage in UAI.

In order to assess the potential for HIV transmission, we compared the HIV status of the participants to that of their partners. Among HIV-positive men with multiple sex partners who reported UAI ($n = 123$), 46% reported UAI with HIV negative/unknown partners only, 42% reported UAI with positive and negative/unknown partners and 12% reported UAI with positive partners only.

Discussion

This anonymous Internet survey provided important new information on the types of drugs currently being used by MSM, by region and in the context of sexual behavior. Relatively high prevalence rates of drug and alcohol use, UAI and multiple sex partners were reported. Overall, men who reported poppers, crystal meth, cocaine, marijuana, Viagra or alcohol use before or during sex were significantly more likely to report unprotected anal intercourse. Also, men with less education, who met sex partners both online and offline and who reported having six or more sex partners during the six-month study period were significantly more likely to report UAI.

Main findings from this study indicate that drugs from Drug Factor 1 (poppers, crystal meth, cocaine, marijuana) and Viagra are associated with UAI and are consistent with other studies of MSM, where poppers, crystal meth and Viagra have been associated with high-risk sexual behavior (Colfax *et al.*, 2001; Mattison *et al.*, 2001; Molitor *et al.*, 1998; Woody *et al.*, 1999); cocaine and marijuana have also been associated with crystal meth use (Rotheram-Borus, 1999). It is possible that the drugs in Drug Factor 2 (ecstasy, GHB, ketamine) were not predictive of UAI because they were less likely to be used before or during sex. Another large national study had similar findings (Colfax *et al.*, 2004).

Regional findings from this study indicate that the highest prevalence of crystal meth use was found in the western regions, where it has historically been most prevalent (Sullivan *et al.*, 1998; Thiede *et al.*, 2003). According to a recent national report (NIDA, 2003), indicators of methamphetamine use remained highest in West Coast areas and parts of the Southwest. Crystal meth abuse is spreading to major cities such as Atlanta, Chicago, Detroit and St. Louis. Relatively low indicators of crystal meth abuse were found in East Coast and Mid-Atlantic areas. Findings from our survey may not necessarily be representative of these regions; however, the differing regional levels of reporting of crystal meth and cocaine may be signifying changes in drugs of abuse (Leigh & Stall, 1993). Additionally, it is possible that state and local agencies may have already missed an opportunity for targeted drug intervention and/or prevention in the North East, as reports of crystal meth use in MSM appear to be on the rise (*Newsday*, 2004; Reuters, 2004).

Nearly half of the sample reported drinking alcohol before or during sex, and this behavior was associated with unprotected sex. Alcohol use and sexual risk behavior is a controversial topic with mixed findings. However, a recent review of event-level alcohol studies (Weinhardt, 2000) indicated that, more often than not, alcohol use was associated

with high-risk sexual behavior. Additionally, a recent event-level study (Colfax *et al.*, 2004) examining drug and alcohol use before sex among HIV-negative MSM found that heavy use of alcohol, use of poppers, amphetamines and cocaine before or during sex were significantly associated with increased risk of engaging in UAI with a serodiscordant partner. These findings complement our main findings. Additionally, the risk of reporting UAI in our study increased as the number of drugs used increased.

A review of research on substance use indicates that MSM who report drug use are more likely to use multiple drugs, at once or sequentially, and use particular drugs such as poppers and amphetamines, compared to heterosexual men (Stall & Purcell, 2000; Stall & Wiley, 1988). In a longitudinal study of HIV-negative MSM non-injecting drug users, consistent abuse of poppers and amphetamines was linked to later HIV seroconversion (Chesney *et al.*, 1998). Thus, substance use and its relationship to high-risk sexual behavior among MSM is of particular concern, as drugs and alcohol may help men to avoid feelings of anxiety associated with same-sex behavior and self-awareness of HIV risk (McKirnan *et al.*, 1996; McKirnan *et al.*, 2001), and certain drugs such as poppers, MDMA and crystal meth may be used specifically to enhance sexual experiences (Lewis & Ross, 1995).

There has been an apparent cultural shift since the introduction of highly active antiretroviral therapy (HAART), as studies report reduced concerns about contracting HIV (among HIV-negative MSM) and about transmitting it among HIV-positive MSM (Chen *et al.*, 2002; Katz *et al.*, 2002; Rietmeijer *et al.*, 2003). Complacency about safer sex among both HIV-positive and HIV-negative men, coupled with an increase in UAI, may be partially related to changed attitudes towards HIV because of the antiretroviral medications now available (Dilley *et al.*, 2003; Elford *et al.*, 2000; Halkitis *et al.*, 2003; Remien, 1998; Vanable *et al.*, 2000).

The majority of HIV-positive men with multiple sex partners reported unprotected sex with HIV-negative or status unknown partners, which signifies the continued risk of spreading HIV and other sexually transmitted diseases (STDs). Other studies of HIV-positive men report a range of serodiscordant or potentially discordant sex, from 21% to 49% (Chen *et al.*, 2003; Halkitis & Parsons, 2003; Whittington *et al.*, 2002).

There are important limitations in our study. First, the survey was only posted on one general interest, gay-oriented site, thus we do not know how the findings would differ (if at all) if men were recruited from sites whose sole purpose is to facilitate meeting sex partners. Second, minority MSM were under-represented in the sample. Third, we could neither verify the reliability of respondents' identity nor their responses since the survey was anonymous. Finally, it is not possible to determine whether the population that participated in this Internet-based survey is representative of the population of MSM using the Internet, of MSM in general or of MSM with HIV, since the MSM population has never been enumerated. Nevertheless, Internet research is an efficient and inexpensive way to reach large samples of high-risk groups. Our preliminary data suggest that white, non-Hispanic MSM were unintentionally over-sampled, as those who have computer skills and access to participate in online sex surveys tend to be younger, wealthier, educated white males (Binik *et al.*, 1999; Lenhart *et al.*, 2003; Toomey & Rothenberg, 2000).

In spite of these limitations, there are important benefits of conducting Internet-based research and using technical and non-technical mechanisms to minimize non-valid data. For example, we asked age and year of birth in different sections of the survey to ensure reliability of responses. In order to minimize the likelihood of participants completing multiple surveys, the study banner was rotated through the online chat-rooms at the end of a string of paid advertisements approximately every 20 minutes, and it was not technically possible for

participants to bookmark the questionnaire. Also, there were no monetary incentives to complete the survey.

Regarding validity of responses, higher reporting of risk behaviors has been found on computer versus other survey methods. A recent survey found that injection drug users were more likely to report high-risk sexual and drug-using behaviors on computer assisted self-interviewing (CASI) than in face-to-face interviews (Newman *et al.*, 2002). Another recent survey comparing online and offline samples found that the online sample of HIV-negative men and never-tested men were significantly more likely to report serodiscordant UAI than men surveyed offline (Elford *et al.*, 2004).

Studies conducted over the past 20 years have found associations between substance abuse treatment and a reduction in HIV risk behaviors (Metzger & Navaline, 2003). Primary and secondary substance abuse treatment among MSM has been successful at reducing drug use and other high-risk behaviors, as treatment can affect decisions about sexual behavior uninfluenced by drugs and alcohol (Shoptaw & Frosch, 2000). There is clearly a need for the integration of sexual behaviors and substance use in HIV prevention efforts. By identifying specific drug use and other high-risk behavior(s) associated with HIV infection, we can inform online education, prevention and/or harm reduction. Our study findings indicate a strong continuing need for HIV information and education. Ongoing drug surveillance is necessary to document new trends in substance use patterns (or emerging substances) among MSM (Stall *et al.*, 2001). We need to fully understand the complexities of current sexual and drug trends in order to create multifaceted interventions.

Findings from this study raise serious public health concerns. There is a need to better understand changing behaviors in this population of MSM that may be associated with HIV transmission in order to develop effective prevention and education strategies. Since online research is such a young field, research, ethical and technical issues are in need of refinement. However, there are opportunities to collect information on high-risk and traditionally hard-to-reach populations. More research is needed to disentangle the intersections of drug use, unprotected sex, serodiscordant sex and the use of the Internet to meet sex partners.

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