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## Symptoms of Substance Dependence and Risky Sexual Behavior in a Probability Sample of HIV Negative Men Who Have Sex with Men in Chicago

Mary Ellen Mackesy-Amiti<sup>1</sup>, Michael Fendrich<sup>2</sup>, and Timothy P. Johnson<sup>3</sup>

<sup>1</sup>Community Outreach Intervention Projects, Division of Epidemiology and Biostatistics School of Public Health, University of Illinois at Chicago, 1603 W Taylor St, Chicago, IL 60612

<sup>2</sup>Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Enderis Hall Room 1191, Milwaukee, WI 53201

<sup>3</sup>Survey Research Laboratory, College of Urban Planning and Public Administration, University of Illinois at Chicago, 412 S. Peoria St., Chicago, IL 60607

### Abstract

**Objective**—This study examines the relationship between self-reported symptoms of substance dependence and risky sexual behavior among 187 HIV-negative men who have sex with men.

**Method**—In a supplement to a Chicago household survey, using random probability sampling, men who reported consensual sex with other men or who identified as gay or bisexual were selected for interviews. Participants reported on sexual behavior, substance use, and symptoms of substance dependence related to past year use of alcohol, marijuana, cocaine, and sedatives, tranquilizers or pain relievers. Risky sexual behavior was defined as unprotected insertive or receptive anal intercourse *plus* having multiple partners, casual partners, or a partner who was HIV positive or of unknown serostatus.

**Results**—Risky sexual behavior in the past six months was significantly and positively associated with alcohol dependence symptoms, cocaine dependence symptoms (receptive only), and prescription drug dependence symptoms (insertive only). Confirmatory factor analyses revealed that dependence symptoms loaded on separate factors by substance, which in turn loaded on an overarching dependence symptoms factor. In structural equation models, individual substance factors were not significantly associated with sexual risk behavior, however the higher-order dependence symptoms factor was significantly and positively associated with both receptive and insertive risk behavior.

**Conclusions**—MSM with symptoms of multiple substance use dependencies are more likely to be engaged in sexual behavior that places them at risk for acquiring HIV and other sexually transmitted infections. Alcohol and drug abuse treatment providers should be aware of the need for HIV testing and counseling in this population.

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**Correspondence to:** Mary E. Mackesy-Amiti, Ph.D., University of Illinois at Chicago, School of Public Health / COIP, 1603 W. Taylor St., Chicago, IL 60612, phone: 312-355-4892, fax: 312-996-1450, mmamiti@uic.edu.

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## Keywords

HIV; men who have sex with men (MSM); substance use; substance dependence; risky sexual behavior

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## 1. Introduction

Although overall rates of HIV infection have declined considerably since the mid-1980s, current levels among urban men who have sex with men (MSM) remain high, and a resurgence of the epidemic appears to be imminent (Centers for Disease Control and Prevention, 2005; Gross, 2003; Jaffe et al., 2007; Sullivan et al., 2009).

A substantial body of research has developed on the subject of alcohol and illicit drug use among MSM, and its relationship to unsafe sex and the spread of HIV (e.g. Celentano et al., 2006; Colfax et al., 2004; Irwin et al., 2006; Seage et al., 1998; Stall and Purcell, 2000; Trocki and Leigh, 1991; Vanable et al., 2004). Several studies have reported higher rates of illicit drug use among MSM than among heterosexual men or men in general (Hughes and Eliason, 2002; McKirnan and Peterson, 1989; Skinner and Otis, 1996; Stall and Wiley, 1988; Woody et al., 2001), although some of these differences may be due to reporting biases (Fendrich et al., 2008; Mackesy-Amiti et al., 2008). Moreover, an abundance of studies have reported an association between unsafe sex and substance use among MSM (Beckett et al., 2003; Darrow et al., 2005; Fernandez et al., 2005; Garofalo et al., 2007; Klitzman et al., 2002; Koblin et al., 2003; Mansergh et al., 2001; Shoptaw and Reback, 2007; Stall and Purcell, 2000; Stueve et al., 2002).

Fewer studies have specifically addressed the issue of substance abuse, problem substance use, or clinical symptoms of substance dependence among MSM in comparison to other men. Two recent studies that did examine symptoms of substance dependence found some evidence of more dysfunctional substance use among MSM than among other men (Cochran et al., 2004; Mackesy-Amiti et al., 2009). These findings are consistent with other reports of mental health disparities affecting lesbian, gay, bisexual, and transgender (LGBT) individuals (Dean et al., 2000; Gay and Lesbian Medical Association and LGBT Health Experts, 2001). These psychosocial health problems are of concern in their own right, but moreover they may be associated with increased risk of STI and HIV infection. In a multi-city telephone survey of MSM, Stall and colleagues (Stall et al., 2003) found that greater numbers of psychosocial health problems were significantly and positively associated with high risk sexual behavior and HIV infection. Similar findings were reported in community based sample of young MSM in Chicago (Mustanski et al., 2007).

In a study that addressed the relationship between dysfunctional drug use and risky sexual behavior, Ryan and colleagues (Ryan et al., 1999) found that subjects who had a history of *both* alcohol and other substance use disorders (but not just one type of disorder) had a significantly elevated risk of HIV infection. Yet, these were not associated with elevated rates of unprotected anal intercourse among HIV negative men. Thus, there is a surprising lack of research suggesting direct links between substance dependence and high risk sexual behavior. The existing research suggests that HIV risk is elevated when there are combined alcohol and other substance abuse disorders. We would expect that any form of substance dependence should elevate individual involvement in high risk sexual behavior. Multiple lines of research (e.g. McKirnan et al., 2001; Ostrow, 2000) have underscored the disinhibiting role that substance intoxication plays for MSM in the context of sexual behavior. Accordingly, we would expect that those who are substance dependent – irrespective of the type of substance they are dependent on – would be more likely to experience intoxication and thus place

themselves more frequently in situations where the risk of STI transmission is increased. Additionally, while any single dependency should increase risk, multiple dependencies should lead to further increases in risk behavior. It should be underscored that the dearth of research into this issue is surprising and that the establishment of such links is potentially critical for HIV and STI risk prevention programming. Such findings would reinforce the potential value of integrating risk prevention messages into substance abuse treatment programs tailored for MSM.

The present study examines associations between self-reported symptoms of substance dependence (for alcohol, marijuana, cocaine, and prescription drugs) and risky sexual behavior in a probability sample of men who have sex with men in an urban community. We then test alternative structural equation models, comparing substance-specific effects with a summative effect.

## 2. Methods

### 2.1. Sample

The MSM Supplement employed a household survey in two Chicago ZIP codes with a high population of MSM, based on consultation with a community advisory board. Subjects were randomly sampled using multistage probability methods; details have been published elsewhere (Fendrich et al., 2008). Surveys were administered from September 2002 through January 2003. Households were screened by interviewers, and adult males who had a history of consensual sex with other men or who identified themselves as gay or bisexual were selected to be interviewed. Screening was initiated with a resident at 56% of the selected households. The response rate for the survey was 35%, and the cooperation rate was 70%.<sup>1</sup> Informed consent was obtained by the interviewer prior to administration of the survey. Following the survey, respondents were asked to provide oral fluid, urine, and hair specimens for drug testing. Respondents were compensated for their time with payments of \$40 for the survey, and \$10 for each biological specimen provided. A total of 216 interviews were completed for this study. Since the number of men who reported a positive HIV test was too small for a stratified analysis, they were excluded from the present analysis, leaving a sample of 187 HIV negative MSM.

### 2.2. Measures

Participants completed an audio computer-assisted self-interview (ACASI) survey that included questions on substance use, drug and alcohol treatment, sexual behavior, HIV testing and serostatus, and demographic background.

**Substance Dependence Symptoms**—Recent drug use was ascertained by asking participants, for each substance they had ever used, how long it had been since they last used it. Participants who indicated they had last used alcohol, marijuana, cocaine, heroin, or prescription drugs (tranquilizers, sedatives, or prescription pain relievers) within the past year were asked questions about dependence symptoms related to the use of these substances. These items were adapted from the National Household Survey on Drug Abuse (NHSDA), and reflected DSM-IV (American Psychiatric Association, 1994) criteria of drug dependence, and included 1) spending a great deal of time in substance-related activities, 2) using much more often or in larger amounts than intended, 3) needing a larger amount to get the same effect (i.e. developing a tolerance), 4) experiencing impairment in meeting social obligations or engaging

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<sup>1</sup>Using formulas recommended by the American Association for Public Opinion Research (American Association for Public Opinion Research, 2006), the response rate is calculated using the formula for response rate #3, defined as the number of completed interviews divided by the eligible sample. The cooperation rate is calculated using formula #1, defined as the number of completed interviews divided by the number of completed interviews plus the number of refusals.

in recreational activities due to substance use, 5) experiencing emotional or psychological problems due to substance use, 6) experiencing physical health problems caused or exacerbated by substance use, and 7) wanting to cut down on use but being unable to. To be consistent with DSM-IV criteria, items 5 and 6 were combined to represent one symptom, resulting in six symptoms for each substance. DSM-IV criteria also include withdrawal symptoms, which were not assessed.

Following the example of Cochran et al. (2004), a measure of “dependence syndrome” was created for each substance by counting the number of symptoms endorsed. Endorsement of three or more symptoms indicated the presence of dependence syndrome. DSM-IV criteria for substance dependence require three or more of seven symptoms (including withdrawal). Thus, respondents who endorsed three or more symptoms would be likely to qualify as dependent on a substance.

**Sexual Risk Behavior**—Questions pertaining to risky sexual activity included 1) the total number of male sex partners in the past six months, 2) the number of times having sex with “a ‘casual partner’ or someone you had sex with only once”, 3) the number of times having receptive anal intercourse with a male partner, 4) the percentage of times having receptive anal intercourse without a condom, 5) the number of times having insertive anal intercourse with a male partner, 6) the percentage of times having insertive anal intercourse without a condom, and 7) having sex in the past six months with a partner who was known to be HIV positive or whose status was not known. Unprotected anal intercourse in itself is not necessarily risky, for example if performed within a monogamous relationship. Since we did not have a direct indicator of unprotected anal sex with risky partners, we constructed a measure from the available information that would reflect a high likelihood of risky sex. We calculated two binary indicators of risky sexual behavior in the past six months: 1) any unprotected insertive anal intercourse *combined with* having multiple partners, casual partners, or a partner who was HIV positive or of unknown status, and 2) any unprotected receptive anal intercourse given the same conditions. Men who reported unprotected anal intercourse, but had only one partner, no casual sex, and no sex with a man who was HIV positive or of unknown status were classified as not having risky sex.

### 2.3. Analysis

Logistic regression analyses were conducted, predicting sexual risk behavior from number of substance dependence symptoms or dependence syndrome for each substance. Sociodemographic covariates included in the analyses were age, race (White vs. Non-white), education (college vs. less than college), income, and employment (full-time vs. less than full-time). Standard errors were adjusted for design effects due to sampling using Stata’s *svy* procedures (StataCorp, 2005). Weighting did not affect the results of the analyses, therefore results are reported from unweighted analyses.

A confirmatory factor analysis of substance dependence symptoms was conducted using MPlus (Muthen and Muthen, 2006) software. Estimation was performed with weighted least square parameter estimates using a diagonal weight matrix with standard errors and mean- and variance- adjusted chi-square test statistic that use a full weight matrix (WLSMV), and the default Delta parameterization. We started with a four-factor solution (one factor for each substance) with six indicators (described above) for each factor. When necessary, collinear indicators were dropped. We then tested a model with an additional higher-order factor (see Gorsuch, 1983, Chap. 11; McClain, 1996) and compared this with the four-factor solution. After selecting the measurement model, we added the insertive and receptive sexual risk indicators as dependent variables.

### 3. Results

#### 3.1. Sample

Some characteristics of the sample are presented in Table 1. The majority of men in the sample were White (80%), had a college education or higher (74%), and most (78%) were employed full-time, and earning at least \$30,000 annually. Twenty-five percent reported that they were currently married to a woman ( $n = 7$ ), or in a cohabiting relationship (gender of partner unspecified,  $n = 40$ ).

#### 3.2. Substance use & dependence symptoms

The proportions of men reporting alcohol, marijuana, cocaine, and prescription drug use, and symptoms related to each of these substances are shown in Table 2. Only three men reported past year heroin use, therefore heroin dependence symptoms were not included in the analysis. Twenty-one percent of the men in our sample ( $N = 39$ ) were positive for substance dependence syndrome, and six percent ( $N = 11$ ) had multiple dependencies. Of those with dependence syndrome, 21% ( $N = 8$ ) reported any past treatment or counseling, and 8% ( $N = 3$ ) reported current treatment or counseling for alcohol or drug use.

#### 3.3. Sexual behavior

Most of the men (81%) were sexually active (i.e. reported at least one sex partner) within the previous six months (see Table 3). Fifty percent of the men reported two or more sex partners in that period, and 52% reported one or more episodes of sex with a “casual” or one-time partner. Unprotected insertive anal intercourse was reported by 35%, and unprotected receptive anal intercourse was reported by 28% of the sample. Nearly one third (32%) reported sex with a partner whose HIV status was positive or unknown. Twenty-two percent of the men scored positive on the insertive risk indicator, and 16% percent scored positive on the receptive risk indicator.

#### 3.4. Dependence symptoms and risky sexual behavior

Table 4 shows the results of the logistic regression analyses predicting indicators of risky sexual behavior from dependence symptoms. Insertive risk was significantly associated with number of alcohol dependence symptoms, number of prescription drug dependence symptoms, prescription drug dependence syndrome, and total number of substance dependence symptoms. Receptive risk was significantly associated with number of alcohol dependence symptoms, alcohol dependence syndrome, cocaine dependence syndrome, and total number of dependence symptoms.

#### 3.5. Factor structure of substance dependence symptoms

The confirmatory factor analysis was performed on the full sample of MSM ( $N = 216$ ). Two items, including one marijuana dependence symptom indicator (#4 - impairment in social obligations or recreational activities), and one prescription drug dependence symptom indicator (#5 - emotional or physical problems) were dropped due to collinearity. The overall fit of the four-factor model was good, chi-square = 9.95 (8 df),  $p = 0.27$ , CFI = 0.995, RMSEA = .034. All of the symptom indicators had significant loadings on their factors.

Adding a higher-order factor resulted in a model chi-square = 9.08 (8 df),  $p = 0.34$ , CFI = 0.997, RMSEA = .025. All of the dependence symptom indicators had significant loadings on their factors, and each of the substance dependence factors had a significant loading on the higher-order factor. Since both models resulted in a good fit, we decided to conduct the SEM analysis with each of the measurement models.

### 3.6. Structural equation model

Using the sample of HIV-negative MSM (N = 187), we added the sexual risk behavior indicators as dependent variables predicted by a) the four specific substance dependence symptom factors, or b) the higher-order dependence symptoms factor. One cocaine dependence symptom indicator (#3 - tolerance) and one prescription drug dependence symptom indicator (#6 - tried to quit but couldn't) were dropped due to collinearity.

The first model fit was good, chi-square = 9.12 (8 df),  $p = 0.33$ , CFI = 0.995, RMSEA = .025, WRMR=0.744. None of the four specific substance dependence symptom factors were found to be significantly associated with the sexual risk behaviors. The second model fit was also good, chi-square = 8.91 (8 df),  $p = 0.35$ , CFI = 0.996, RMSEA = .023, WRMR=0.825. The higher-order latent dependence symptoms factor was significantly associated with both sexual risk behavior variables. The model results are presented in Table 5. The StdXY column contains the coefficients standardized using the variance of the observed variables, in addition to the variance of continuous latent variables. This standardized coefficient represents the amount of change in an outcome variable per standard deviation unit of a predictor variable.

## 4. Discussion

Dependence symptoms related to the use of alcohol, cocaine, and prescription drugs were associated with risky sexual behavior in this household probability sample of men who have sex with men. The results of the structural equation models suggest that sexual risk behavior is not associated with dependence symptoms for any one substance, adjusting for dependence symptoms for other substances, but it is associated with dependence symptoms overall. This is consistent with Ryan et al.'s (Ryan et al., 1999) finding that only having a history of *both* alcohol and other substance use disorder conveyed additional risk; the multiplicity of problems indicates greater risk. We also see in the regression analyses presented in Table 4 that there is a significant association between both of the sexual risk behaviors and the total number of substance dependence symptoms endorsed. Men with three or more symptoms, irrespective of the substance involved, have a 40–60% increased odds of engaging in risky sexual behavior.

These findings are also consistent with Stall et al.'s (Stall et al., 2003) message regarding the *syndemic* of psychosocial health problems among MSM. HIV/AIDS is only the most recognized of multiple serious health problems experienced by MSM populations in the United States. These health conditions have additive effects on HIV risk. We find similarly that the more substance dependence symptoms are reported, the more likely MSM are to be engaged in risky sexual behavior.

More than two-thirds of the men who met the criteria for substance dependence syndrome reported no current or past substance use treatment. In a previous paper based on this sample (Mackesy-Amiti, et al., 2009), we reported that history of drug or alcohol treatment was significantly associated with a positive HIV test. Moreover, initial drug or alcohol treatment usually preceded HIV diagnosis, suggesting that for many MSM, treatment reflects a missed opportunity for HIV risk prevention education. Other researchers (Ostrow et al., 2009; Shoptaw and Frosch, 2000; Shoptaw et al., 2005) have noted the importance of implementing interventions that target drug reduction as part of comprehensive and efficacious HIV prevention strategies. Future research should address how to expand the use of substance use treatment and counseling services among MSM, and how to integrate HIV prevention counseling that addresses the needs of MSM with these services. Finally, although this paper focused exclusively on substance use related problems, reflecting on recent literature, it may be important to investigate the extent to which psychiatric symptoms may be linked to sexual risk in samples of MSM. Paralleling our suggestions in relation to this specific study, studies focusing, for example on the link between depressive symptoms and HIV risk behavior, could

inform useful strategies for integrating prevention within the context of mental health service delivery.

## Limitations

Unfortunately, data were not collected on dependence symptoms related to stimulant use. However, only six percent of the sample reported past year use of methamphetamine, and 7.5% reported past year use of methamphetamine or another stimulant drug (excluding MDMA). On the other hand, past year use of MDMA was reported by 18% of the sample, a significant increase compared to the rate in the earlier Chicago Urban Men's Health Study (Fendrich, et al., In Press). Future research on substance dependence among MSM should include assessments of symptoms related to the use of MDMA as well as other stimulant drugs.

Our measure of sexual risk behavior was also limited. Some individuals may have been characterized as having had risky sex when in fact the unprotected intercourse they reported did not occur with a risky partner. Partner-specific measures of unprotected intercourse that differentiate between primary monogamous relationships and other relationships, and between HIV positive, negative, and unknown status partners would yield more valid information on risk.

A more rigorous test of the contribution of dysfunctional substance use to risky sexual behavior, would control for the level of substance use – for example, by including only men who used at least one illicit substance in the past year. Our small sample size precluded taking this approach. Also because of the small sample size, we were not able to include sociodemographic predictors in the structural equation model. Logistic regression analyses indicated that age was significantly and negatively associated with insertive risk behavior. Other sociodemographic variables (race, education, employment, income) were not associated with risk behavior.

These data are cross-sectional, and therefore we cannot draw any conclusions about causal relationships based on these findings. The sample for this study was geographically limited, being drawn from two postal codes in one community area in Chicago, a major Midwestern city. The lack of diversity in the sample's sociodemographic characteristics reflects the composition of the population of this community. In addition, the area sampled is known for its active gay community, and the findings might not be generalizable to other settings.

## Conclusions

Our findings underscore the importance of making substance abuse treatment available to MSM, and integrating HIV prevention strategies into substance abuse treatment targeted to MSM. Despite its limitations, this study is unusual in that it is based on a probability sample. It fills an important gap in the literature that should be explored in other locales and using more recent data.

## References

- American Association for Public Opinion Research. Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 4th edition. Lenexa, Kansas: AAPOR; 2006.
- Beckett M, Burnam A, Collins RL, Ranouse DE, Beckman R. Substance use and high-risk sex among people with HIV: A comparison across exposure groups. *AIDS Behav* 2003;7:209–219. [PubMed: 14586205]
- Celentano DD, Valleroy LA, Sifakis F, MacKellar DA, Hylton J, Thiede H, McFarland W, Shehan DA, Stoyanoff SR, Lalota M, Koblin BA, Katz MH, Torian LV. Associations between substance use and sexual risk among very young men who have sex with men. *Sex Transm Dis* 2006;33:265–271. [PubMed: 16434886]

- Centers for Disease Control and Prevention. Trends in HIV/AIDS diagnoses—33 states, 2001–2004. *Morb Mortal Weekly Rep* 2005;54:1149–1153.
- Cochran SD, Ackerman D, Mays VM, Ross MW. Prevalence of non-medical drug use and dependence among homosexually active men and women in the US population. *Addiction* 2004;99:989–998. [PubMed: 15265096]
- Colfax G, Vittinghoff E, Husnik MJ, McKirnan D, Buchbinder S, Koblin B, Celum C, Chesney M, Huang YJ, Mayer K, Bozeman S, Judson FN, Bryant KJ, Coates TJ. Substance use and sexual risk: A participant- and episode-level analysis among a cohort of men who have sex with men. *Am J Epidemiol* 2004;159:1002–1012. [PubMed: 15128613]
- Darrow WW, Biersteker S, Geiss T, Chevalier K, Clark J, Marrero Y, Mills V, Obiaja K. Risky sexual behaviors associated with recreational drug use among men who have sex with men in an international resort area: Challenges and opportunities. *J Urban Health* 2005;82:601–609. [PubMed: 16221920]
- Dean L, Meyer IH, Robinson K, Sell RL, Sember R, Silenzio VMB, Bowen DJ, Bradford J, Rothblum E, White J, Dunn P, Lawrence A, Wolfe D, Xavier J. Lesbian, Gay, Bisexual, and Transgender Health: Findings and Concerns. *J Gay Lesb Med Assoc* 2000;4:102–151.
- Fendrich M, Johnson TP, Mackesy-Amiti ME, Pollack LM. Sexual risk behavior and drug use in two Chicago samples of men who have sex with men: 1997 vs. 2002. *J Urban Health*. In Press.
- Fendrich M, Johnson TP, Mackesy-Amiti ME. Validity of self-reported substance use in MSM: Comparisons with a general population sample. *Ann Epidemiol* 2008;18:752–759. [PubMed: 18693041]
- Fernandez MI, Bowen GS, Varga LM, Collazo JB, Hernandez N, Perrino T, Rehbein A. High rates of club drug use and risky sexual practices among Hispanic men who have sex with men in Miami, Florida. *Subst Use Misuse* 2005;40:1347–1362. [PubMed: 16048821]
- Garofalo R, Mustanski BS, McKirnan DJ, Herrick A, Donenberg GR. Methamphetamine and young men who have sex with men: Understanding patterns and correlates of use and the association with HIV-related sexual risk. *Arch Pediatr Adolesc Med* 2007;161:591–596. [PubMed: 17548765]
- Gay and Lesbian Medical Association. Healthy People 2010 Companion Document for Lesbian Gay, Bisexual, and Transgender (LGBT) Health. San Francisco, CA: Gay and Lesbian Medical Association; 2001. LGBT Health Experts.
- Gorsuch, RL. Factor analysis. 2nd Edition. Hillsdale, NJ: Lawrence Erlbaum; 1983.
- Gross M. The second wave will drown us. *Am J Public Health* 2003;93:872–881. [PubMed: 12773343]
- Hughes TL, Eliason M. Substance use and abuse in lesbian, gay, bisexual and transgender populations. *J Prim Prev* 2002;22:263–298.
- Irwin TW, Morgenstern J, Parsons JT, Wainberg M, Labouvie E. Alcohol and sexual HIV risk behavior among problem drinking men who have sex with men: An event level analysis of timeline followback data. *AIDS Behav* 2006;10:299–307. [PubMed: 16482407]
- Jaffe HW, Valdiserri RO, De Cock KM. The reemerging HIV/AIDS epidemic in men who have sex with men. *J Am Med Assoc* 2007;298:2412–2414.
- Klitzman RL, Greenberg JD, Pollack LM, Dolezal C. MDMA ('ecstasy') use, and its association with high risk behaviors, mental health, and other factors among gay/bisexual men in New York City. *Drug Alcohol Depend* 2002;66:115. [PubMed: 11906799]
- Koblin BA, Chesney MA, Husnik MJ, Bozeman S, Celum CL, Buchbinder S, Mayer K, McKirnan D, Judson FN, Huang Y, Coates TJ. High-risk behaviors among men who have sex with men in 6 US cities: baseline data from the EXPLORE Study. *Am J Public Health* 2003;93:926–932. [PubMed: 12773357]
- Mackesy-Amiti ME, Fendrich M, Johnson TP. Prevalence of recent illicit substance use and reporting bias among MSM and other urban males. *Addict Behav* 2008;33:1055–1060. [PubMed: 18430520]
- Mackesy-Amiti ME, Fendrich M, Johnson TP. Substance-related problems and treatment among men who have sex with men in comparison to other men in Chicago. *J Subst Abuse Treat* 2009;36:227–233. [PubMed: 18715744]
- Mansergh G, Colfax GN, Marks G, Rader M, Guzman R, Buchbinder S. The Circuit Party Men's Health Survey: findings and implications for gay and bisexual men. *Am J Public Health* 2001;91:953–958. [PubMed: 11392940]



- McClain, AJ. Hierarchical analytic methods that yield different perspectives on dynamics: Aids to interpretation. In: Thompson, B., editor. *Advances in Social Science Methodology*. Greenwich, CT: JAI Press; 1996. p. 229-240.
- McKirnan DJ, Peterson PL. Alcohol and drug use among homosexual men and women: Epidemiology and population characteristics. *Addict Behav* 1989;14:545–553. [PubMed: 2589133]
- McKirnan DJ, Vanable PA, Ostrow DG, Hope B. Expectancies of sexual "escape" and sexual risk among drug and alcohol-involved gay and bisexual men. *J Subst Abuse* 2001;13:137–154. [PubMed: 11547615]
- Mustanski B, Garofalo R, Herrick A, Donenberg G. Psychosocial health problems increase risk for HIV among urban young men who have sex with men: preliminary evidence of a syndemic in need of attention. *Ann Behav Med* 2007;34:37–45. [PubMed: 17688395]
- Muthen LK, Muthen BO. MPlus [Computer software]. 2006
- Ostrow DG, Plankey MW, Cox C, Li XH, Shoptaw S, Jacobson LP, Stall RC. Specific sex drug combinations contribute to the majority of recent HIV seroconversions among MSM in the MACS. *JAIDS-J Acq Imm Def* 2009;51:349–355.
- Ostrow DG. The role of drugs in the sexual lives of men who have sex with men: Continuing barriers to researching this question. *AIDS Behav* 2000;4:205–219.
- Ryan CM, Huggins J, Beatty R. Substance use disorders and the risk of HIV infection in gay men. *J Stud Alcohol* 1999;60:70–77. [PubMed: 10096311]
- Seage GR, Mayer KH, Wold C, Lenderking WR, Goldstein R, Cai B, Gross M, Heeren T, Hingson R. The social context of drinking, drug use, and unsafe sex in the Boston young men study. *J Acquir Immune Defic Syndr Hum Retrovirol* 1998;17:368–375. [PubMed: 9525439]
- Shoptaw S, Reback CJ. Methamphetamine use and infectious disease-related behaviors in men who have sex with men: Implications for interventions. *Addiction* 2007;102:130–135. [PubMed: 17493062]
- Shoptaw S, Reback CJ, Peck JA, Yang X, Rotheram-Fuller E, Larkins S, Veniegas RC, Freese TE, Hucks-Ortiz C. Behavioral treatment approaches for methamphetamine dependence and HIV-related sexual risk behaviors among urban gay and bisexual men. *Drug Alcohol Depend* 2005;78:125–134. [PubMed: 15845315]
- Shoptaw S, Frosch D. Substance abuse treatment as HIV prevention for men who have sex with men. *AIDS Behav* 2000;4:193–203.
- Skinner WF, Otis MD. Drug and alcohol use among lesbian and gay people in a Southern U.S. sample: Epidemiological, comparative, and methodological findings from the Trilogy Project. *J Homosex* 1996;30:59–92. [PubMed: 8743117]
- Stall R, Mills TC, Williamson J, Hart T, Greenwood G, Paul J, Pollack L, Binson D, Osmond D, Catania JA. Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *Am J Public Health* 2003;93:939–942. [PubMed: 12773359]
- Stall R, Purcell DW. Intertwining epidemics: A review of research on substance use among men who have sex with men and its connection to the AIDS epidemic. *AIDS Behav* 2000;4:181–192.
- Stall R, Wiley J. A comparison of alcohol and drug-use patterns of homosexual and heterosexual men: The San-Francisco Men's Health Study. *Drug Alcohol Depend* 1988;22:63–73. [PubMed: 3266145]
- StataCorp. *Stata Statistical Software: Release 9: Survey Data*. College Station, TX: StataCorp LP; 2005.
- Stueve A, O'Donnell L, Duran R, San Doval A, Geier J. Being high and taking sexual risks: findings from a multisite survey of urban young men who have sex with men. *AIDS Educ Prev* 2002;14:482–495. [PubMed: 12512849]
- Sullivan PS, Hamouda O, Delpech V, Geduld JE, Prejean J, Semaille C, Kaldor J, Folch C, Op de Coul E, Marcus U, Hughes G, Archibald CP, Cazein F, McDonald A, Casabona J, van Sighem A, Fenton KA. Reemergence of the HIV epidemic among men who have sex with men in North America, Western Europe, and Australia, 1996–2005. *Ann Epidemiol* 2009;19:423–431. [PubMed: 19460672]
- Trocki KF, Leigh BC. Alcohol consumption and unsafe sex: A comparison of heterosexuals and homosexual men. *J Acquir Immune Defic Syndr* 1991;4:981–986. [PubMed: 1890607]
- Vanable PA, McKirnan DJ, Buchbinder SP, Bartholow BN, Douglas JM, Judson FN, MacQueen KM. Alcohol use and high-risk sexual behavior among men who have sex with men: The effects of consumption level and partner type. *Health Psychol* 2004;23:525–532. [PubMed: 15367072]

Woody GE, VanEtten-Lee ML, McKirnan D, Donnell D, Metzger D, Seage G, Gross M. Substance use among men who have sex with men: Comparison with a national household survey. *J Acquir Immune Defic Syndr* 2001;27:86–90. [PubMed: 11404525]

**Table 1**

## Characteristics of HIV negative respondents

		<b>N</b>	<b>Percent</b>
Age	18–29	41	22%
	30–39	66	35%
	40–49	52	28%
	50–55	28	15%
Race/Ethnicity	White	149	80%
	Black	15	8%
	Hispanic	12	6%
	Other	11	6%
Income	\$30,000 or less	42	22%
	>\$30–50,000	46	25%
	>\$50–80,000	46	25%
	>\$80,000	53	28%
Education	High School or less	14	7%
	Some college	35	19%
	College graduate	91	49%
	Graduate degree	47	25%
Employment	Full time	146	78%
	Part time	13	7%
	Not working	28	15%
Relationship Status	Single	140	75%
	Married/Cohabiting	47	25%

**Table 2**

## Past year substance use and dependence symptoms

	<b>N</b>	<b>Percent</b>
Alcohol use	173	93%
Any alcohol dependence symptoms	72	39%
Alcohol dependence syndrome <sup>a</sup>	29	16%
Marijuana use	80	43%
Any marijuana dependence symptoms	25	13%
Marijuana dependence syndrome <sup>a</sup>	12	6%
Cocaine use	33	18%
Any cocaine dependence symptoms	9	5%
Cocaine dependence syndrome <sup>a</sup>	6	3%
Prescription drug <sup>b</sup> use	27	14%
Any prescription drug dependence symptoms	7	4%
Prescription drug dependence syndrome <sup>a</sup>	5	3%
Total	187	

<sup>a</sup>Three or more symptoms

<sup>b</sup>Sedatives, tranquilizers, or prescription pain relievers

**Table 3**

## Sexual behavior in the past six months

Variable	Value	N	Percent
Number of Partners	0	36	19%
	1	58	31%
	2 or more	93	50%
Casual Sex (number of times)	0	90	48%
	1 or more	97	52%
Unprotected Insertive Anal Intercourse (number of times)	0	121	65%
	1 or more	66	35%
Unprotected Receptive Anal Intercourse (number of times)	0	134	72%
	1 or more	53	28%
Sex with HIV Positive/Unknown Partner	No	126	67%
	Yes	59	32%
Insertive Risk Indicator	No	145	78%
	Yes	42	22%
Receptive Risk Indicator	No	157	84%
	Yes	30	16%

**Table 4**  
Associations between substance dependence symptoms and risky sexual behavior

Measure	Insertive Risk		Receptive Risk	
	AOR <sup>a</sup>	95% CI <sup>b</sup>	AOR <sup>a</sup>	95% CI <sup>b</sup>
Number of symptoms				
Alcohol	<b>1.23</b>	<b>1.04</b>	<b>1.43</b>	<b>1.17</b>
Marijuana	1.07	0.78	1.12	0.81
Cocaine	1.12	0.73	1.41	0.95
Rx drugs <sup>c</sup>	<b>1.59</b>	<b>1.03</b>	0.97	0.56
Dependence syndrome				
Alcohol	1.97	0.98	<b>2.76</b>	<b>1.13</b>
Marijuana	1.21	0.31	1.74	0.46
Cocaine	2.51	0.3	<b>8.89</b>	<b>49.66</b>
Rx drugs <sup>c</sup>	<b>6.29</b>	<b>1.1</b>	0.94	0.12
Total number of symptoms	<b>1.13</b>	<b>1</b>	<b>1.19</b>	<b>1.08</b>

<sup>a</sup> Adjusted odds ratio; adjusted for age, race, education, income, and employment

<sup>b</sup> Adjusted for design effects

<sup>c</sup> Sedatives, tranquilizers, pain relievers

**Table 5**

Structural equation model of dependence symptoms and sexual risk behavior

	Estimates	S.E.	Est./S.E.	StdXY
<b>Alcohol Symptoms BY:</b>				
alc1: spending time	0.481	0.178	2.698	0.842
alc2: using more	0.450	0.178	2.526	0.787
alc3: needing more	0.467	0.16	2.911	0.816
alc4: social impair	0.543	0.194	2.791	0.950
alc5: physical/psych	0.537	0.187	2.876	0.939
alc6: unable cut down	0.481	0.178	2.704	0.842
<b>Marijuana Symptoms BY:</b>				
mj1: spending time	0.739	0.115	6.428	0.975
mj2: using more	0.715	0.112	6.401	0.944
mj3: needing more	0.625	0.115	5.415	0.824
mj5: physical/psych	0.684	0.094	7.288	0.903
mj6: unable cut down	0.715	0.112	6.374	0.943
<b>Cocaine Symptoms BY:</b>				
coc1: spending time	0.697	0.172	4.050	0.975
coc2: using more	0.640	0.178	3.592	0.895
coc4: social impair	0.704	0.157	4.480	0.985
coc5: physical/psych	0.691	0.168	4.120	0.966
coc6: unable cut down	0.671	0.161	4.164	0.939
<b>Rx Drug Symptoms BY:</b>				
rx1: spending time	0.853	0.092	9.259	0.960
rx2: using more	0.864	0.079	10.937	0.972
rx3: needing more	0.874	0.080	10.947	0.984
rx4: social impair	0.859	0.103	8.304	0.967
<b>Dependence Symptoms BY:</b>				
Alcohol Symptoms	1.436	0.749	1.917	0.821
Marijuana Symptoms	0.862	0.285	3.023	0.653
Cocaine Symptoms	0.977	0.455	2.147	0.699
Rx Drug Symptoms	0.517	0.193	2.673	0.459
<b>Receptive Risk ON:</b>				
Dependence Symptoms	0.472	0.136	3.459	0.472
<b>Insertive Risk ON:</b>				
Dependence Symptoms	0.326	0.12	2.721	0.326
<b>Insertive Risk WITH:</b>				
Receptive Risk	0.527	0.131	4.018	0.527