Published in final edited form as:

Arch Sex Behav. 2019 January ; 48(1): 369–382. doi:10.1007/s10508-018-1282-8.

The prevalence and correlates of sexual arrangements in a national cohort of HIV-negative gay and bisexual men in the US

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Abstract

Sexual agreements have received considerable attention as an aspect of dyadic functioning associated with HIV risk. To date, this research has primarily utilized convenience samples which over-represented men from large urban areas and with higher HIV risk. The current study utilized a national cohort of 1,061 HIV-negative gay and bisexual men recruited to be geographically diverse within the U.S. The sample included 531 (50.0%) men who identified as single. Of the 530 partnered men, 240 (45.3%) were monogamous; 238 (44.9%) were in open relationships (where sex with outside partners was permitted); and 52 (9.8%) were in monogamish relationships (where sex with outside partners was limited to instances where both primary partners were present). Regardless of urban (versus non-urban) residence, men in monogamous relationships engaged in less anal sex generally and CAS specifically with casual partners. Single men reported significantly more frequent anal sex with casual partners compared to open and monogamish men; however, there were no differences among these three groups with respect to CAS with casual partners. In multivariable models, monogamish men reported significantly more frequent marijuana use and alcohol consumption compared to all other groups. Urban (versus non-urban) residence moderated associations between sexual arrangements and depression as well as the use of illicit drugs other than marijuana. These findings point to the need to better examine the potentially unique mechanisms which confer risk and resilience for gay male couples in urban versus non-urban settings. The observed association between sexual arrangements and substance use suggest interventions which facilitate the negotiation of sexual agreements may present an opportunity to engage in dyadic substance use intervention.

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Conflict of Interest: All authors declare that they have no conflict of interest.

Keywords

gay male relationships; MSM; sexual agreements; HIV; drug use; mental health

INTRODUCTION

Recent years have seen an expansion in research on main partner relationships among gay and bisexual men (GBM). Much of this work has been energized by the establishment of main partnerships as a primary context for HIV infection. GBM and other men who have sex with men (GBMSM) bear a disproportionate burden of HIV infection (Centers for Disease Control and Prevention, 2015). GBMSM accounted for 67% of new HIV infections in 2015, a 6% increase from 2005 to 2014 (Centers for Disease Control and Prevention, 2015). As early as 2000, Davidovich, de Wit and Stroebe (2000) noted that main partnerships provide a sexual context that facilitates sex behaviors which may transmit HIV infection. Epidemiological studies have supported this conclusion. Estimates suggest that 35–68% of new infections were identified to be from main partners (Goodreau et al., 2012; Sullivan, Salazar, Buchbinder, & Sanchez, 2009).

The risk of main partner HIV transmission arises behaviorally from the fact that GBM engage in a higher number of sex acts, more acts of receptive anal intercourse, and lower rates of condom usage with their main (versus casual) partners (Sullivan et al., 2009). Paradoxically, GBM in main partnerships perceive themselves to be at lower risk of HIV infection (Goldenberg, Finneran, Andes, & Stephenson, 2015; Stephenson, White, & Mitchell, 2015). Partnered GBM are more confident that they will remain HIV-negative throughout their lifetime (Mitchell et al., 2016; Stephenson, White, Darbes, Hoff, & Sullivan, 2015) and have corresponding low rates of routine HIV testing (Mitchell et al., 2016; Mitchell & Petroll, 2012; Stephenson, White, Darbes, et al., 2015).

Research has examined the strategies GBM use to promote their partners' health behavior generally and to reduce HIV-risk specifically (Lewis, Gladstone, Schmal, & Darbes, 2006). One common strategy by which partners manage each other's HIV risk is through the formation of sexual agreements – understandings about the limitations and boundaries placed upon sex with people outside the relationship (Hoff, Beougher, Chakravarty, Darbes, & Neilands, 2010). Neilands, Chakravarty, Darbes, Beougher and Hoff (2009) suggested that sexual agreements can be viewed as a relationship factor similar to – and potentially informed by – other aspects of relationship functioning such as commitment and satisfaction consistent with the framework of Couples Interdependence Theory (CIT) (Rusbult & Van Lange, 2003). In this framework, sexual health and HIV-prevention are seen as joint goals, whose achievement requires the coordinated effort of both partners in the couple. This conceptualization of agreements is largely consistent with previous work on negotiated safety, in which the formation of a sexual agreement – in conjunction with HIV testing – was viewed as a way for couples to minimize the risk associated with the cessation of condom use (e.g., Crawford, Rodden, Kippax, & Van de Ven, 2001; Davidovich et al., 2000; Kippax et al., 1997).

In some instances, the literature has distinguished between sexual agreements – which refer to some implicit or explicit shared understanding about whether sex with outside partners is allowed (Hoff & Beougher, 2010)– and sexual arrangements (Parsons, Starks, Dubois, Grov, & Golub, 2013). This latter construct refers to how the couple “handles” sex with outside partners, without necessarily implying that the couple has arrived at any “agreement” about this behavior. We utilize the term “sexual arrangement” when referring to data collected in this paper. The rationale for this distinction is reflective of assessment procedures, which are similar those utilized by Parsons et al. (2013). It also acknowledges that a study of individual partnered men is unable to verify that partners within a relationship concur on whether sex with outside partners is permitted.

Research on sexual agreements and/or arrangements has typically distinguished between monogamous (those in which sex with outside partners is not permitted) and non-monogamous subtypes (those which permit some sex with outside partners) (Hoff & Beougher, 2010; LaSala, 2004; Mitchell, Harvey, Champeau, Moskowitz, & Seal, 2012; Parsons et al., 2013). Studies have consistently found that roughly half (47% - 60%) of partnered GBM are in relationships characterized by monogamous agreements or arrangements (LaSala, 2004; Mitchell et al., 2012; Parsons et al., 2013). More recent work has distinguished between subtypes of non-monogamy (Grov, Starks, Rendina, & Parsons, 2014; Parsons et al., 2013; Parsons, Starks, Gamarel, & Grov, 2012). Open relationships are those in which members of the couple are permitted to have sex with casual partners independently. In contrast, monogamish relationships restrict sex outside the relationship to instances in which both members of the couple participate together (sex as a couple with one or more outside partner). Studies examining subtypes of non-monogamy have typically found that open agreements or arrangements are at least modestly more common than the relatively more restrictive monogamish counterpart. Across studies, 22.5 – 49% of non-monogamous men have open arrangements (Hoff et al., 2010; Mitchell & Petroll, 2013) while 19.9 – 44% are monogamish (Mitchell et al., 2012; Parsons et al., 2013).

Subsequent work has examined HIV-related correlates of sexual agreements or arrangements. Men in monogamous relationships report lower perceived risk of HIV seroconversion and higher confidence in remaining HIV-negative, compared to GBM in a nonmonogamous relationship (Stephenson, White, Darbes, et al., 2015; Stephenson, White, & Mitchell, 2015). At the same time, they are also the least likely to get tested for HIV (Stephenson, White, Darbes, et al., 2015) or discuss their HIV sero-status with their partner (Mitchell et al., 2016). With regard to sexual HIV-risk behavior, the distinction between monogamish and open subtypes of non-monogamy is potentially meaningful from the perspective of CIT. Sex with casual partners requires potentially require more coordination between main partners for monogamish (versus open) couples as sex with outside partners can only happen when both main partners are present. This heightened level of coordination affords greater opportunity for partners to reinforce relational goals and shared consequences of HIV-prevention practices. Consistent with this framework, Parsons et al. (2013) found that men in open relationships were more likely to engage in condomless anal sex (CAS) with casual partners than those in monogamish relationships.

A couple's sero-status may contextualize their sexual agreement or arrangement as each partner might have different priorities and desires based on their personal HIV-status (Hoff et al., 2009). For example, one study examining couples' motivations for their relationship agreement found that sero-concordant negative and sero-discordant couples, compared to sero-concordant positive couples, were more likely to endorse HIV and STI prevention as a reason for making a sexual agreement (Hoff et al., 2010). Given the motivation for HIV-prevention among HIV-negative and sero-discordant couples, it is perhaps unsurprising that evidence indicates that Pre-Exposure Prophylaxis (PrEP) uptake may vary with sexual arrangements. Men in non-monogamous relationships perceive PrEP as more important for both themselves and their partners (Hoff et al., 2015; John, Starks, Rendina, Grov, & Parsons, 2017), and are more willing to persuade their partners to go on PrEP (John et al., 2017).

Viewed through the lens of CIT (Hoff, Chakravarty, Beougher, Neilands, & Darbes, 2012; Neilands et al., 2009), sexual agreements or arrangements serve to regulate sexual behavior. It is therefore expected that agreements would covary with sexual behavior, HIV-risk, and related perceptions. Perhaps one of the most intriguing findings in the recent decade is the fact that sexual agreements and arrangements also covary with drug use and depression. This observed correspondence is consistent with the broader literature on syndemics in which HIV-related risk behavior is linked to both depression and drug use – particularly poly-drug use (e.g., Parsons, Grov, & Golub, 2012; Stall et al., 2003; Starks, Tuck, Millar, & Parsons, 2016).

Among heterosexuals, being partnered has been associated with decreased drug use; however, similar differences between single and partnered sexual minority individuals have not been observed (Austin & Bozick, 2011). One potential reason for the failure to observe such differences is that studies pool partnered GBM – combining monogamous and non-monogamous relationships. To the extent that drug use is associated with sexual behavior, and men in non-monogamous relationships are more likely to engage in sexual behavior with outside partners, it is plausible that men in non-monogamous relationships would report higher levels of substance use. Survey research has generally supported this hypothesis. Men in monogamous relationships are less likely to use drugs than their non-monogamous counterparts (Mitchell, 2016; Mitchell, Boyd, McCabe, & Stephenson, 2014; Parsons & Starks, 2014). Men in monogamous and monogamish relationships tend to report drug use that is highly similar to their partners. In contrast, greater between-partner variability in use has been observed in open arrangements (Parsons & Starks, 2014). Inherent in both monogamous and monogamish agreements, is the idea that sexual behavior occurs with the partners together. Parsons and Starks (2014) speculated that the shared nature of sexual behavior in these arrangements provides a context for drug use and can in part explain the greater similarity in use.

Although, much of the research examining the association between depression and relationship status has focused on married or cohabitating heterosexual relationships (Inaba et al., 2005; Kim & McKenry, 2002; Lamb, Lee, & DeMaris, 2003; Simon, 2002; St John & Montgomery, 2009; Yan, Huang, Huang, Wu, & Qin, 2011), studies examining the association between being partnered and depression among gay couples have similarly

found lower rates of depression among partnered GBM compared to those who are single (Gottman et al., 2003; Kurdek, 2004; Whitton & Kuryluk, 2014). A number of factors may lead to this association. Partnered individuals may benefit from the presence of social support provided by their partner. More generally, consistent with CIT, partnered GBM are able to draw on couple-level resources when coping with adversity or moving towards goals, which may reduce stress and yield better coping.

Few studies have examined the association between sexual agreements and depression. Given that previous studies have found depression to be associated with sexual behavior and CAS with casual partners (Millar, Starks, Grov, & Parsons, 2017) and GBMSM in non-monogamous relationships are typically more likely to engage in these behaviors than their monogamous counterparts (Hoff et al., 2012), it is plausible that an association may be observed; however, there is limited evidence of such an association to date. Parsons et al. (2013) found that only monogamish men had lower depression scores compared to unpartnered GBM, but no arrangement differences among men in relationships. This study was limited to partnered men in New York City. A second study similarly found no association between depression and sexual agreements in a sample of partnered men (Starks, Doyle, Millar, & Parsons, 2017). Starks et al. (2017) utilized a nation-wide online sample, but failed to examine geographical differences. It is possible that couples living in non-urban areas experience different rates of depression. Two studies – utilizing the same sample – have previously reported on the prevalence of depression among MSM in the US. While Millar, Starks, Grov and Parsons (2017) found no differences in depression rates by geographic region, Cain et al. (2017) observed higher rates of depression among those MSM living outside of urban areas. Neither of these studies examined relationship status or sexual agreements.

The current literature on correlates of sexual arrangements has relied primarily on convenience samples, often with limited geographical representation. This substantially limits the generalizability of findings as much of the existing research primarily examines GBM that reside in US metropolitan areas (e.g., Hoff et al., 2012; Mitchell & Petroll, 2013; Parsons et al., 2013; Starks, Gamarel, & Johnson, 2014). GBM in large metropolitan areas may have access to larger pools of potential partners, greater community support, and easier access to affirming mental and physical health care. Transitioning to a more affirming climate has been shown to facilitate positive interpersonal development and assuage the impact of social marginalization and stigma among sexual minority individuals generally (Puckett, Horne, Herbitter, Maroney, & Levitt, 2017). Available data from national samples indicates that GBM in rural areas experience greater syndemic burden – particularly sexual compulsivity (Parsons et al., 2017) – and are at greater risk of felt stigma and long-term experiences of enacted discrimination (Swank, Frost, & Fahs, 2012). Population density has been linked to depression in GBM through pathways involving internalized homophobia and social support (Cain et al., 2017). It is plausible that these differences may correspond to differences in the prevalence of sexual agreements or moderate associations between agreements and health outcomes. To date, very little work has explored these potential differences in the US population.

The current study had two specific goals. The first was to examine the prevalence of sexual arrangements among partnered HIV-negative GBM. Based upon previous research, we anticipated that approximately half of the partnered men in the sample would indicate a monogamous relationship arrangement. Further, we anticipated that non-monogamous men would be approximately equally divided between open and monogamish arrangements. The second goal was to examine the potential for rural versus urban residence to moderate the association between sexual arrangements and health outcomes including drug use, anal sex (and CAS) with casual partners, and depression.

METHODS

Participants

Data were collected as part of [BLINDED FOR REVIEW]—a longitudinal study of a U.S. national cohort of gay and bisexual men. Eligible participants were at least 18 years of age; were cis gender male and as gay or bisexual; self-reported an HIV-negative status; and were able to complete online surveys in English and at-home self-administered testing for HIV, chlamydia, and gonorrhea. Participants also needed to report having sex with a man within the past year, to have an address to receive mail that was not a P.O. Box, and to have not moved more than twice in the past six months (i.e., residential stability).

Of the 2,393 (26.5%) men who completed a brief screening survey (described below), 1,375 (57.5%) met study eligibility criteria and provided consent. These men were asked to complete additional survey items and were compensated with a \$10 Amazon gift card. Inclusion in the final cohort was predicated upon completion of the full baseline survey (administered online via Qualtrics) and verification of HIV-negative sero-status via an at-home HIV test. In total, 1,071 men (84.5%) completed these steps. Of the 1071 men, 10 men indicated having a female primary/main partner, thus the sample included in the current analysis was restricted to those who indicated that were single or reported having male primary/main partners ($n = 1061$). They received \$50 compensation in the form of Amazon gift cards: one \$25 gift card for survey completion and another for completion of HIV/STI testing. All study protocols were approved by [BLINDED FOR REVIEW]. Further details related to eligibility and participant characteristics are provided elsewhere [BLINDED FOR REVIEW].

Procedures

Participants were identified via Community Marketing and Insights (CMI) panel of over 45,000 LGBT individuals living in the U.S., over 22,000 of who were GBM. Based upon census data related to population density, 9,011 men were invited to complete a two-minute screening survey. The sample was selected to represent the diversity and distribution of GBM at the population level based upon U.S. Census related to the distribution of same-sex households and racial ethnic composition by state. The recruitment and enrollment procedures and milestones have been described in detail elsewhere [BLINDED FOR REVIEW]. Participants were enrolled between April 2014 and October 2014. Participation included completion of an online survey followed by an at-home HIV test. Participants were

compensated \$25 for the online survey and an additional \$25 for completion of at-home testing.

Measures

Demographic characteristics—Participants reported demographic characteristics including race/ethnicity, education, income, age, sexual orientation, and zip code of residence. Participants also indicated whether or not they were currently prescribed pre-exposure prophylaxis (PrEP) to prevent HIV infection. Participants were asked whether or not they had a main partner. The survey contextualized main partner by stating, “These questions will focus on your main partner – by main partner, we mean the person with whom you are in a relationship, such as your boyfriend/girlfriend, partner, lover or spouse. As of today, do you have a main partner?” Those who indicated they did were asked the year in which they met their main partner, which was used to determine relationship length.

Rural vs. urban community context—Participants’ residences were classified as urban vs. non-urban utilizing zip code data. Zip codes of residence were classified into urban or nonurban using the Rural Urban Commuting Area coding system (RUCA 2.0), where any code above 1 was classified as non-urban. This method of zip code-RUCA approximation has been used in a previous study by our investigative team [BLINDED FOR REVIEW].

Sexual arrangements—Similar to previous studies (Parsons et al., 2013; Starks et al., 2017), participants first indicated whether or not they had a main partner. Those who indicated “no” were coded as single. Those who indicated that they did have a main partner were subsequently asked to report how they and their partners “handled sex outside of their relationship.” Participants who reported “neither of us has sex with others, we are monogamous,” or “I don’t have sex with others and I don’t know what my partner does” were classified as monogamous. Those who reported, “only I have sex with others,” “only he has sex with others,” “both of us have sex with others separately,” “we both have sex with others separately and together,” or “I have sex with others and I don’t know what my partner does” were classified as open. Those who reported “both of us have sex with others together” only were classified as ‘monogamish.’

Depression—Individual self-report depression scores were assessed at baseline, using the Center for Epidemiological Studies – Depression (CESD) (Radloff, 1977). The scale is comprised of 20 items that were scored on a Likert-type scale from 0 (*rarely or none of the time*) to 3 (*most or all of the time*) regarding the way an individual participant may have felt or behaved over the past 3 months. The possible range of scores is 0 to 60; the higher scores indicated the presence of more depressive symptomology. The scale demonstrates adequate reliability (Cronbach’s $\alpha = .93$).

Substance use—Participants were asked whether or not they used alcohol, marijuana, cocaine, crack, crystal methamphetamine, ecstasy, gamma-hydroxybutyrate (GHB), ketamine, and heroin in the previous 90 days. For each substance the participant indicated using, they then reported the number of days on which the substance was used in the previous 90 days. Alcohol and Marijuana were reported by 88.8% and 30.3% of participants,

respectively. In contrast, cocaine, crack, crystal methamphetamine, ecstasy, GHB, ketamine, and heroin, were all reported by fewer than 10% of participant. As such, data from these latter drugs were aggregated into a single variable indicating the cumulative total number of days reported for each substance. Collectively, 10% of participants reported the use of at least one of these substances.

Sexual behavior—Participants who identified as being in a main partnership were asked to report the frequency of total sexual acts (receptive or insertive anal intercourse) as well as the frequency of condomless anal sex (CAS) (either receptive or insertive) with their main partner. All participants, regardless of relationship status, were asked to report the frequency of total sex acts (receptive or insertive anal intercourse) with a casual partners as well as the frequency of CAS (either receptive or insertive) with a casual partner or a new partner. Self-reports, for all participants independent of their current relationship status, were based on individual recall of sexual acts of the past three months.

Analytic plan—Hypotheses related to the prevalence of sexual arrangements were tested using a χ^2 goodness-of-fit test. Bivariate associations between sexual arrangements and demographic variables as well as outcomes of primary interest (depression, substance use, and sexual behavior with casual partners) were assessed using ANOVA and χ^2 tests of independence. Subsequently, multivariable regression models were calculated to test the significance of the interaction between sexual arrangements and urbanicity in the prediction of each outcome. All models were calculated in SPSS and incorporated age, race, and income as covariates. Additionally, to more accurately measure HIV-risk, all models that predicted CAS excluded participants who reported having a current PrEP prescription. Depression was modeled as a linear outcome, sexual behavior with casual partners and substance use outcomes were modeled as count variables in the context of negative binomial regression. SPSS provides an omnibus test for the overall model (*model log-likelihood χ^2*), and also an omnibus test for the overall effect of the interaction (*Wald χ^2*). This latter statistic is useful when assessing the interaction between two categorical variables where at least one has more than 2 categories. It provides a check on type I error when multiple dummy codes are required to represent the effect of a single categorical variable. Where a significant interaction between sexual arrangement and urbanicity was indicated, tests of simple main effects were conducted by rotating the referent category for categorical variables involved.

RESULTS

Participant characteristics

Table 1 reports demographic characteristics by relationship arrangements. Participants included 531 GBM who were categorized as single (50.0%). The remaining 530 participants indicated having a main partner and were divided among monogamous (22.6%), open (22.4%) or monogamish (4.9%) arrangements. That is, among men reporting a main partner, 45.3% indicated they were monogamous, 44.9% open and 9.8% monogamish. Relationship arrangement groups did not differ in terms of age, race or ethnicity, or education. Among those in relationships, there were no significant differences in partner HIV-status. Men in

open relationships were significantly more likely to identify as bisexual compared to monogamous and single men. Men in monogamish arrangements did not differ from other groups with respect to sexual identity. Men in open and monogamish arrangements were significantly more likely to earn \$30,000 or more annually than those who were single. Monogamous men did not differ from any other groups with respect to income. Men in open arrangements reported significantly longer relationship duration than those in monogamous arrangements. Men in monogamish arrangements did not differ from either of the other groups. A small number of men (2.9%) were currently prescribed PrEP. The likelihood of being prescribed PrEP did not differ across groups. Of particular interest to subsequent analyses, the majority of men reported living in a zip code classified as “urban” (87.9%) and this proportion did not vary significantly across groups.

It was hypothesized that half of partnered men would indicate a monogamous (versus a non-monogamous) arrangement. Results of the χ^2 goodness-of-fit test indicated that the observed proportion of monogamous men (45.3%) was significantly less than the 50% hypothesized ($\chi^2(1) = 4.72, p = .03$). It was further hypothesized that non-monogamous men would be split evenly between open and monogamish arrangements. Limiting the sample to non-monogamous men, results of the χ^2 goodness-of-fit test indicated that the observed proportion of non-monogamous men in open arrangements (82.1%) was significantly more than the 50% hypothesized ($\chi^2(1) = 119.30, p < .001$). With regard to sex with main partners, bivariate analyses (see Table 2) indicated men in open arrangements reported significantly less frequent sex and less frequent CAS with their main partners compared to both monogamous and monogamish men.

Depression: Sexual arrangements and urbanicity

At the bivariate level, men in monogamous and open arrangements reported significantly lower depression scores than single men. Men in monogamish arrangements did not differ from any other groups (see Table 2). Table 3 contains results of the multivariable model predicting depression. The interaction between sexual arrangements and urbanicity was significant ($Wald \chi^2(3) = 8.33, p < 0.05$; see Figure 1). Tests of simple main effects revealed that, among urban men, single men had greater depression scores ($B = 2.32$; 95% CI, 0.55, 4.08; $p < .05$) relative to men in open relationships. Further, changing the referent group revealed that men in monogamous relationships differed from all other arrangement groups. Specifically, in urban areas, men in monogamous relationship had lower depression scores than men in open relationships ($B = -2.87$, 95% CI $-4.79, -.99, p < 0.1$); men in monogamish relationships ($B = -4.40$, 95% CI $-7.63, -1.17, p < 0.1$); and single men ($B = -5.18$, 95% CI $-6.85, -3.51, p < 0.1$). Among men living in non-urban settings, no statistical differences across arrangement groups were observed.

Sexual Behavior with Casual Partners

At the bivariate level, single men reported significantly more instances of anal sex with casual partners compared to all other groups. Monogamous men reported significantly fewer. Men in open and monogamish relationships did not differ significantly from one another (see Table 2). Table 3 contains results of the multivariable model predicting frequency of sex with casual sex partners. The interaction between sexual arrangements and urbanicity was

non-significant ($Wald \chi^2(3) = 6.50; p < 0.09$). In a model which omitted the non-significant interaction (see Table 3), the overall main effects of urbanicity was non-significant ($B = -1.00$; 95%CI $-0.65, 0.45$; $p = .73$). In this model, the main effect of sexual arrangements on the frequency of anal sex with casual partners was statistically significant. Similar to bivariate findings, even when controlling for age, race, income, and urbanicity, single men reported significantly more sex with casual partners compared to all other groups, monogamous men reported significantly fewer instances of sex with casual partners than all other groups, and those men in open and monogamish relationships did not differ significantly from one another.

With respect to CAS with casual partners, the initial specification of a negative binomial distribution resulted in convergence problems in multivariable models. A model in which the Poisson distribution was used indicated that the interaction between sexual arrangements and urbanicity was non-significant ($Wald \chi^2(3) = 3.99; p = 0.26$) and this finding was robust even when large values of deviance were specified. In a model which omitted the non-significant interaction (see Table 3), the overall main effects of urbanicity was non-significant ($B = 0.05$; 95%CI $-0.55, 0.66$; $p = .87$). Similar to bivariate findings, even when controlling for age, race, income, and urbanicity, men in monogamous relationships reported significantly fewer instances of CAS with casual partners compared to single ($B = -4.70$; 95%CI $-5.93, -3.47$; $p < .01$), open ($B = -3.58$; 95%CI $-4.95, -2.21$; $p < .01$) and monogamish men ($B = -3.93$; 95%CI $-5.31, -2.55$; $p < .01$). Meanwhile, these latter groups did not differ significantly from one another.

Substance Use

In bivariate analyses (see Table 2), there were no significant between-group differences among sexual arrangement groups with respect to the odds of marijuana use. Other drug use was reported more frequently with men in open and monogamous arrangements. With regard to alcohol use, bivariate analyses indicated that men in monogamish arrangements reported significantly more alcohol use than single men and those in monogamous arrangements. Men in open arrangements did not differ from any other group.

In multivariable models (see Table 4), the interaction between sexual arrangements and urbanicity was non-significant in predicting marijuana use ($Wald \chi^2(3) = 4.39, p = 0.18$). In a model which omitted the non-significant interaction, the overall main effects of urbanicity was non-significant ($B = 0.62$; 95%CI $-0.02, 1.26$; $p = .06$). However, the main effect of sexual arrangements on marijuana was statistically significant after controlling for age, race, income, and urbanicity. Men in monogamish relationships reported significantly more frequent marijuana use compared to monogamous ($B = 1.41$; 95%CI $0.56, 2.25$; $p < .01$), single ($B = 1.09$ 95%CI $0.33, 1.86$; $p < .01$), and open men ($B = 0.84$; 95%CI $0.42, 1.65$; $p < .05$)

In multivariable models predicting alcohol use (see Table 4), the sexual arrangements by urbanicity interaction term was non-significant ($Wald \chi^2(3) = 1.15, p = 0.77$). A subsequent model omitting this term suggested that the overall effect of urbanicity was not significant ($B = 0.14$; 95%CI $-0.08, 0.36$; $p = .22$). With regard to sexual arrangement, single ($B = -0.53$; 95%CI $-0.79, -0.26$; $p < .01$), monogamous ($B = -4.1$; 95%CI $-0.69, -0.13$; $p < .01$),

and open ($B = -0.43$; 95%CI $-0.70, -0.15$; $p < .01$) men all reported significantly lower alcohol use than men in monogamish relationships. These latter groups did not differ significantly from each other.

There was a statistically significant interaction between urbanicity and sexual arrangements in the prediction of other drug use ($Wald \chi^2(3) = 9.42, p < .05$) (see Table 4). Among men living in non-urban settings, men in monogamish arrangements reported more frequent use of other drug use relative to single men ($B = 2.18$, 95%CI $0.09, 4.27$, $p < .05$), men in monogamous arrangements ($B = 6.41$, 95%CI $3.70, 9.12$, $p < .01$), and men in open arrangements ($B = 3.12$, 95%CI $1.01, 5.23$, $p < .01$). Furthermore, in non-urban settings, monogamous men reported less use of other drug use relative to single men ($B = -4.23$, 95%CI $-6.52, -1.95$, $p < .01$) and men in open arrangements ($B = -3.30$, 95%CI $-5.60, -0.99$, $p < .01$). Among men living in urban settings, monogamous men reported fewer instances of other drug use relative to single men ($B = -2.37$, 95%CI $-3.20, -1.55$, $p < .01$) men in open arrangements ($B = -2.89$, 95%CI $-4.05, -1.67$, $p < .01$) and men in monogamish arrangements ($B = -2.68$, 95%CI $-3.98, -1.40$, $p < .01$). No other differences we found between the arrangement groups in urban settings. Figure 2 contains estimated marginal number of drug use days reported by arrangement and urbanicity groups.

DISCUSSION

These findings consolidate and advance the body of research on the prevalence and correlates of sexual arrangements among partnered GBM. The primary advantage of the current study was the utilization of a U.S. national cohort of GBM selected to be geographically diverse. Some findings were consistent for men in urban versus non-urban settings. The probability of CAS with casual partners and frequency of marijuana use was consistent across sexual arrangement groups; and men in monogamish relationships had higher levels of alcohol use than all other groups. Other findings indicated that urban (versus non-urban) residence meaningfully contextualizes the associations between sexual arrangements and a range of health outcomes including depression, frequency of sex with casual partners, and the use of illicit drugs other than marijuana.

With respect to arrangement prevalence, the proportion of monogamous men in the current sample (45.3% of partnered men) falls within the range observed in most previous studies. Among non-monogamous men, the proportion of men in monogamish (versus open) arrangements was lower than that observed elsewhere (Grov et al., 2014; Parsons et al., 2013; Parsons, Starks, et al., 2012). Previous studies examining correlates of this arrangement-type have utilized convenience samples recruited primarily at social venues catering to GBM in large urban areas. This sampling strategy may over-represent men who favor this specific subtype of non-monogamous arrangement.

Relationship factors, including sexual agreements, has been associated with HIV prevention strategies (Hoff, Campbell, Chakravarty, & Darbes, 2016). Previous research and conventional understandings of monogamy would suggest that men in monogamous relationships should have fewer (and ideally no) instances of anal sex generally and CAS specifically with casual partners compared to their non-monogamous counterparts (Hoff et

al., 2016; Mitchell & Petroll, 2013). Interestingly, the effect of sexual arrangement on anal sex and CAS with casual partners did not differ based on urbanicity. In concert with previous findings (Mitchell & Petroll, 2013; Parsons et al. 2013) both unpartnered GBM and men in non-monogamous arrangements were directly associated with greater frequencies of sex with casual partners, and associated with instances of CAS with casual partners compared to men in a monogamous relationship.

The current findings highlight the need for sexual arrangements to be understood within the context of HIV-prevention as a viable strategy to reduce risk. In order to promote sexual health among partnered GBM, an explicit discussion related to HIV-prevention, may be a potential strategy to minimize risk and maximize relationship satisfaction. Such attention could readily be integrated into Couples HIV Testing and Counseling (CHTC) which incorporates modules in which couples for a sexual agreement and discuss expectations related to disclosure in the event one partner were to break their agreement. In addition to discussions related to HIV-prevention and disclosure, if a sexual arrangement were to evolve, or sex with outside partners were to occur irrespective of a sexual arrangement, discussion may mitigate or reduce risk associated with casual sex partners.

Epidemiological studies of main partner HIV transmission risk have cited the increased frequency of sex and CAS between main partners as a mechanism, which explains increased rates of HIV transmission in these relationships (Goodreau et al., 2012; Sullivan et al., 2009). The present findings are consistent with this assertion. Rates of sex and CAS with main partners were consistently higher than those with casual partners. This suggests that, regardless of agreement type, if one member of the couple unknowingly becomes infected with HIV, there is substantial opportunity for infection to be transmitted between partners. Notably, men in open relationships reported less frequent sex and less frequent CAS with their main partners compared to monogamous and monogamish men. This finding may arise simply from the fact that, for both monogamous and monogamish men, sex always involves both members of the couple. Parsons, Starks, Gamarel and Grov (2012) presented evidence that main partner sexual relationship quality, including the frequency of sex between main partners, was relatively consistent across arrangement types. The difference here may be due in part to issues of power (the present study had access to a larger sample) or measurement (Parsons et al. (2012) dichotomized frequency of sex with main partners, while the present study utilized count data). Finally, Parsons et al. (2012) had access to dyadic data and therefore were able to identify couples with discrepant perceptions of their sexual arrangements when examining between-group differences.

Findings related to drug use were partially consistent with Parsons and Starks (2013). In the previous study, monogamy was associated with lower levels of both marijuana and other drug use. Here, monogamy was associated only with decreased use of other illicit drugs not including marijuana. One reason for the difference in findings may be that marijuana use has become a relatively more normative behavior (Hasin et al., 2015), bringing patterns of use more in line with tobacco use than with other illicit drugs (Volkow, Baler, Compton, & Weiss, 2014). One potential reason monogamous men may be less likely to use drugs other than marijuana is that they potentially facilitate sex with casual partners. Some data suggest that gay men in open agreements may be more likely to use drugs or other substances

during, or prior, to sex to enhance and/or prolong a sexual experience compared to monogamous agreements (Mitchell et al., 2014). While findings related to monogamy were consistent with previous research, the particularly frequent use of drugs other than marijuana among monogamish men who live in non-urban areas represents a new finding. The pattern contrasts markedly with drug use among urban men, where monogamish and open relationships reported similar frequencies of use. Additional research is needed to elucidate mechanisms that might explain this association. It may be that non-urban men are particularly likely to utilize drugs to facilitate group sex.

Findings related to depression builds on the current literature by further examining the association between depression and sexual arrangements by geography. It is potentially noteworthy that monogamous men in urban areas and monogamish men in non-urban areas had expected group means (provided in Figure 1) below the clinical cutoff of 16 on the CESD (Radloff, 1977). All other groups had average scores at or above this threshold. The current study's findings expand on the previous work that has found lower rates of depression among married and cohabitating couples among heterosexual samples (Kim & McKenry, 2002; Simon, 2002). In common with the previous literature, single men in urban areas had greater depression scores than men in monogamous and open relationships. The current study also found differences in depression scores among men living in urban areas who had different sexual arrangements. Specifically, monogamous men in urban areas had the lowest depression scores compared to all other urban groups. These findings oppose those found in a previous study. Specifically, Parsons et al., (2013) found that among men who live in New York City, only men in monogamish relationships had lower depression scores compared to unpartnered men. One explanation for the differences in the current findings and Parsons et al., (2013) is that the current study examined sexual arrangements in urban settings nationwide and Parsons et al., (2013) focused on arrangements in New York City. Together, these studies suggest that sexual arrangements are an important predictor for mental health among couples who live in urban areas. Future studies are needed to fully understand the association between depression and sexual arrangements in different urban settings.

While these results collectively reinforce the predictive utility of sexual arrangements for a range of outcomes related to sexual health, results from the current study say little about the mechanisms which might explain these associations. Consistent with CIT (Rusbult & Van Lange, 2003), Neilands et al. (2009) suggested that relationship factors such as commitment and satisfaction may influence sexual agreements. In separate studies, relationship factors have also been linked to sexual risk taking, (Davidovich, de Wit, & Stroebe, 2006) and depression (Starks et al., 2017; Whitton & Kuryluk, 2014) in gay male couples. In addition, reciprocal associations between relationship functioning and individual drug use have been the basis for couples approaches to substance use treatment (Fals-Stewart, O'Farrell, & Birchler, 2004) and shown promise with same-gender couples (Fals-Stewart, O'Farrell, & Lam, 2009). It is plausible that associations between sexual agreements and these related domains may be explained by shared associations with other relationship factors. It is also plausible that – to the extent that sexual HIV transmission risk, drug use, and depression are co-occurring and synergistic concerns – as posited within syndemics theory (Parsons, Grov, et al., 2012; Stall et al., 2003)– improved regulation and risk reduction in one domain leads

to risk reduction in related domains. In this latter case, CIT (Lewis et al., 2006; Yovetich & Rusbult, 1994) would predict that couples who have better relationship functioning may be more successful in the accommodation process involved in the creation of joint goals related to managing risk behavior.

These findings have implications for HIV-prevention efforts focused on HIV-negative men in relationships. First and foremost, these results are consistent with the hypothesis that sexual agreements modulate sexual behavior. This hypothesis is a central premise of CHTC which seeks to reduce HIV sexual transmission risk through the negotiation of sexual agreements and clarification about how the couple might handle violations of these agreements (Stephenson et al., 2011; Sullivan et al., 2014). However, these findings also suggest that arrangements – as assessed in the current study – are better indicators of the overall occurrence of sex with casual partners than with CAS specifically. This suggests that interventions such as CHTC, which make potentially implicit processes for “handling sex” with casual partners explicit, may catalyze protective factors within the couple by addressing aspects of a sexual agreement related to HIV-prevention practices if sex with outside partners were to occur (either in violation of the agreement, or as part of activities permitted within the agreement) (Stephenson et al., 2011; Sullivan et al., 2014).

These findings also indicate that interventions, including CHTC, which evoke conversations about sexual agreements may also provide a platform for brief substance use intervention. It is possible that the same dyadic factors which lead sexual agreements to mitigate HIV-risk might also generalize and agreements about drug use might serve to reduce this risk behavior in a parallel manner. The link between substance use and sexual risk taking is well-established among gay men, including in studies specifically focused on partnered gay men (Mitchell et al., 2014; Parsons & Starks, 2014). The presence of this association may help to introduce the topic of drug use along side sexual behavior in agreement conversations. To the extent that drug use serves to enhance HIV transmission risk during sex and sex serves as a potential context for drug use, such a joint focus might well enhance an interventions effects on both outcomes.

While additional data are needed to clarify how sexual agreements may covary with depression across urban versus non-urban areas, present findings and previous research suggest that depression could complicate the successful enactment of relationship agreements. Relationship functioning and depression have been linked in gay male couples (Starks et al., 2017) and relationship functioning has in turn been associated with HIV related sexual risk taking among partnered gay men (Davidovich et al., 2006). It follows from these findings that interventions which incorporate concurrent treatment for depression may help to improve the efficacy of relationship agreements to direct behavior. Conversely, interventions which improve dyadic functioning may yield improvements in individual mental health outcomes for the partners involved.

These findings must be viewed in light of several limitations. First, this study focused exclusively on HIV-negative men. Although we were able to determine that results were robust to the inclusion of partner HIV-status, findings may not generalize to HIV-positive men. Second, this study utilized a stratified sampling strategy that insured geographic

diversity. While this insured the inclusion of men who are under-represented in convenience samples obtained from large urban centers, the sample is not a random sample of HIV-negative gay men. The significance of these data arises from the fact that the sample utilized here is very different from those convenience samples which have primarily served as the basis for research on the correlates of sexual agreements to date. These findings therefore provide a significant indication of the ways in which sampling may shape conclusions about the sexual and mental health of partnered gay men. Third, relationship length was assessed by proxy using an item which asked how long ago men had met their main partners. Given that not all men will view “first meeting” as synonymous with the initiation of a relationship, our evaluation may over-estimate actual relationship length. Fourth, some men ($n = 14$) indicated that they had sex with other partners while not knowing if their main partner did. These participants were classified as monogamous arrangements. We did not have dyadic data to corroborate this response; thus, we may have potentially miscategorized people’s sexual arrangement. Fifth, our sample contained bisexually-identified men (4.2%), yet we restricted the sample to men who reported having current male primary partners regardless of self-identification. Sixth, some men (12.3%) were in relationships with HIV-positive partners. Data were not available related to HIV medication adherence or immune functioning for these men. Seventh, while our assessment of relationship arrangements was consistent with previous studies (e.g., Parsons et al., 2013) we did not assess relationship rules. Many couples form specific rules which govern aspects of sexual behavior like condom use (Grov et al., 2014). For this reason, we were unable to account for agreements about condom use with casual partners among men with non-monogamous arrangements. Finally, the number of men currently prescribed PrEP was small in relation to the sample size and currently being prescribed PrEP is an imperfect indicator of actual use and adherence. Future studies, with access to larger proportions of men on PrEP should examine interactions between relationship status and sexual agreements with PrEP to better understand how biomedical prevention shapes sexual decision making across these groups.

Despite these limitations, the study consolidates and extends the body of research on the correlates of sexual arrangements for partnered gay men. It also highlights the importance of understanding processes which operate uniquely for GBM men in urban versus non-urban areas. These findings underscore previous literature which has indicated that how a gay couple handles sex with outside partners not only predicts sexual behavior within and outside their relationship, but also predicts depression and drug use, which are salient and related health outcomes. The findings from this large national sample of HIV-negative partnered gay men support ongoing efforts to develop interventions which target agreement negotiation as a mechanism to achieve HIV transmission risk reduction. They also suggest that such interventions may serve as a platform for novel interventions which target these health behaviors (substance use and depression) which covary with sexual agreements.

Acknowledgements:

The *One Thousand Strong* study was funded by NIH/NIDA (R01 DA 036466: Jeffrey T. Parsons Christian Grov, MPIs). We would like to acknowledge other members of the *One Thousand Strong* Study Team (Dr. Ana Ventuneac, Demetria Cain, Mark Pawson, Ruben Jimenez, Chloe Mirzayi, Thomas Whitfield, Raymond Moody, Brett Millar) and other staff from the Center for HIV/AIDS Educational Studies and Training (Andrew Cortopassi, Chris Hietikko, Doug Keeler, Carlos Ponton, and Brian Salfas). We would also like to thank the staff at Community

Marketing and Insights, Inc. (David Paisley, Thomas Roth, and Heather Torch). Finally, special thanks to Dr. Jeffrey Schulden and Pamela Goodlow at NIDA. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Sources of Funding:

One Thousand Strong was funded by the National Institutes of Health (R01 DA 036466: Parsons & Grov).

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Figure 1.
Sexual arrangement and urbanicity interact in the prediction of depression

Figure 2.
Sexual arrangement and urbanicity interact in the prediction of other drug use

Table 1.

Demographic characteristics

	Overall	Single	Monogamous	Open	Monogamish	Test Statistic
Subgroup <i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Race/Ethnicity						$\chi^2(9) = 10.99$
White	754 (71.1)	375 (70.6)	170 (70.8)	170 (71.4)	49 (75.0)	
African American	82 (7.7)	45 (8.5)	16 (6.7)	14 (5.9)	7 (13.5)	
Latino	135 (12.1)	60 (11.3)	37 (15.4)	33 (13.9)	5 (9.6)	
Other	90 (8.5)	51 (9.6)	17 (7.1)	21 (8.8)	1 (1.9)	
Sexual Identity						$\chi^2(3) = 11.70$
Gay	1016 (95.8)	508 (95.7)	235 (97.9)	223 (93.7)	50 (96.2)	
Bisexual	45 (4.2)	23 (4.3)	5 (2.1)	16 (6.3)	2 (3.8)	
Partner HIV status						$\chi^2(2) = 1.14$
Negative/Unknown	465 (87.7)	NA	213 (88.8)	205 (86.1)	47 (90.4)	
Positive	65 (12.3)	NA	27 (11.3)	33 (13.9)	5 (9.6)	
Education						$\chi^2(3) = 1.25$
4 year degree or more	591 (55.7)	290 (54.6)	135 (56.3)	134 (56.3)	32 (61.5)	
Less than a 4 year degree	470 (44.3)	241 (45.4)	101 (43.8)	104 (43.7)	20 (38.5)	
Income						$\chi^2(3) = 9.30^*$
<\$30,000	333 (31.4)	189 (35.6) ^a	68 (28.3) ^b	64 (26.9) ^b	12 (23.1) ^{ab}	
\$30,000 or more	728 (68.6)	342 (64.4)	172 (71.7)	174 (73.1)	40 (76.9)	
PrEP status						$\chi^2(3) = 5.65$
Currently prescribed	31 (2.9)	18 (3.4)	2 (0.8)	28 (11.8)	1 (1.9)	
Not currently prescribed	1030 (97.1)	531 (96.6)	239 (99.2)	210 (88.2)	51 (98.1)	
Residency						$\chi^2(3) = 0.44$
Non- Urban	127 (12.0)	61 (11.5)	31 (12.9)	31 (12.6)	7 (13.5)	
Urban	934 (88.0)	470 (88.5)	209 (87.1)	215 (87.4)	45 (86.5)	
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	

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	Overall	Single	Monogamous	Open	Monogamish	Test Statistic
Age	40.30 (13.85)	40.01 (14.34)	39.22 (13.23)	41.62 (13.56)	40.69 (12.19)	$F(3,1057) = 1.30$
Relationship length (Months)	81.15 (102.92)	NA	68.77 (90.78) ^a	106.26 (114.87) ^b	94.69 (81.18) ^{a, b}	$F(2,527) = 8.26^{**}$

* p .05
** p .01

Table 2.

Sexual arrangement and outcomes of primary interest: Bivariate associations

	Overall	Single	Monogamous	Open	Monogamish	Test Statistic
	<i>M(SD)</i>	<i>M(SE)</i>	<i>M(SE)</i>	<i>M(SE)</i>	<i>M(SE)</i>	
CESD	16.49 (11.62)	18.28 (0.51) ^a	13.37(0.67) ^b	15.77 (0.76) ^b	15.94 (1.45) ^{ab}	F(3,1057) = 10.60 ^{**}
Drug use instances						
Marijuana/Hash	5.98 (19.07)	5.84 (0.79)	3.95 (0.93)	6.88 (1.36)	12.50 (4.13)	Wald χ^2 (3) = 4.99
Poppers	2.71 (9.71)	2.90 (0.44) ^a	1.28 (0.42) ^b	3.50 (0.72) ^a	3.69 (1.30) ^a	Wald χ^2 (3) = 11.74 ^{**}
Other drugs	1.16 (8.55)	1.27 (0.32) ^a	0.10 (0.04) ^a	1.69 (0.86) ^b	2.46 (1.43) ^b	Wald χ^2 (3) = 19.03 ^{**}
Alcohol use days	22.78 (24.25)	20.70 (1.00) ^a	23.42 (1.59) ^a	24.05 (1.56) ^{ab}	35.40 (4.22) ^b	Wald χ^2 (3) = 13.91 ^{**}
Frequency of sex with CPs [†]						
Any anal sex	4.49 (13.18)	6.83 (0.77) ^a	0.07 (0.05) ^b	3.98 (0.45) ^c	3.80 (1.36) ^c	Wald χ^2 (3) = 157.37 ^{**}
CAS	1.85 (5.35)	2.66 (0.28) ^a	0.06 (0.05) ^b	1.91 (0.33) ^a	1.86 (0.82) ^a	Wald χ^2 (3) = 116.39 ^{**}
Frequency of sex with MPs						
Any anal sex	13.22 (21.57)	NA	15.13 (1.46) ^a	9.45 (1.24) ^b	21.6 (3.17) ^a	Wald χ^2 (2) = 17.48 ^{**}
CAS	11.66 (19.94)	NA	13.47(1.28) ^a	8.29 (1.24) ^b	18.27 (2.88) ^a	Wald χ^2 (2) = 14.12 ^{**}

*
p .05**
p .01

NOTE: CESD = Cender for Epidemiological Studies Depression scale; CP = Casual Partners; MP = Main Partner.

[†] Analysis of casual partners excluded participants who reported a current PrEP prescription.

Table 3.
Sexual arrangement and urbanicity: Interactions predicting depression and sex with casual partners

	Depression			Frequency of Any Anal Sex with Casual Partners			Frequency of CAS with Casual Partners		
	<i>B</i>	95% CI	β	<i>B</i>	95% CI	<i>Exp(B)</i>	<i>B</i>	95% CI	<i>Exp(B)</i>
Intercept	24.17**	(18.54, 29.81)	–	2.22**	(1.43, 3.02)	9.24	1.03*	(0.16, 1.90)	2.79
Age	–0.08**	(–0.13, –0.03)	0.93	–0.02*	(–0.03, –0.01)	0.98	–0.01	(–0.02, 0.001)	0.99
Race (ref = non-white)	–0.65	(–2.18, 0.89)	0.52	–0.18	(–0.52, 0.17)	0.84	–0.17	(–0.19, 0.54)	1.19
Income (ref = < \$30,000)	–5.73**	(–7.35, –4.10)	0.00	0.13	(–0.22, 0.48)	1.14	–0.24	(–0.67, 0.19)	0.79
Arrangement (ref = open)									
Single	–1.32	(–7.44, 4.79)	0.26	0.53**	(0.22, 0.84)	1.70	0.31	(–0.08, 0.70)	1.36
Monogamous	–1.74	(–8.36, 4.88)	0.18	–4.08**	(–5.32, –2.85)	0.02	–3.58**	(–4.95, –2.21)	0.03
Monogamish	–7.82	(–15.89, 0.26)	0.00	–0.16	(–0.85, 0.53)	0.85	–0.12	(–1.02, 0.79)	0.89
Urban (ref = non-urban)	–4.11	(–9.68, 1.45)	0.01	–1.00	(–0.65, 0.45)	0.91	0.05	(–0.55, 0.67)	1.05
Urban X Arrangement									
UrbanXSingle	3.63	(–2.72, 9.99)	38.04						
UrbanXMonogamous	–1.13	(–8.02, 5.76)	0.32						
UrbanXMonogamish	9.35*	(0.63, 18.06)	11470						
				<i>Likelihood $\chi^2(10)$=131.70**</i>			<i>Likelihood $\chi^2(7)$=335.68**</i>		
							<i>Likelihood Ratio $\chi^2(7)$=159.80**</i>		

*
p .05

**
p .01

NOTE: The urban by arrangement interaction coefficients are omitted from models in which this effect was non-significant.

Table 4.

Sexual Arrangement and Urbanicity Interactions Predicting Substance Use

	Marijuana Use			Alcohol Use			Other Drug Use		
	<i>B</i>	95% CI	<i>Exp(B)</i>	<i>B</i>	95% CI	<i>Exp(B)</i>	<i>B</i>	95% CI	<i>Exp(B)</i>
Intercept	2.58**	(1.61, 3.55)	13.18	2.49**	(2.17, 2.81)	12.05	1.51	(-0.13, 3.15)	4.52
Age	-0.02*	(-0.03, -0.00)	0.98	0.00	(-0.001, 0.01)	1.00	-0.04**	(-0.06, -0.01)	0.97
Race (ref = non-white)	-0.34	(-0.77, 0.09)	2.46	0.17*	(0.18, 0.50)	1.19	-1.28**	(-2.07, -0.49)	0.28
Income (ref = < \$30,000)	-0.52*	(-0.93, -0.11)	0.60	0.34**	(0.18, 0.50)	1.41	-0.25	(-0.98, 0.48)	0.78
Arrangements (ref = open)									
Single	-0.25	(-0.76, 0.25)	0.78	-0.10	(-0.53, 0.06)	0.91	1.39	(-0.41, 3.19)	4.02
Monogamous	-0.57	(-1.20, 0.07)	0.57	0.02	(-0.16, 0.20)	1.02	-2.69*	(-5.21, -0.17)	0.07
Monogamish	0.84*	(0.04, 1.65)	2.32	0.43**	(0.15, 0.70)	1.53	3.83**	(1.54, 6.11)	45.87
Urban (ref = non-urban)	0.62	(-0.02, 1.26)	1.85	0.14	(-0.08, 0.36)	1.15	1.43	(-0.22, 3.08)	4.16
Urban X Arrangements									
UrbanXSingle							-1.97	(-4.08, 0.14)	0.14
UrbanXMonogamous							-0.35	(-3.13, 2.43)	0.71
UrbanXMonogamish							-3.70**	(-6.31, -1.09)	0.03
	<i>Likelihood χ^2 (07)=20.61**</i>			<i>Likelihood χ^2 (7)=42.44**</i>			<i>Likelihood χ^2 (10)=41.45**</i>		

*
p .05**
p .01

NOTE: The urban by arrangement interaction coefficients are omitted from models in which this effect was non-significant.