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## Factors Associated with Men in HIV-negative Gay Couples Who Practiced UAI Within and Outside of Their Relationship

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### Abstract

Despite recent advances in research with gay male couples, less data exists about men who have had UAI within and outside of their HIV-negative seroconcordant relationship. Multilevel modeling with dyadic data from 142 couples was used to identify the characteristics associated with men who have had UAI with both their main partner and a casual MSM partner within the same timeframe. Analyses revealed that men were more likely to have had UAI within and outside of their relationship if they perceived their main partner has had a recent HIV test. Men were less likely to have had UAI within and outside of their relationship if they valued their sexual agreement and reported having a sexual agreement that does not allow sex outside of their relationship. Research with a more diverse sample of couples is warranted. Future interventions must consider the complexity of relationships and sexual behaviors among gay male couples.

### Keywords

Gay male couples; UAI; Sexual agreements; Testing; HIV risk; Multilevel modeling

## INTRODUCTION

In the U.S., gay, bisexual, and other men who have sex with men (MSM) have been severely affected by HIV for over thirty years. Recent estimates from five U.S. cities indicate that 68% (95% CI 58 – 78) of HIV transmissions among MSM are from their main sex partners within the context of a relationship (e.g., gay male couples) [1]. Specifically, the high percentage of HIV transmissions among MSM were due to men having a higher number of sex acts with their main partners, more frequent receptive roles in anal sex with their main partners, and lower condom use during anal sex with their main partners [1]. In a sample of young MSM from the Midwest, unprotected anal intercourse (UAI) was eight times more likely to occur in relationships that the men perceived as *serious* compared to *casual*, thereby possibly increasing their risk for HIV [2]. Because a higher percentage of MSM acquire HIV in the context of a relationship, research has begun to examine what relationship factors affect HIV risk, namely UAI, among gay male couples.

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Recent research indicates that some factors, including relationship characteristics, may increase an individual's and therefore his partner's risk for acquisition of HIV while other factors may provide more of a protective role against HIV acquisition within the relationship [2–8]. For example, Darbes et al. showed that HIV-specific social support provided by a partner appears to reduce HIV risk by reducing the odds that an individual would have had UAI outside of his relationship [7]. Another study with gay male couples found that being in a strictly monogamous relationship and having had a recent HIV test decreased the odds that one or both of the men within the relationship had had UAI with a casual MSM partner [6].

Sexual agreements have also been examined to assess HIV risk among gay male couples in the U.S. To clarify, a sexual agreement is an explicit agreement made between two gay male partners about which sexual behaviors may occur within and outside of their sexual relationship, with the overall aim of minimizing HIV risk and enhancing some aspect of their relationship [4]. For example, Mitchell et al. (2012) reported how having higher levels of commitment to a sexual agreement decreased the odds that one or both of the men within the relationship had had UAI with a casual MSM partner [6]. In addition, Gomez et al. (2011) found that higher levels of trust, commitment, social support, and constructive communication patterns decrease the likelihood that one or both of the men within the gay male couple would break their sexual agreement, thereby potentially decreasing their risk for HIV [3]. Several other relationship factors, including relationship satisfaction and trusting a main partner, have also been positively associated with gay male couples' concordance on having a sexual agreement as well as adhering to it [5].

In contrast, couples who had communication patterns with higher levels of mutual avoidance and withholding information were more likely to have one or both of the men self-reporting a break in their sexual agreement, which may have increased the couples' risk for acquisition of HIV [3]. Having had UAI with a casual MSM partner has also been positively associated with one or both of the men in the gay couple self-reporting that they had a recent HIV test [8].

Though advances in HIV prevention research have broadened the scope of gay male couples risk for acquisition of HIV, critical gaps still exist that warrant further research. Specifically, our understanding of why certain men among HIV-negative seroconcordant gay male couples engage in UAI within *and* outside of their relationship remain largely unknown. Research is also needed to assess which factors are associated with this particular group of gay men, considering their risk for acquiring and transmitting HIV within their relationship.

Gay men who engage in UAI within *and* outside of their relationship could be considered as having concurrent sexual partnerships. Previous research with MSM has examined how sexual concurrent partnerships increase risk and transmission of HIV [9–12]. However, much of this prior research has not examined the specific characteristics of the men's relationships nor the sexual concurrency of men among HIV-negative seroconcordant gay couples. Furthermore, the majority of previous research with gay male couples has assessed factors associated with men having had UAI with their main partners *or* with a casual MSM partner. Limited data exists about men who have had UAI with *both* their main partners and a casual MSM partner within the same timeframe and who are also in a HIV-negative

seroconcordant relationship. Because the majority of gay men are acquiring HIV within the context of a relationship [1], more information is urgently needed to identify which relationship and other factors might be associated with men who have had UAI within and outside of their HIV-negative seroconcordant relationship.

The present exploratory study seeks to contribute to the existing literature by determining which relationship and other factors might be associated with men who have had UAI within and outside of the relationship by using dyadic data from a convenience sample of gay male couples who lack a known HIV infection. Due to the non-independent nature of dyadic data, we used multilevel logistic random-intercept regression modeling to address our overall study aim: to identify which factors would be associated with the likelihood (i.e., odds) that a participant would self-report having had UAI with *both* his main partner and a casual MSM partner during the same timeframe. As a secondary aim, we also sought to describe how the men who engaged in UAI with *both* their main partner and a casual MSM partner differed from men who did not. Measures that represented the interdependent, dyadic nature of a sexual relationship, and had previously been validated with gay male couples, were purposely selected to assess relationship factors of commitment, trust, and investment in one's sexual agreement [13–15]. Additional measures of HIV testing and relationship and demographic characteristics were also included to address our study aims.

## METHODS

### Recruitment and Eligibility

A cross-sectional study design paired with a standard reciprocal dyadic data collection method was used for the present study. Oregon State University's Institutional Review Board approved our study. A convenience sample of 144 gay male couples was recruited from Portland, Oregon and Seattle, Washington between June and November 2009. Recruitment methods included referrals from local organizations providing social services to gay men and other MSM, distribution of business cards and flyers at gay-identified events and venues, and electronic invitations sent to profiles located on websites frequented by gay men in the Pacific Northwest. All recruitment materials listed the study's eligibility criteria with instructions for interested gay couples to contact the principal investigator (PI) to learn more about participating in the study. Once an interested gay couple contacted the PI, each male in the couple was then asked separately whether they met all of the study's eligibility criteria listed on the recruitment materials. If both men said yes, then an appointment was arranged for the couple to meet the PI at a mutually convenient location (e.g., coffee shop or health center) to participate in the study. Gay couples that were interested or had participated in the study were encouraged to tell other gay couples about it. Because all eligibility criteria were listed on the recruitment materials, interested study participants were informally screened. A response rate was not recorded.

To participate in the study, both members of each couple had to: 1) be English speaking; 2) be HIV negative or have an unknown HIV status; 3) self identify as gay, bisexual, queer, or homosexual; 4) be eighteen years of age or older; 5) be able to follow simple online instructions to complete an electronic survey on a computer; 6) be in a sexual relationship

for at least 3 months with another man who also identified as gay, bisexual, homosexual, or queer; and 7) have had anal intercourse within the three months prior to study recruitment.

## Procedures

At the pre-arranged appointment, each qualified male in every couple was given an identification number to link the two men together as a couple. For example, if one of the men was given the number 1400 and his partner was given the number 1401, then both men would be linked by their numbers to represent the 140<sup>th</sup> dyad. After receiving their numbers, both men were directed to separate laptops in order to individually read the electronic consent form and to separately complete an anonymous, 15 to 25 minute, self-administered, electronic survey. For each couple, the men sat apart from their partner while completing the survey. Personal identifying information was not collected in the study in order to protect the anonymity of participants' responses, and to help decrease measurement error and reporting bias, such as social desirability [16]. The survey and participant data were collected and stored by the host server, surveymonkey.com. Data from 144 gay male couples were then downloaded from the host server, re-screened for eligibility criteria (post-hoc), and missing values, and adjusted accordingly based on recommendations made by Acock [17]. Data from two couples were deleted due to ineligibility and inconsistencies in responses. Specifically, one participant in a couple completed less than 80% of the survey while another male in a different couple had self-reported as being HIV-positive.

## Measures

**Outcome Variable**—We used two items to identify which participants had had UAI with both their main partner and a casual MSM partner. Specifically, using a dichotomous item, with “yes” and “no” as possible responses, each participant was asked whether he had engaged in UAI with his main partner in the previous three months. Using the same dichotomous format, participants were also asked whether they had engaged in UAI with a casual MSM partner during the same timeframe. Because we were most interested in factors associated with men who had engaged in UAI with *both* their main partner, as well as with a casual MSM partner, during the same time period, we then created a dichotomous, dummy variable to represent this outcome. This variable categorized participants as either having had UAI with *both* their main partner and a casual MSM partner in the previous three months or having not had UAI with both their main partner and a casual MSM partner in the previous three months.

**Independent Variables**—Participants were asked to complete a variety of items and measures assessing: common demographic factors, such as age, race, highest education-level achieved; relationship characteristics, including type of relationship, relationship duration, and aspects of a sexual agreement; self-reported HIV status, most recent HIV test, and perceived HIV serostatus of their partner; and validated measures for relationship factors of trust [13], relationship commitment [14], and investment in one's sexual agreement [15]. These measures, including the relationship factors, have been detailed in-depth elsewhere [5, 6].

Several demographic and relationship characteristics that were assessed were recoded as follows: type of sexual agreement as 1 for only sex with each other and 0 for any type of agreement that allowed sex with casual MSM (e.g., sex together and with others – guidelines & sex with whomever whenever – without guidelines); race of the couple as 1 for interracial and 0 for non-interracial; relationship duration as 1 for less than two years and 0 for greater than two years; self-reported last HIV test as 1 for less than three months and 0 for greater than three months or never; perceived partner's last HIV test as 1 for less than three months and 0 for greater than three months or never.

### Data analysis

Prior to data collection, a minimum sample size of 140 couples was calculated to achieve an estimated power of 0.95 for assessing non-independence within same-sex couples and for detecting subject-specific probabilities regarding UAI within and outside of the relationship in a multilevel logistic regression model with dyadic data [18–20]. Multilevel modeling takes into account the non-independence of nested, dyadic data – as in the case of two partnered men within a gay couple. We used guidelines provided by Kenny et al. (2006) and Rabe-Hesketh & Skrondal (2008) to construct and estimate univariate and multivariable multilevel logistic random-intercept regression models for our analyses [18, 19]. Multilevel logistic random-intercept regression models identify and estimate which participant variables are associated with the outcome (i.e., within the couple) while also accounting for and estimating the variability between the couples that may exist and are associated with the outcome. Dyadic data from 142 gay male couples were analyzed using Stata version 11 (StataCorp LP, College Station, TX).

First, responses to several questions were appropriately categorized and descriptive statistics were calculated. Certain scale items in the relationship factor measures were reverse coded for analytical purposes. Recommendations from Kenny et al. [18] were then used to arrange the data into an appropriate format for multilevel logistic regression modeling, an analytical technique used to calculate individual probabilities from dyadic data [19]. In this case, data from both men in each couple were used to predict which variable(s) (i.e., predictors) would be associated with the likelihood (i.e. odds) that at least one of the men in the couple had had UAI with his main partner and a casual MSM partner within the previous three months.

Due to the non-independent nature of our data, we employed univariate multilevel logistic random-intercept regression models to explore and identify which predictors were significantly associated (i.e.  $p < 0.05$ ) with the outcome variable.

Dyadic data consists of two levels of data: the individual-level (i.e., level-1) and dyad-level (i.e., level-2). For multilevel modeling, the outcome variable (e.g., UAI within and outside of the relationship) is always a level-1 variable, whereas, a level-2 variables represent characteristics of the dyad, such as relationship duration and type of relationship, and may also include interactions between variables [18]. Due to the exploratory nature of this study, we did not assess for any interactions between the predictors. Significant level-1 and level-2 predictors identified from the univariate multilevel logistic random-intercept regression models were analyzed for multicollinearity by using a pairwise deletion correlation matrix with Bonferroni correction. Suggestions made by Acock [21] were followed for the pairwise

deletion correlation matrix, which identified that two predictors (e.g. 0.96 for type of relationship and type of sexual agreement) were highly correlated with one another. In this instance, we chose to retain type of sexual agreement as a level-1 predictor for further analyses because it was most strongly correlated with the outcome variable, and to explore the role that sexual agreements have on men's engagement of UAI within and outside of their relationship. All other predictors that were significant at  $p < 0.05$  were included into the final multivariable multilevel logistic random-intercept regression models.

Predictors in the final multilevel model were then removed one at a time starting with the predictor with the largest  $p$  value until all remaining predictors were significant at  $p < 0.05$  [22]. Our final multilevel models measured both fixed- and random-effects by using the *xlogit* command in Stata. To help ensure that we obtained accurate estimates for predicting subject-specific probabilities, we used adaptive quadrature for maximum likelihood estimation by employing the Stata command, *quad(#)* in all of our final logistic multilevel regression models [19]. Adaptive quadrature was used in our final models to maximize that the parameters used would yield the largest likelihood toward our outcome variable [19]. Given the literature on sexual concurrency among MSM, and HIV risk among gay male couples [2–12], the following variables were evaluated and included as potential confounders in our final multivariable model: participants' age and relationship duration. Model assumptions were examined by using the likelihood-ratio test. Lastly, odds ratios and their associated 95% confidence intervals were then calculated and reported.

## RESULTS

The average age of participants and couples was 34.1 years (SD 8.4 and 7.6, respectively). The majority of the sample self-identified as: gay or queer (98%,  $n = 279$ ); HIV-negative (95%,  $n = 270$ ); non-Hispanic (92%,  $n = 262$ ); White (85%,  $n = 241$ ); living in an urban environment (82%,  $n = 234$ ); well educated, with a Bachelor's degree or higher (70%,  $n = 193$ ); middle-class, by earning more than \$30,000 per year (79%,  $n = 224$ ); employed (86%,  $n = 243$ ); and/ or as living with their main partner (82%,  $n = 234$ ). Approximately two-thirds of the couples had been in their relationship for two years or longer (64%,  $n = 183$ ). A little over half of the couples (51%,  $n = 72$ ) reported having a monogamous relationship while the remaining 49% ( $n = 70$ ) of the couples indicated having an open relationship that allowed them to engage in sexual behaviors outside of their relationship. Although 66% of the men reported having made a sexual agreement with their main partner, only 48% ( $n = 68$ ) of the couples concurred about having an established sexual agreement. Types of sexual agreements reported by the men varied: 53% had an agreement that allowed sexual behaviors to occur outside of their relationship while 47% indicated their agreement only allowed sex to occur with their main partner.

The participants also had faith in ( $M = 1.91$ , SD 0.94) and viewed their main partners as predictable ( $M = 1.36$ , SD 1.16) and dependable ( $M = 1.38$ , SD 1.08) for being trustworthy. Further, the men typically indicated having a high level of commitment to their relationship ( $M = 4.55$ , SD 0.68) and when applicable, reported high levels of investment toward their sexual agreements ( $M = 3.26$ , SD 0.65). Less than a quarter of the men (24%,  $n = 68$ ) got tested for HIV in the previous three months.

Most men (90%,  $n = 257$ ) had UAI with their main partner within the previous three months. During the same timeframe, twenty-eight men (10%) had UAI with a casual MSM partner. However, only twenty-three men (8%) had engaged in UAI with *both* their main partner and a casual MSM partner during the three months prior to assessment. Eight of these twenty-three men represented both partners of four couples. The remaining fifteen men represented couples of which only one partner had engaged in UAI within and outside of his relationship. Table 1 provides additional descriptive data of the sample's demographic and relationship characteristics.

Results from the univariate multilevel logistic random-intercept regression analyses revealed that among the sample of gay male couples, the twenty-three men who engaged in UAI with *both* their main partner and a casual MSM partner differed from the rest of the sample on a number of characteristics. Compared to men who did not have UAI within and outside of their relationship, the twenty-three men who did, were less likely to: be in a sexual agreement that did not allow sex with casual MSM partners (OR = 0.02; 95% CI 0.00, 0.47;  $p < 0.05$ ); value their sexual agreement (OR = 0.11; 95% CI 0.02, 0.71;  $p < 0.05$ ); and/or commit to their sexual agreement with their main partner (OR = 0.23; 95% CI 0.07, 0.70;  $p < 0.05$ ). These men were also less likely to report being in a strictly monogamous relationship (OR = 0.05; 95% CI 0.01, 0.34;  $p < 0.01$ ). In contrast, the twenty-three men were more likely to self-report having had a recent HIV test (OR = 5.39; 95% CI 1.77, 16.47;  $p < 0.01$ ) and perceive that their main partner had also had an HIV test within the previous three months (OR = 5.09; 95% CI 1.33, 19.52;  $p < 0.05$ ).

After controlling for participants' age and duration of their relationship, only certain Level-1 predictors were significantly associated with the outcome of interest (i.e., that a man had had UAI with both his main partner and a casual MSM partner in the three months prior to assessment) in our final multilevel model. Specifically, the odds of having had UAI with one's main partner and a casual MSM partner were negatively associated with one's value toward the sexual agreement he has with his main partner (OR = 0.20; 95% CI 0.07, 0.57;  $p < 0.01$ ). The odds of having had UAI with both a main partner and a casual MSM partner were also negatively associated with being in a type of sexual agreement that did not allow sex with casual MSM partners (OR = 0.05; 95% CI 0.00, 0.83;  $p < 0.05$ ). Further, the odds of having had UAI with both a main partner and a casual MSM partner were positively associated with perceiving that one's main partner has had a recent HIV test (i.e., within the previous three months) (OR = 8.01; 95% CI 1.35, 47.46;  $p < 0.05$ ). Findings from the analyses of our univariate and final multivariable multilevel logistic random-effects regression models are presented in Table 2.

## DISCUSSION

Findings from this study are the first to report about the characteristics of, and factors associated with, men in HIV-negative seroconcordant gay male couples who recently self-reported having had UAI with *both* their main partner and a casual MSM partner. Our study sample primarily consisted of white, non-interracial, well-educated, employed, urban gay male couples who live in the Pacific Northwest. Among these 142 couples, several characteristics, including aspects of their sexual agreements, type of relationship, and recent

HIV testing, were associated with the 8% of men who had UAI within and outside of their relationship. In detail, men who valued their sexual agreement more and those who indicated having a sexual agreement that does not allow sex with casual MSM partners were significantly less likely to have had UAI within and outside of their relationship. In contrast, men who perceived their main partner to have been recently tested for HIV were significantly more likely to have had UAI within and outside of their relationship.

Our findings suggest that some of the men among the sample of gay male couples may have used HIV testing as a prevention tool, at least during the same time period when they had engaged in UAI with both their main partner and a casual MSM partner. This confirms the importance of increasing access to HIV testing and promoting its uptake among men who practice UAI, either within and/or outside of their relationship, as well as quickly linking men who test positive for HIV with medical care. Early entry into care and treatment can decrease the likelihood that individuals transmit HIV unknowingly to others. Appropriately, the National HIV/AIDS Strategy for the United States includes increasing access to HIV testing and linkage to care for newly diagnosed individuals as priority areas [23].

Other findings from our analyses indicate that men who reported valuing their sexual agreement, and those who had a type of sexual agreement that did not allow sex with casual MSM partners were significantly less likely to have had UAI with both their main partner and a casual MSM partner during the same time frame. Though these findings are not entirely surprising, future interventions should consider how sexual agreements among HIV-negative seroconcordant gay male couples could be used to help reduce the individual's, and thereby the couple's, risk for HIV. Previous HIV prevention research supports this notion, as well as has suggested that improving relationship characteristics, such as communication and social support, may help decrease the risk for HIV among gay male couples, while improving the quality of their relationships [3–8].

### **Limitations and Suggestions for Future Research**

This study is not without limitations, including the use of a cross-sectional study design and a convenience sample. Our cross-sectional design hinders our ability to make causal assertions about our findings. The use of a convenience sample also precludes us from generalizing our findings to gay couples who do not live in Portland, Oregon or Seattle, Washington, in addition to couples who may have been unwilling to participate in our study.

Other study limitations include the lack of data about the timing of 1) when UAI with the main partner occurred with respect to when UAI occurred with a casual MSM partner, and 2) when the participant last got tested for HIV with respect to his engagement of UAI within and outside of his relationship. Future research that addresses the sequence of when these events happen is important for accurately assessing the individual's and couple's risk for HIV and other sexually transmitted infections (STIs), as well as for deciding how often the couple should get tested for such infections. In line with this need for more information to inform testing, efforts to implement HIV testing for gay male couples in the U.S. are currently being developed [24].



Because we were most interested in sexual behaviors (i.e., UAI) directly associated with HIV risk, we did not assess whether participants had engaged in other sexual behaviors, such as oral sex, felching and rimming [25]. Collecting data about the full spectrum of gay men's sexual behaviors that occur both within and outside of their relationships is necessary for assessing risk and designing novel HIV/STI prevention programs for gay couples. Moreover, we did not assess whether men who had UAI within and outside of their relationship were allowed to engage in UAI with casual MSM partners according to the guidelines of the couples' sexual agreement. Prior research has described that the types and components of sexual agreements are quite diverse among gay male couples [4, 26], however, additional research that specifically examines the rules regarding UAI within and outside of relationships is warranted. Relatedly, men who had UAI within and outside of their relationship may have used other strategies to help reduce their risk for acquiring HIV. For example, instead of using a condom for anal sex, some men may have used serosorting, strategic positioning, withdrawal, and/or information about an HIV-positive person's viral load count as an alternative approach for trying to reduce their risk for HIV [27–34]. Future HIV prevention research should assess how seroadaptive strategies are individually used, as well as by the couple, for negotiating HIV risk.

Lastly, we did not collect data on the HIV serostatus of the casual MSM partners or about the participant's and couple's attitudes toward their risk for acquiring HIV. Understanding how HIV-negative seroconcordant gay male couples' perceive their risk for acquiring HIV and STIs is critical for assessing how the couple negotiates and decides on which sexual behaviors, including UAI, to engage in within and outside of their relationship. Recent research has begun to examine some of these dyadic processes among gay male couples [31]; however, additional research is needed to further examine how perceived risk for acquiring HIV affects the couples' decisions to engage in UAI, practice certain seroadaptive strategies, and aspects of their sexual agreements.

Our study's main strengths include our relatively large sample size of 142 gay male couples who lacked a known HIV infection, and the use of dyadic data with multilevel modeling analyses to assess factors associated with one or both men in the couple having had UAI within and outside of their relationship. Our study is also the first to report factors associated with men among HIV-seroconcordant gay couples who recently have had UAI within and outside of their relationship. Because most MSM in the U.S. acquire HIV while in a same-sex relationship [1], our findings are timely and suggest that HIV testing and sexual agreements are important for HIV prevention among HIV-negative seroconcordant gay male couples.

## Conclusions

Development and promotion of HIV prevention programs must consider the complexity of gay male couples' relationships, and the processes that gay men and their main partners use to negotiate their HIV risk while enhancing their sexual health and relationships. To advance HIV prevention efforts, research must assess how gay male couples' manage and enhance their sexual health with respect to their relationships and engagement of UAI. Furthermore, future research studies that include a larger and more diverse sample of gay male couples is

essential for assessing which factors encourage and prevent men to engage in UAI within *and* outside of their HIV-negative seroconcordant relationships. Advances in these research areas will help inform us on how best to develop and tailor future HIV prevention interventions for gay male couples.

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## References

1. Sullivan PS, Salazar L, Buchbinder S, Sanchez TH. Estimating the proportion of HIV transmissions from main sex partners among men who have sex with men in five US cities. *AIDS*. 2009; 23(9): 1153–1162. [PubMed: 19417579]
2. Mustanski B, Newcomb ME, Clerkin EM. Relationship characteristics and sexual risk-taking in young men who have sex with men. *Health Psychol*. 2011; 30(5):597–605. [PubMed: 21604883]
3. Gomez AM, Beougher SC, Chakravarty D, et al. Relationship dynamics as predictors of broken agreements about outside sexual partners: Implications for HIV prevention among gay couples. *AIDS Behav*. 2011 Online First. 10.1007/s10461-011-0074-0
4. Hoff CC, Chakravarty D, Beougher SC, Darbes LA, Dadasovich R, Neilands TB. Serostatus differences and agreements about sex with outside partners among gay male couples. *AIDS Educ Prev*. 2009; 21(1):25–38. [PubMed: 19243229]
5. Mitchell JW, Harvey SM, Champeau D, Moskowitz DA, Seal DW. Relationship factors associated with gay male couples' concordance on aspects of their sexual agreements: Establishment, type, and adherence. *AIDS Behav*. 2011 Online 20 October.
6. Mitchell JW, Harvey SM, Champeau D, Seal DW. Relationship factors associated with HIV risk among a sample of gay male couples. *AIDS Behav*. 2012; 16(2):404–411. [PubMed: 21614560]
7. Darbes LA, Chakravarty D, Beougher SC, Neilands TB, Hoff CC. Partner-provided social support influences choice of risk reduction strategies in gay male couples. *AIDS Behav*. 2011 Online First. 10.1007/s10461-010-9868-8
8. Mitchell JW, Petroll AE. HIV testing rates and factors associated with recent HIV testing among male couples. *Sex Transm Dis*. 2012; 39(12):379–381. [PubMed: 22504604]
9. Bohl DD, Raymond HF, Arnold M, McFarland W. Concurrent sexual partnerships and racial disparities in HIV infection among men who have sex with men. *Sex Transm Infect*. 2009; 85(5): 367–379. [PubMed: 19773457]
10. Kim JH, Riolo RL, Koopman JS. HIV transmission by stage of infection and patterns of sexual partnerships. *Epidemiology*. 2010; 21(5):676–684. [PubMed: 20571409]
11. Gorbach PM, Holmes KK. Transmission of STIs/HIV at the partnership level: Beyond individual-level analyses. *J Urban Health*. 2003; 80(4 Suppl 3):iii 15–25.
12. Morris SR, Little SJ. MSM: Resurgent epidemics. *Curr Opin HIV AIDS*. 2011; 6:326–332. [PubMed: 21537172]
13. Rempel JK, Holmes JG, Zanna MP. Trust in close relationships. *J Pers Soc Psychol*. 1985; 49(1): 95–112.
14. Rusbult CE, Martz JM, Agnew CA. The investment model scale: Measuring commitment level, satisfaction level, quality of alternatives, and investment size. *Pers Relatsh*. 1998; 5:357–391.
15. Neilands TB, Chakravarty D, Darbes LA, Beougher SC, Hoff CC. Development and validation of the sexual agreement investment scale. *J Sex Res*. 2010; 47(1):24–37. [PubMed: 19396645]
16. Catania JA, Gibson DR, Chitwood DD, Coates TJ. Methodological problems in AIDS behavioral research: Influences on measurement error and participation bias in studies of sexual behavior. *Psychol Bull*. 1990; 108:339–362. [PubMed: 2270232]
17. Acock AC. Working With Missing Values. *J Marriage Fam*. 2005; 67:1012–1028.
18. Kenny, D.; Kashy, D.; Cook, W. *Dyadic data analysis*. New York: Guilford Press; 2006.

19. Rabe-Hesketh, S.; Skrondal, A. *Multilevel and Longitudinal Modeling Using Stata*. College Station: Stata Press; 2008.
20. Hsieh FY, Bloch DA, Larsen MD. A simple method of sample size calculation for linear and logistic regression. *Stat Med*. 1998; 17:1623–34. [PubMed: 9699234]
21. Acock, AC. *A Gentle Introduction to Stata*. 3. College Station: Stata Press; 2010.
22. Hosmer, DW.; Lemeshow, S. *Applied logistic regression*. New York: Wiley; 2000.
23. White House Office of National AIDS Policy. *National Strategy for HIV/AIDS for the United States*. Jul. 2010 Available at <http://www.whitehouse.gov/sites/default/files/uploads/NHAS.pdf>
24. Stephenson R, Sullivan PS, Salazar LF, Gratz B, Allen S, Seelbach E. Attitudes towards couples-based HIV testing among MSM in three US cities. *AIDS Behav*. 2011; 15:S80–S87. [PubMed: 21336607]
25. Klein H. Felching among men who engage in barebacking (unprotected anal sex). *Arch Sex Behav*. 2011 Online first. 10.1007/s10508-011-9770-0
26. Hoff CC, Beougher SC. Sexual agreements among gay male couples. *Arch Sex Behav*. 2010; 39(3):774–87. [PubMed: 18686027]
27. CDC. [Accessed 10 April 2010] Meeting summary: consultation on serosorting practices among men who have sex with men. 2009. <http://www.cdc.gov/hiv/topics/research/resources/other/serosorting.htm>
28. CDC. [Accessed 2 October 2010] Factsheet: HIV/AIDS among men who have sex with men. 2010. <http://www.cdc.gov/hiv/topics/msm/resources/factsheets/msm.htm>
29. Parsons JT, Schrimshaw EW, Wolitski RJ, et al. Sexual harm reduction practices of HIV-seropositive gay and bisexual men: serosorting, strategic positioning, and withdrawal before ejaculation. *AIDS*. 2005; 19:S13–25. [PubMed: 15838191]
30. Van de Ven P, Kippax S, Crawford J, et al. In a minority of gay men, sexual risk practice indicates strategic positioning for perceived risk reduction rather than unbridled sex. *AIDS Care*. 2002; 14:471–80. [PubMed: 12204150]
31. Eaton L, West T, Kenny D, Kalichman S. HIV transmission risk among HIV seroconcordant and serodiscordant couples: dyadic processes of partner selection. *AIDS Behav*. 2009; 13(2):185–95. [PubMed: 18953645]
32. Kippax S, Race K. Sustaining safe practice: Twenty years on. *Soc Sci Med*. 2003; 57:1–12. [PubMed: 12753812]
33. Van de Ven P, Mao L, Fogarty A, et al. Undetectable viral load is associated with sexual risk taking in HIV serodiscordant gay couples in Sydney. *AIDS*. 2005; 19(2):179–184. [PubMed: 15668543]
34. Prestage G, Mao L, Kippax S, et al. Use of viral load to negotiate condom use among gay men in Sydney, Australia. *AIDS Behav*. 2009; 13(4):645–651. [PubMed: 19199021]

Table 1

## Characteristics of the sample

Characteristic	%	(N = 284 MSM)
Sexual identity		
Gay or queer	98	279
Bisexual	2	5
Race		
White	85	241
Non-white	15	43
Ethnicity		
Hispanic	8	22
Non-Hispanic	92	262
Geographical area of residence		
Urban	82	234
Suburb or rural	18	50
Education		
Bachelor's or advanced degree	70	193
Individual income		
Less than \$30,000 or none	21	60
More than \$30,000	79	224
Employment		
Employed	86	243
Unemployed or student	14	41
Relationship duration <sup>1</sup>		
< 2 years	36	101
> 2 years	64	183
Made sexual agreement with main partner	66	187
Type of sexual agreement <sup>2</sup>		
Only sex with each other	47	87
Sex together and with others (guidelines)	44	81
Sex with whomever whenever (no guidelines)	9	17
Self-reported HIV serostatus		
Negative	95	270
Unknown	5	14
Self-reported last HIV test		
< 3 months ago	24	68
> 3 months ago or never	76	216
Self-reported unprotected anal intercourse		
with main partner	91	257
with a casual MSM partner	10	28
with both main partner and a casual MSM partner	8	23

Characteristic	% (N = 284 MSM)	
	% (N = 142 Couples)	
Race of the couple <sup>3</sup>		
Interracial	29	41
Non-interracial	71	101
Type of relationship		
Strictly monogamous	51	72
Open to some degree	49	70
Establishment of a sexual agreement <sup>4</sup>		
Concurrence – yes	48	68
Concurrence – no	16	23
Non-concurrence	36	51

## Notes

<sup>1</sup>Data for relationship duration represents 141 male couples; 1 couple had discrepant reports (i.e., 6 – 12 months vs. 5 – 10 years) about how long they have been in their relationship.

<sup>2</sup>Type of sexual agreement was self-reported only by the men who indicated that they had made a sexual agreement with their main partner

<sup>3</sup>Interracial couple was defined as any male couple who had one male self-reporting a different race than his partner (i.e., Asian and African American, White and Mixed, etc.). Non-interracial couple was defined as any male couple with both men self-reporting the same race.

<sup>4</sup>Establishment of a sexual agreement was determined by comparing responses between the two men within the gay male couple. “Concurrence – yes” meant both men in the couple stated they had a sexual agreement; “Concurrence – no” meant both men in the couples stated they did not have a sexual agreement; “Non-concurrence” meant one male in the couple stated he had a sexual agreement with his main partner while the partner stated they did not have a sexual agreement.

**Table 2**

Odds ratios and 95% confidence intervals from multilevel random-effects logistic regression analyses of men in gay couples who had UAI with both their main partner and a casual MSM partner (vs. did not) by predictor variable

Predictor variables	Odds ratio (95% CI)	
	Univariate analysis	Multivariable analysis
<b>Potential confounders</b>	<b>OR (95% CI)</b>	<b>OR (95% CI)</b>
Age of the participant	1.02 (0.95 – 1.10)	1.01 (0.93 – 1.11)
Relationship duration (< 2 years vs. > 2 years)	0.51 (0.11 – 2.28)	1.28 (0.18 – 9.39)
<b>Level-1 predictor</b>		
Trust scale		
Predictability	0.79 (0.48 – 1.29)	
Dependability	0.88 (0.54 – 1.44)	
Faith	0.80 (0.42 – 1.54)	
Investment model		
Commitment level	0.49 (0.24 – 1.01)	
Relationship satisfaction	0.62 (0.34 – 1.13)	
Investment	1.40 (0.60 – 3.27)	
Quality of alternatives	0.56 (0.33 – 0.95)*	
Sexual agreement investment scale		
Value	0.11 (0.02 – 0.71)*	0.20 (0.07 – 0.57)**
Commitment	0.23 (0.07 – 0.70)*	
Satisfaction	0.53 (0.21 – 1.36)	
Type of sexual agreement (only sex together vs. sex with casual MSM partners allowed)	0.02 (0.00 – 0.47)*	0.05 (0.00 – 0.83)*
Self-reported last HIV test (< 3 months vs. longer or never)	5.39 (1.77 – 16.47)**	
Perceived partner's last HIV test (< 3 months vs. longer or never)	5.09 (1.33 – 19.52)*	8.01 (1.35 – 47.46)*
<b>Level-2 predictor</b>		
Race of the couple (Interracial vs. Non-Interracial)	0.35 (0.06 – 2.00)	
Type of relationship (Monogamy vs. Open to some degree)	0.05 (0.01 – 0.34)**	
Concurrence on having an established sexual agreement (vs. not or none)	2.86 (0.70 – 11.70)	
Concurrence on type of sexual agreement (vs. not)	0.15 (0.02 – 1.28)	
Concurrence on adherence to sexual agreement (vs. not)	0.14 (0.01 – 1.65)	

Notes:

Additional statistics of the final multivariable model include: 182 obs., 117 dyads; Log likelihood -39.09; Wald  $\chi^2(5) = 14.19, p < 0.01$ ; ICC 0.42

OR odds ratio, CI confidence interval

\*  $p < 0.05$ ,

\*\*  $p < 0.01$