

# Relationship Characteristics Associated with Sexual Risk Behavior Among MSM in Committed Relationships

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## Abstract

Understanding situations that increase HIV risk among men who have sex with men (MSM) requires consideration of the context in which risky behaviors occur. Relationships are one such context. This study examines the presence and predictors of unprotected anal intercourse (UAI) in the past 3 months among 566 MSM couples. A majority of couples allowed sex with outside partners. Overall, 65% of the sample engaged in UAI with primary partner, including nearly half of discordant couples. Positive relationship factors, such as attachment and intimacy, were associated with an increased likelihood of UAI with primary partner. Meanwhile, 22% of the sample engaged in at least one episode of UAI with an outside partner, half of whom were discordant or unknown HIV status outside partners. Higher levels of HIV-specific social support, equality, and sexual agreement investment were significantly associated with a decreased likelihood of engaging in UAI with a discordant or unknown HIV status outside partner. HIV-positive men in discordant relationships had two and one half times the odds of having UAI with a discordant or unknown HIV status outside partner as their HIV-negative partners. Many MSM in relationships, including some in serodiscordant ones, engage in UAI with primary partners. Potential explanations include relationship closeness, relationship length, and agreement type. In addition, relationship context appears to have a differential impact upon UAI with primary and outside partners, implying that prevention messages may need to be tailored for different types of couples. Prevention efforts involving MSM couples must take into account relationship characteristics as couples balance safer sex and HIV risk with intimacy and pleasure.

## Introduction

OVER THE PAST three decades, a diverse body of research has gathered increasing amounts of evidence linking relationship status and relationship dynamics with HIV risk among men who have sex with men (MSM) in relationships.<sup>1-9</sup> Behavioral studies consistently find that men are more likely to engage in unprotected anal intercourse (UAI) with primary partners than with outside partners, especially in concordant relationships.<sup>2,3,10,11</sup> Epidemiological investigations provide additional support for these findings by attributing the source of many new HIV infections to primary partners.<sup>6,7,9,12</sup>

Various relationship dynamics are associated with decreased condom use among MSM in relationships, each one reducing it in its own way. For instance, couples may forgo condoms to establish trust, build intimacy, increase sexual pleasure, and demonstrate their commitment to the relation-

ship.<sup>6-8,10,13-18</sup> They may also do so as a result of their agreements about sex, preferences for sexual positions, or in light of each partner's HIV status.<sup>1,3,5,6,10,13,19</sup> While knowledge and disclosure of HIV status is critical in condom decision-making, testing rates among HIV-negative MSM in committed relationships, are lower than those in the general MSM population, even in the presence of risky sexual behavior.<sup>20</sup> Finally, MSM in relationships may experience condom fatigue or mistakenly perceive themselves to be low risk due to their relationship status or access to new biomedical interventions.<sup>1,11,21-25</sup> While the literature lays the foundation for understanding HIV risk for MSM couples, much of it fails to include both partners and few studies attempt to account for the relationship dynamics above.

Most HIV prevention efforts target individual MSM, regardless of relationship status. While these efforts have been successful in reducing risk for many, they do not address the

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complex interplay between relationship dynamics and HIV risk that exists for MSM couples. As such, these men and their experiences in relationships remain woefully absent from existing prevention messages. Prior literature has documented that many couples make agreements about whether to have sex with outside partners.<sup>26–28</sup> Couples with negotiated safety agreements and monogamous agreements have been found to have lower risk than those who do not have agreements or those who have open agreements.<sup>11,29</sup> However, far less attention has been paid to the nuances inherent in these agreements. For example, far less is known regarding the process of negotiating and maintaining agreements. Disclosing a situation where risk for HIV transmission may have occurred due to a broken agreement about safer sex necessitates delicate and sensitive communication between partners. Yet few models exist that MSM couples may use to navigate the disclosure of breaks when they happen.<sup>13,21,30–33</sup> In addition, Interdependence Theory posits that men prioritize the needs of their relationship over their personal health when making decisions—which could make negotiation and/or disclosure of broken agreements even more difficult.<sup>34,35</sup> These complexities between individual and partner-level priorities highlight the need to examine the influence of relationship dynamics on sexual risk behavior in MSM couples.

The present study examines relationship dynamics associated with HIV risk behavior among MSM couples. We first describe the rates of anal sex with primary and outside partners in this sample of concordant negative, concordant positive, and discordant couples. Following this, we identify specific relationship factors associated with UAI with primary and outside partners in the past 3 months.

## Methods

### Recruitment

We recruited MSM couples ( $n = 566$ ) from the San Francisco Bay Area between June 2005 and February 2007, using active and passive recruitment strategies in community venues. Field research staff reached potential participants by handing out study postcards in person, by placing recruitment materials in MSM-identified social venues such as bars, clubs, and cafes, and in community health and HIV/AIDS service organizations, and by placing advertisements in MSM-oriented publications and online. We aimed our recruitment strategies to produce a sample that reflects the diverse demographics of the San Francisco Bay Area, in terms of race/ethnicity and HIV status. All recruitment materials invited interested potential participants to call a recruitment hotline for further information.

### Screening and eligibility

Potential participants were screened individually over the telephone to determine eligibility. To be eligible, each partner had to be at least 18 years old, be in their relationship for at least 3 months (“primary partner” was defined as a man the participant is committed to above anyone else and with whom he has had sex), be fluent in English, and be a resident of the San Francisco Bay Area. Each partner also had to have knowledge of his own as well as his primary partner’s HIV status and responses from both partners had to match. We did not verify the reported HIV statuses because the focus of this

research was to study sexual risk behaviors and these behaviors are driven by each participant’s perceptions of their own and their partner’s HIV status, not necessarily their actual HIV statuses. Eligible couples were given appointments to come to the study offices in downtown San Francisco. Each partner was consented, then proceeded to take an audio computer-assisted self-interview (ACASI) that required approximately 70 min to complete. Both partners took the survey simultaneously but separately. Upon completion, each partner received \$40.00.

### Measures

**Demographic characteristics.** Respondents reported their age, race/ethnicity, employment status, annual income, cohabitation status, and relationship length.

**HIV status.** The respondent’s HIV status was determined via self-reports of the results of his most recent HIV test. Respondents also reported their primary partner’s HIV status.

**Sexual agreement.** Respondents were asked about their agreement type. Each participant’s response was compared with his partner’s to create two couple-level agreement categories: (1) closed agreements, where both partners reported their agreement as not allowing sex with outside partners, (2) open agreements, where both partners either reported their agreement as allowing sex with outside partners or where the two partners provided discrepant reports of their agreement type, with one partner reporting it as closed and the other reporting it as open. Respondents also reported whether they explicitly discussed their agreement.

**Sexual behavior.** Respondents reported the number of times they engaged in a variety of sexual behaviors in the past 3 months. They were asked about the frequency of each behavior under different scenarios—used/did not use condoms, with the primary/outside partners, and the HIV status of the partners. The resulting data were sufficiently detailed to determine receptive versus insertive anal sex, with and without ejaculation. Based on the participant’s own HIV status and that of his primary and outside partners, the sum of the number of insertive and receptive UAI acts was used to create two binary outcome variables: UAIPP (1 = reported at least one act of UAI with primary partner in the past 3 months; 0 = reported zero acts of UAI with primary partner in the past 3 months) and UAIOUT (1 = reported at least one act of UAI with outside partner(s) of discordant or unknown HIV status in the past 3 months; 0 = reported zero acts of UAI outside partner(s) of discordant or unknown HIV status in the past 3 months).

A number of standardized measures were also recorded and used in the model selection process. Table 1 details the measures that appear in the final models.

### Data analysis

**Descriptive analyses.** First, to describe the demographic characteristics of the participants and their sexual risk behavior, measures of central tendency and frequencies along with chi-square tests were calculated. Pearson’s chi-square test was used for couple-level responses, whereas the Rao-Scott chi-square was used to obtain accurate inferences in

TABLE 1. STANDARDIZED MEASURES UTILIZED IN THE STUDY

Measure	Reliability	Reference	No. of items	Response scale	Sample item
Sexual Agreement Investment Scale	0.95	14	13	5-point: 'Not at all' to 'Extremely'	"How much do you appreciate having your current agreement?"
Miller Social Intimacy Scale	0.91	41	17	10-point: 'Very Rarely' to 'Almost Always' OR 'Not Much' to 'A Great Deal', depending on the question	"When you have leisure time, how often do you choose to spend it alone with your partner?"
Dependability (from Trust Scale)	0.71	42	5	7-point: 'Strongly Disagree' to 'Strongly Agree'	"I have found that my partner is unusually dependable, especially when it comes to things that are important to me."
Attachment	0.80	43	8	9-point: 'Not at all True' to 'Extremely true'	"I can never get too close to my partner."
HIV-Specific Social Support	0.89	44	24	4-point: 'Strongly Disagree' to 'Strongly Agree'	"My partner depends on me for help when it comes to practicing safer sex."
Revised UCLA-Loneliness Scale	0.67	45	4	4-point: 'Never' to 'Often'	"I feel in tune with people around me."
Equality	0.91	43	8	9-point: 'Not at all True' to 'Extremely true'	"My partner shows as much affection to me as I think I show to him."

Note: For all scales, higher scores reflected higher levels of the construct.

the case of individual-level responses for individuals nested within couples.

**Model selection.** Next, to detect relationship dynamics associated with sexual risk, generalized linear models with a binomial distribution and a logit link were fitted. A manual backward model selection process was utilized for each of the two binary outcomes: UAI with primary partner in the past 3 months (UAIPP) and UAI with outside partner(s) of discordant or unknown HIV status (UAIOUT) in the past 3 months. From the extensive list of variables recorded in the survey, each was first tested independently for association with the outcome. For every outcome, those associated with a  $p$  value of 0.25 or less were shortlisted and included in the pool of potential predictors during the model selection process.<sup>36</sup> The resulting multi-variable model was then run successively and the relationship dynamic with the greatest  $p$  value exceeding 0.05 was deleted at each step until the model contained only dynamics that were all statistically significant at the 0.05 level. All models controlled for relationship length and agreement type and the statistical significance of these control variables were ignored during the model selection process (i.e., these variables were retained at all steps, including in the final models presented below).

To allow for the possibility of different final models by type of sexual partner and couple serostatus, this model selection process was used to build six separate models: one for each of the three couple serostatus groups (concordant negative, concordant positive, and discordant) and for each of the two binary sexual risk outcomes of interest (UAIPP and UAIOUT). PROC GENMOD in SAS V9.2 was used to fit these generalized linear models. The data were analyzed at either the couple-level or at the level of the individual nested within couple, depending on the outcome being modeled. Specifically, the outcome UAIPP is a couple-level variable since both partners reporting UAI with *each other*. Therefore, for the outcome UAIPP, the data was analyzed at the couple-level with the couple-level average scores on the relationship dynamics being used to test for associations with it using a standard generalized linear model. In contrast, for the UAIOUT models, the outcome is an individual-level variable since either partner may or may not have UAI with an outside partner of discordant or unknown serostatus, leading to the partners having potentially different responses for this variable. Therefore, for the outcome UAIOUT, the data were input to the models at the individual level, but clustered by couple using the REPEATED statement in SAS PROC GENMOD. For these models, odds ratios and their 95% confidence intervals were estimated via generalized estimating equations (GEE) with an exchangeable correlation structure; confidence intervals were computed based on robust Huber-White sandwich standard errors.

**Missing data.** All variables used in the generalized linear modeling analyses had trivial amounts (<1%), if any, of missing data, with the exception of the Sexual Agreement Investment Scale (SAIS) score, which had roughly 20% of values missing, a nontrivial amount of incomplete data.<sup>37</sup> Missing SAIS values were imputed using *Mplus 6* which provides the facility to impute clustered continuous, ordinal and binary data.<sup>38</sup> All variables used to build the models were also used to inform the imputation process. Twenty imputed

data sets were generated via *Mplus* and then read into SAS for further processing. During the model selection process, the imputed data were utilized in all instances where the model contained SAIS, with the results from the twenty datasets being aggregated using PROC MIANALYZE. In the absence of SAIS in any model, the original (non-imputed) dataset was used.

## Results

Nearly all couples (99%) reported having a sexual agreement (Table 2). Specifically, 45% were closed, 55% were open. The 55% of couples with open agreements can be further categorized into 41% where both partners mutually agreed to an open agreement and 13% where the partners reported discrepant agreements (data not shown in table; numbers do not add up due to rounding). A majority of couples (64%) reported discussing their agreements explicitly. Concordant negative couples comprised 55% of the sample, 22% were concordant positive, and 23% were discordant. The sample was racially/ethnically diverse, with the largest proportions of couples being either interracial (47%) or couples where both partners were White (45%). Individual incomes were less than \$60,000 annually for most men, and for the majority of couples both partners were employed. The median age of the men was 42

years (mean: 42; range: 18–83) and the median relationship length was 4 years (mean: 6.9; range: 0.25–48) (data not shown in table). Seventy-seven percent of couples lived together.

Overall, 74% of couples ( $N=416$ ) reported engaging in anal sex with their primary partner in the past 3 months (Table 3). Couples who reported UAIPP comprised 65% of the overall sample. While a majority of concordant couples—69% of concordant negative and 73% of concordant positive—engaged in UAIPP, nearly half (47%) of the discordant couples also reported UAIPP. These percentages were significantly different from each other ( $p<0.01$ ). Among discordant couples reporting UAIPP, 85% of HIV-negative partners and 53% of HIV-positive partners were insertive at least once in the past 3 months (data not shown in table).

Anal sex with outside partners was reported by 31% of the overall sample and 22% reported UAI with outside partners in the past 3 months. Fewer men (15%) in concordant negative relationships reported UAI with outside partners than men in discordant relationships (25%) and concordant positive relationships (38%). Overall, 13% of the sample reported UAIOUT, a behavior that is potentially high risk for HIV transmission. By couple serostatus, 10% of men in concordant negative, 16% of men in concordant positive, and 19% of men in discordant relationships reported engaging in UAIOUT.

TABLE 2. CHARACTERISTICS OF THE SAMPLE

	Overall sample 566 couples		Couple serostatus					
			Concordant negative 310 couples		Concordant positive 124 couples		Discordant 132 couples	
	%	(N)	%	(N)	%	(N)	%	(N)
Agreement type								
Closed	45	(255)	27	(153)	10	(44)	8	(58)
Open	55	(306)	27	(153)	14	(80)	13	(73)
No agreement	<1	(5)	<1	(4)	0	(0)	<1	(1)
Agreement explicitly discussed	64	(364)	38	(215)	13	(75)	13	(74)
Race of couple								
Interracial	47	(268)	27	(151)	11	(63)	10	(54)
White	45	(254)	25	(144)	8	(44)	12	(66)
Black	5	(26)	<1	(4)	3	(15)	1	(7)
Latino	2	(11)	1	(7)	<1	(1)	<1	(3)
Asian/Pacific Islander	1	(5)	<1	(4)	<1	(1)	0	(0)
Native American	<1	(2)	0	(0)	0	(0)	<1	(2)
Employment								
Both partners employed	49	(279)	35	(199)	4	(25)	10	(55)
One partner employed	32	(180)	15	(83)	9	(49)	9	(48)
Both partners unemployed	19	(107)	5	(28)	9	(50)	5	(29)
Individual income ( $n=1132$ individuals)								
Less than \$30,000	45	(507)	19	(214)	15	(167)	11	(126)
\$30,000 to \$59,999	30	(343)	19	(214)	5	(53)	7	(76)
\$60,000 or \$99,999	16	(177)	10	(116)	2	(17)	4	(44)
\$100,000 or higher	9	(105)	7	(76)	<1	(11)	2	(18)
Length of relationship—categorized								
6 months or less	9	(51)	4	(22)	2	(12)	3	(17)
More than 6 months and up to 2 years	28	(156)	15	(83)	7	(41)	6	(32)
More than 2 years and up to 5 years	26	(147)	16	(90)	6	(33)	4	(24)
More than 5 years and up to 10 years	17	(98)	8	(46)	4	(22)	5	(30)
More than 10 years	20	(114)	12	(69)	3	(16)	5	(29)
Partners live together	77	(435)	44	(248)	14	(82)	19	(105)

Note: Not all applicable percentages sum to 100% due to rounding.

TABLE 3. PERCENTAGES OF ANAL SEX WITH PRIMARY AND OUTSIDE PARTNERS IN PAST 3 MONTHS BY COUPLE SEROSTATUS

	Overall sample % (N)	Couple serostatus			p Values <sup>a</sup>
		Concordant negative % (N)	Discordant % (N)	Concordant positive % (N)	
<i>With primary partner (couple-level data)</i>	N=566	N=310	N=132	N=124	
Anal sex	74 (416)	75 (232)	65 (86)	79 (98)	0.03
UAI	65 (368)	69 (215)	47 (62)	73 (91)	<0.01
<i>With outside partners (individual-level data)</i>	N=1132	N=620	N=264	N=248	
Anal sex	31 (349)	25 (157)	32 (84)	44 (108)	<0.01
UAI	22 (252)	15 (92)	25 (65)	38 (95)	<0.01
UAI with discordant or unknown HIV status outside partner	13 (149)	10 (60)	19 (50)	16 (39)	<0.01

UAI, unprotected anal intercourse.

<sup>a</sup>The *p* values for couple-level data are for the Pearson's chi-square statistic whereas for individual-level data nested within couples, they are for the Rao-Scott chi-square statistic.

For all categories of anal sex with outside partners, the percentages in the three couple serostatus groups differed significantly from each other ( $p < 0.05$ ).

In multivariate models, several important relationship variables were found to be associated with UAIPP (Table 4). The more intimacy couples reported, the greater the odds were of engaging in UAI with each other (AOR: 1.03; 95% CI: 1.01, 1.05). Among concordant negative couples, the longer couples were in their relationship, the less likely they were to engage in UAI with each other (AOR: 0.92; 95% CI: 0.89, 0.94). Among concordant positive couples, greater loneliness (AOR: 0.72; 95% CI: 0.53, 0.98), greater HIV-specific social support (AOR: 0.91; 95% CI: 0.85, 0.99), and greater perceived dependability of partner (AOR: 0.88; 95% CI: 0.78, 0.9976) were associated with lower odds of UAIPP. Conversely, greater attachment was associated with higher odds of UAIPP (AOR: 1.09; 95% CI: 1.03, 1.16).

Among discordant couples, greater HIV-specific social support (AOR: 0.89; 95% CI: 0.83, 0.94) and longer relation-

ship length (AOR: 0.88; 95% CI: 0.82, 0.95) were associated with lower odds of UAIPP, while greater attachment was associated with higher odds of UAIPP (AOR: 1.07; 95% CI: 1.02, 1.12).

In multivariate models for UAI with a discordant or unknown HIV status outside partner (UAIOUT), for men in concordant negative relationships, greater equality in the relationship (AOR: 0.98; 95% CI: 0.95, 0.9998) and higher HIV-specific social support (AOR: 0.91; 95% CI: 0.88, 0.94) were associated with lower odds of UAIOUT. Men with open agreements had nine times the odds of engaging in UAIOUT compared to men with closed agreements (AOR: 9.08; 95% CI: 3.69, 22.3).

Men in concordant positive relationships with open agreements had three times the odds of engaging in UAIOUT as those with closed agreements (AOR: 3.36; 95% CI: 1.04, 10.84). However, the more invested men were in their agreement, regardless of type, the lower their odds of engaging in UAIOUT (AOR: 0.97; 95% CI: 0.94, 0.997).

TABLE 4. RELATIONSHIP FACTORS ASSOCIATED WITH UNPROTECTED ANAL SEX WITH PRIMARY PARTNER IN PAST 3 MONTHS

Parameter	Odds ratio	OR_LB	OR_UB	p Value
<i>Among concordant negative couples</i>				
Relationship length (years)	0.92	0.89	0.95	<0.01
Open agreement	0.77	0.44	1.33	0.34
Intimacy	1.03	1.01	1.05	<0.01
<i>Among concordant positive couples</i>				
Relationship length (years)	0.96	0.89	1.03	0.29
Open agreement	2.05	0.74	5.62	0.17
Perceived dependability of primary partner	0.88	0.78	0.9976	0.046
Attachment	1.09	1.03	1.16	<0.01
Loneliness	0.72	0.53	0.98	0.04
HIV-specific social support	0.92	0.85	0.99	0.02
<i>Among discordant couples</i>				
Relationship length (years)	0.88	0.82	0.95	<0.01
Open agreement	1.44	0.61	3.39	0.40
Attachment	1.07	1.02	1.12	0.01
HIV-specific social support	0.89	0.83	0.94	<0.01

N=566 couples. Relationship length and agreement type were treated as control variables in the above models. OR\_LB: lower bound of 95% confidence interval of odds ratio; OR\_UB: upper bound of 95% confidence interval of odds ratio.

TABLE 5. RELATIONSHIP FACTORS ASSOCIATED WITH UNPROTECTED ANAL SEX WITH OUTSIDE PARTNER OF DISCORDANT OR UNKNOWN HIV STATUS IN PAST 3 MONTHS

<i>Parameter</i>	<i>Odds ratio</i>	<i>OR_LB</i>	<i>OR_UB</i>	<i>p Value</i>
Among men in concordant negative relationships				
Relationship length (years)	1.03	0.995	1.06	0.09
Open agreement	9.08	3.70	22.30	<0.01
Equality	0.98	0.95	0.9998	0.048
HIV-specific social support	0.91	0.88	0.94	<0.01
Among men in concordant positive relationships				
Relationship length (years)	1.05	0.997	1.10	0.06
Open agreement	3.36	1.04	10.84	0.04
Sexual agreement investment	0.97	0.94	0.997	0.03
Among men in discordant relationships				
Relationship length (years)	0.97	0.92	1.02	0.19
Open agreement	5.87	2.18	15.75	<0.01
HIV-positive (self)	2.51	1.33	4.74	<0.01
HIV-specific social support	0.91	0.88	0.94	<0.01

*N* = 1132 men from 566 couples. Relationship length and agreement type were treated as control variables in the above models. OR\_LB, lower bound of 95% confidence interval of odds ratio; OR\_UB, upper bound of 95% confidence interval of odds ratio. Models were fitting using generalized estimating equations (GEE) clustering on couple ID with an exchangeable correlation structure to account for the nesting of individuals within couples.

Finally, men in discordant relationships with open agreements had approximately six times the odds of engaging in UAI/OUT as those with closed agreements (AOR: 5.86; 95% CI: 2.18, 15.75). Moreover, in these relationships, the HIV-positive partner had two and one half times the odds of engaging in UAI/OUT as the HIV-negative partner (AOR: 2.51; 95% CI: 1.33, 4.74).

## Discussion

High proportions of MSM in relationships reported UAI with their primary partner in the past 3 months regardless of couple serostatus. Far fewer reported UAI with outside partners in the same period; however, among those who did, over half reported UAI with a discordant or unknown HIV status outside partner—a behavior that is potentially at high risk for HIV transmission. Further, an earlier enquiry with this sample revealed low rates of HIV-testing among the HIV-negative men reporting recent risk behavior—a trend that has far-reaching negative consequences for HIV transmission.<sup>20</sup>

The high proportion of couples reporting UAI with each other suggests that men in relationships prefer not to use condoms with their primary partners. Among concordant negative couples, UAI poses no risk of HIV transmission if both partners are monogamous and maintain their closed agreement. There is evidence, however, that the boundaries of sexual agreements change over time and can be broken, and that breaks often go undisclosed.<sup>8,33,39</sup> Thus, additional attention should be paid to longitudinal examinations of agreement breaks, whether agreements change over time, and what factors may be associated with disclosure of broken agreements. Among discordant couples, those who engage in UAI may increase HIV transmission risk for the HIV-negative partner. The fact that many of the discordant couples in this study engaged in UAI may support earlier findings of condom fatigue, perception of low risk due to undetectable viral load, and the sense that condoms represent a barrier to establishing trust, intimacy, and pleasure.<sup>4,7,13,16,18,24</sup>

Relationship dynamics associated with sexual behavior revealed differences as well as similarities by partner type

(i.e., primary vs. outside partners of discordant or unknown HIV status) and couple serostatus. Attachment (for concordant positive and discordant couples) and intimacy (for concordant negative couples), two variables that convey relationship closeness, were positively associated with UAI with one's primary partner, findings that fit nicely with existing research on why many couples typically avoid condoms.<sup>7,10,13</sup> Loneliness, (for concordant positive couples) and HIV-specific social support (for concordant positive couples and discordant couples) were associated with lower odds of UAI/PP. Feeling lonely could diminish one's desire for sex and having a partner who provides more HIV-specific social support may reduce the odds of UAI with one's primary partner, which could decrease the chances of HIV transmission to the HIV-negative partner in discordant relationships or reduce the transmission of STIs among concordant HIV-positive couples. Relationship length was not significantly associated with lower odds of UAI/PP for concordant positive couples, but was for concordant negative and discordant couples. This result is somewhat unexpected, in that under the rubric of negotiated safety it may be common practice for concordant negative couples to begin to use condoms with each other, but after testing HIV-negative that they abandon condom use with each other. This result may speak to the need to examine changes in agreements over time, as changing from a closed to an open agreement could impact condom use with primary partners. For discordant couples, it may be that better communication about potential transmission risks improves over time, which results in fewer chances for unprotected sex between discordant primary partners. This is in alignment with the findings pertaining to increased HIV-specific social support also being associated with less odds of UAI with the primary partner, as this construct may be related to a couple's ability to discuss sex and HIV issues together.<sup>40</sup>

Agreement type was not associated with UAI/PP, suggesting that men with either agreement are almost equally likely to engage in UAI with primary partner. In contrast, agreement type was associated with UAI with outside partners of discordant or unknown HIV status. Specifically, couples with

open agreements were significantly more likely to engage in UAI/OUT than those with closed agreements, regardless of couple serostatus. While it is not surprising that open agreements are associated with greater odds of outside sexual activity, our findings directly associate open agreements with risky sexual activity outside the relationship and is consistent with earlier published studies investigating risk factors for MSM couples.<sup>11,29</sup> This strongly supports the need for future interventions to help MSM in open relationships navigate safety with all their sexual partners, primary and outside.

For all three couple serostatus groups, various relationship dynamics were associated with UAI/OUT. Examples include positive relationship variables such as agreement investment (for concordant positive couples), equality (for negative concordant couples), and HIV-specific social support (for concordant negative and discordant couples). Men who reported high levels of these aspects of their relationships were less likely to engage in potentially risky UAI with outside partners. These are issues that should be included in any interventions or community-based programs with MSM couples. Open communication and being content with one's relationship may support couples who have open agreements. However, men with open agreements, across serostatus groups, were more likely to report *unprotected* anal sex with outside partners of unknown or discordant HIV status. This speaks to a need for agreements that allow outside partnerships to include discussions of safety and focus on providing men with skills to disclose these encounters should they represent a break in their agreement with their partner. Finally, HIV-positive men in discordant relationships were two and one half times as likely to engage in UAI with outside partners of discordant or unknown status, a behavior that is potentially at increased risk of HIV transmission. Additional exploration of the relationship that may exist between the types of sex that men have with primary partners and the types of sex they have with outside partners is needed. This emphasis on the type of sex that occurs between men in relationships and their outside partners is necessary to ensure safety for all parties.

With the arrival of rapid home-use HIV test kits, as well as the pilot availability of HIV testing in pharmacies across the US, it is hoped that those most at risk will test in a timely manner. Further, the availability of novel biomedical interventions such as PrEP could lead to a re-calculation of risk in the minds of those at risk. These new tools may have broad implications for condom use; therefore clearer communication and negotiation about the use of these among partners will be critically important for maintaining couples' sexual health.

Strengths of our study include the large sample of MSM couples, as opposed to studies of individual or single MSM. The sample was also diverse in terms of race/ethnicity, couple serostatus, and agreement type. Moreover, the use of ACASI minimizes potential issues of reliability of self-reported data that is personal in nature. One limitation is the study's modified convenience sample that is from a limited geographic area. This might prevent the generalization of findings to all MSM couples or even MSM couples from other geographical regions. Moreover, only 13% of our overall sample reported an instance of UAI with an outside partner of discordant or unknown serostatus in the past 3 months. It is possible therefore that future findings from samples of MSM couples

who report higher rates of risky behavior may vary from ours. Finally, the cross-sectional nature of the data prevents us from making causal inferences.

Relationship dynamics associated with HIV risk for MSM couples are important to address in the fight to halt the spread of HIV. Balancing the desire for a fulfilling relationship with the need to navigate safe sex can be a complex process for many couples, which is one of the many ways in which HIV prevention for couples is distinct from single MSM. Future HIV prevention efforts for MSM, in general, and MSM couples, in particular, can enhance their effectiveness by addressing the added complexity of competing interests relationships can bring.

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