

# Affect and Condom Use Among Men Who have Sex with Men: A Daily Diary Study

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**Abstract** Men who have sex with men (MSM) are disproportionately affected by HIV. Although some theoretical models created to explain why individuals engage in risky sexual behavior contain an affective component, there has been relatively little focus on the influence of affect on sexual risk-taking. The goal of this study is to investigate the association between affect and condom use among MSM using an archival dataset from a survey of users of a popular sex-oriented website. Multilevel modeling was used to analyze daily diary data from 2871 MSM. At the within-person level, positive affect was positively related to condomless anal sex (CAS), whereas negative affect was negatively related to CAS. However, these results were qualified by interactions of trait affect and relationship to sex partner. These findings suggest that interventions focused on emotional regulation may have the potential to reduce CAS among MSM.

**Keywords** Affect · Men who have sex with men (MSM) · HIV · Sexual risk-taking

## Introduction

HIV infection is a serious concern for men who have sex with men (MSM), who constitute the population most heavily affected by HIV in the United States [1]. Although MSM represent only about 2 % of the population in the

United States, in 2013, MSM accounted for 55 % of the estimated number of persons diagnosed with AIDS among all adults and adolescents in the United States [1]. The disturbingly high rate of HIV incidence among MSM has spurred much research dedicated to identifying factors that promote sexual risk behaviors. Several theoretical models, such as the Theory of Planned Behavior [2], Social Cognitive Theory [3], the Health Belief Model [4, 5], the AIDS Risk Reduction Model [6], and the Information-Motivation-Behavioral Skills Model [7] have attempted to explain why individuals engage in sexual behavior that puts them at risk for HIV infection.

These theoretical models have been critical in advancing research on risky sexual behavior. However, because they have focused on cognitive predictors of risk, less research has been conducted to investigate the influence of affect on sexual risk-taking behavior [8–10]. McKirnan et al. [11] highlighted this deficit in psychosocial models of HIV risk behavior, which tend to assume that people behave as “rational operators” whose knowledge and attitudes affect behavior in a straightforward fashion. This model, however, may not be appropriate for sexual behavior, because it is often highly emotionally charged. The authors posit that “non-rationality” in sexual risk-taking could be influenced by a number of factors, including “emotional states that distort perceptions of personal vulnerability” (p. 3). The purpose of the present study is to contribute to this understudied potential risk factor by assessing within-person associations between affect and sexual risk-taking behavior among MSM.

## Affect, Risk Perception, and Risky Decision Making

The relation between affect and risky decision-making has been explored in a number of studies, many of which have

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presented participants with gambling scenarios in a laboratory context. One strand of research, which we refer to as the probability perspective, has shown that positive mood decreases perceived vulnerability to risk [12]. One's perception of risk is, in turn, likely to affect one's subsequent decision-making. For example, if positive mood causes one to perceive the risk in a gambling situation to be fairly low, one is more likely to go "all in" on his next hand. Other research, however, has shown that such effects are overshadowed by the tendency for positive affect to encourage behavior that is more conservative or self-protective in situations where there is a real threat of loss [13–15]. Indeed, positive affect has been shown to increase risk aversion by boosting the subjective utility of a potential loss (i.e. the perceived impact of a loss; 15), despite the tendency for positive affect to lower risk perception [16]. We refer to such findings as representing the subjective utility perspective on affect and risky decision-making.

Researchers of the relation between negative affect and risk have similarly proposed two mechanisms whereby negative affect could influence risk-taking tendencies. Consistent with the probability perspective, negative affect has been found to be associated with a global increase in perception of risk [12], which, in turn, could be expected to decrease risk-taking behavior. In contrast, Leith and Baumeister [17] proposed that, when feeling upset, people may become unable or unwilling to control their immediate impulses. These researchers provided evidence that negative affect increases people's preference for high-risk, high-reward options over those that may be more beneficial to the person in the long-run. We refer to such findings as representing the impaired self-regulation perspective.

The findings of Nygren et al. [16] suggest that those who are feeling happy may be less likely than others to engage in sexual risk-taking behavior due to the high subjective utility of the potential negative consequences (e.g., contracting HIV). However, negative affect may either (a) decrease likelihood of engaging in sexual risk-taking behavior because of increased perception of risk, or (b) increase likelihood of engaging in sexual risk-taking behavior because of impairment in self-regulation resulting from negative mood.

### Affect and Sexual Risk-Taking

Research on the relation between affect and sexual risk-taking is sparse. A meta-analysis found no compelling evidence for an association between negative affect and sexual risk-taking [18]. However, in response, Kalichman and Weinhardt [8] noted several limitations of studies included in this analysis. A major limitation is that studies of negative affect and sexual risk have typically relied on measures of current or recent affective states in relation to

sexual behaviors practiced at an earlier time. This mismatch in the time frames for affect and sexual behavior has made studies insensitive to the co-occurrence of mood and sexual events, highlighting the need for event-level and within-person analyses.

Two studies conducted by Mustanski and colleagues addressed some of these limitations by using daily diary methods to examine within-person associations between mood and sexual risk-taking [10, 19]. Use of daily reports of mood and sexual behavior minimized retrospective recall bias, and avoided the temporal misalignment between mood and sexual events in previous studies. Two facets of negative affect were examined in both studies: anxiety and negative activation (which emphasized feelings of sadness and stress). Mustanski [10] hypothesized that men high in negative activation would be more likely to make impulsive choices, including engagement in risky sexual behavior (consistent with the impaired self-regulation perspective). No hypothesis was offered as to the association between anxiety and sexual risk-taking. Contrary to hypothesis, negative activation was unrelated to all measures of sexual risk behavior. Anxiety was positively related to sexual risk, which appears consistent with the impaired self-regulation perspective. However, results differed in the other study, which focused on highly sexually active MSM. Grov et al. [19] found that negative activation was negatively related to sexual risk behavior (particularly among men who were not sexually compulsive) and that anxiety was positively related to frequency of sexual experiences and number of partners (but not engagement in sexual risk behaviors).

Research on positive affect among MSM is especially rare. The two daily diary studies described above, however, did examine positive affect in relation to sexual risk-taking. Mustanski [10] found that positive affect was negatively related to risk-taking outcomes in MSM. No such association, however, emerged in Grov et al.'s [19] study of MSM who were highly sexually active.

To summarize, although a meta-analysis found no relation between negative affect and sexual risk-taking [18], most research in this area has been limited by a mismatch in timeframes for assessment of affect and sexual behavior and by a focus on the between-person level [8]. Moreover, little research has examined positive affect in relation to sexual risk behavior. Two recent daily diary studies have addressed these limitations and suggested that, for some MSM, within-person fluctuations in affect are associated with sexual behavior [10, 19].

### Present Study

The present study aimed to address limitations of previous research by investigating the relation between affect

(positive and negative) and condomless anal intercourse (CAS; conceptualized as sexual risk-taking) in MSM at the within-person level using daily diary methods. We built on Mustanski's seminal research in this area by using a larger, more diverse sample of MSM, as well as investigating a broader range of possible moderators. The present study also differs from similar work in its focus on men who use technology to find potential sex partners. State affect may have a stronger influence on sexual behavior for users of such services than for other men, given ability of such services to provide easy access to an array of available sex partners.

As reviewed above, positive affect has been linked with lower risk-taking in basic laboratory research [16] and field research with MSM [10], despite evidence that positive affect also reduces the perception of risk [12]. Hence, the following hypothesis was proposed:

**Hypothesis 1** Positive affect will be negatively associated with sexual risk-taking at the within-person level.

Negative affect has been found to increase risky behavior in laboratory research [17], despite evidence that it also increases perception of risk [12]. A meta-analysis found no evidence for an association between negative affect and sexual risk-taking [18], and a study examining this association at the within-person level also found no relation between negative activation and sexual risk-taking (although a positive main effect was found for anxiety; 10). Given these disparate findings, the main effect of negative affect on sexual risk-taking was investigated as a research question:

**Research question 1** What is the association between negative affect and sexual risk-taking behavior at the within-person level?

Some researchers have suggested that the relation between state affect and sexual risk-taking in MSM may depend, in part, on trait affect. Mustanski [10] pointed out the inconclusive person-level results from research on affect and sexual risk-taking, and suggested that the inconsistent results may be clarified by exploring trait affect and state affect simultaneously—both as independent and interactive predictors. Indeed, he found that MSM with high trait anxiety were less likely to have sex with risky partners when experiencing high state anxiety, whereas the opposite was true for MSM with low trait anxiety. Although this was the only statistically significant interaction between state and trait affect found in the study, it is worth noting that Mustanski examined only interactions between corresponding state and trait affect variables (e.g. the interaction between trait negative affect and state negative affect).

There are reasons to believe that cross-level interactions pairing different types of trait and state affect might predict

sexual risk behavior. For example, a spike in negative affect may be experienced as especially jarring and distressing for people with generally high positive affect, as state negative affect is experienced as deviation from the status quo. Therefore, there may be a stronger relation between state negative affect and sexual risk-taking behavior for those with high trait positive affect than those with low trait positive affect. Similarly, a spike in positive affect may be experienced as particularly different from the norm for people with generally high negative affect; therefore, there may be a stronger relation between state positive affect and sexual risk-taking for those with high trait negative affect than those with low trait negative affect. Hence, we examined cross-level interactions not only between corresponding pairs of trait and state affect (e.g., positive trait affect interacting with positive state affect), but also interactions between noncorresponding pairs (e.g., positive trait affect interacting with negative state affect). Given the lack of research and theory on such interactions, we proposed the following research question:

**Research question 2** How do trait and state affect interact to predict sexual risk-taking?

An additional potential moderator that has not been explored in previous daily diary research on affect and sexual behavior is relationship to partner. Research at the between-person level has indicated that condom use is much less common for MSM having sex in the context of a committed romantic relationship [20]. This powerful relational factor may override any influence of affect on sexual risk-taking; thus, the association between affect and sexual risk-taking may not be as pronounced in those whose sexual experiences are mostly with a partner who is a boyfriend or spouse. To test this possibility, relationship to partner was investigated as a moderator of the within-person level link between affect and sexual risk-taking. The following hypothesis was proposed:

**Hypothesis 2** The association between affect (positive and negative) and sexual risk-taking at the within-person level will be (a) weaker to the extent that one's sexual experiences are with a committed romantic partner (e.g., boyfriend, spouse), and (b) stronger to the extent that one's sexual experiences are with a casual sexual partner (e.g., casual dating partner, new sexual partner).

## Method

### Participants

The sample featured 2871 MSM with a mean age of 38.12 ( $SD = 12.65$ ; range was 18–79 years). Participants

identified their race as African American/Black (3.3 %), White (83.9 %), Hispanic/Latino (6.1 %), Asian/Pacific Islander (2.5 %), or Other (3.6 %). Participants identified their sexual orientation as Homosexual/Gay (84.3 %), Bisexual (12.4 %), Heterosexual/Straight (0.3 %), Unsure/Questioning (1.4 %) or Other (1.4 %). The sample was generally highly educated (60.6 % had at least their Bachelor's degree). For relationship status, 55.7 % of participants reported that they were not dating anyone, 7.9 % reported that they were dating more than one person, and 35.8 % reported that they were in a romantic relationship with one person (with relationship duration from less than 3 months to more than 5 years). The sample was mostly (87.3 %) HIV-negative.

## Measures

### *Demographic Form*

As a part of the baseline survey, participants completed a variety of demographic questions including age, gender, race/ethnicity, current relationship status, sexual orientation, level of education, employment status, general health, and HIV status.

### *Daily Affect*

Affect was measured using a 9-item measure adapted from a previous study of emotional correlates of sexual events [21]. Participants reported how much they felt each emotion during the past day on a Likert-type scale ranging from 1 (“None”) to 4 (“A lot”). Affect subscales were developed for this study using multilevel factor analysis (described in Results section), which yielded three factors representing positive affect (Joviality; sample item: “Happy”) and negative affect (Hostility and Sadness; sample items: “Irritable” and “Depressed”). Within-person coefficient alphas for the scales were .78 for Joviality, .73 for Hostility, and .79 for Sadness.

Although these subscales were developed for this study, they were named to reflect the corresponding subscales from the Positive and Negative Affect Scale-Expanded (PANAS-X) [22] with which they share items. Validity has not been formally established for this measure due to its ad hoc nature, but it is assumed to function similarly to the psychometrically strong PANAS-X because of the substantial overlap between corresponding subscales of the two measures. Many other daily diary studies of affect and sexual behavior have similarly used ad hoc measures [e.g., 10, 19, 23, 24] due to the need to create brief measures in daily diary surveys [25].

### *Daily Sexual Risk-Taking*

Sexual risk-taking behavior was operationalized as the incidence of condomless receptive and insertive anal sex each day. To calculate this, information was drawn from responses to a few items within a set of items drawn from valid measures used in national studies of sexual behaviors [26]. Participants first indicated which of 17 sexual behaviors they had engaged in during the previous day. The two sexual behaviors that will be used for this study are “Inserted my penis into another man’s anus (anal sex/topping)” and “Had another man insert his penis into my anus (anal sex/bottoming).” Condom use was assessed for each sexual behavior reported by the participant that day. If participants reported engaging in a behavior more than once in the past day, they were asked about condom use each time they engaged in that behavior. Participants who reported engaging in insertive anal sex were asked “For this sexual encounter, did you wear a condom on your penis?” Participants who reported engaging in receptive anal sex were asked “For this sexual encounter, did your partner wear a condom on his penis?” Response choices included “Yes” and “No.” The index of sexual risk-taking behavior was calculated by summing the number of instances of insertive and receptive anal sex, respectively, during which condoms were not used. Because condomless insertive and receptive anal sex carry different levels of risk [10], they were analyzed separately in this study.

### *Relationship to Partner*

Three relationship to partner variables were created to assess individual differences in the frequency of three types of sex partners: Serious Relationship, Friend, and Casual Relationship. These scales were created from participants’ reports regarding each sexual experience on each day of the study. Participants were asked, “Which of the following best describes who this person was?” The answer choices included (a) “Boyfriend or significant other,” (b) “Someone I was casually dating/hanging out with,” (c) “A friend,” (d) “Someone I just met,” (e) “My spouse or domestic partner,” (f) “Someone who paid me or gave me something for sex,” (g) “Someone who I paid or gave something for sex,” and (h) “Other, please specify.” These seven response options were collapsed into three larger categories of relationship type: Serious Relationship (combining categories a and e above), Friend (category c above), and Casual Relationship (combining categories b, d, f, and g above). For each day, each participant received scores indicating whether they had insertive CAS with partners falling in each of the three categories of relationship type (0 = no, 1 = yes). Similar scores were given for receptive CAS. The scores of each of these variables

were averaged across days for each participant, resulting in variables representing the proportion of days in which insertive CAS was experienced with each partner type and the proportion of days in which receptive CAS was experienced with each partner type.

## Procedure

This study used archival data collected for the Men's National Sex Study [27]. Recruitment was conducted with the cooperation of one of the world's largest operators of sex-oriented websites for MSM. In October 2010, recruitment e-mails were sent to all registered users of the company's two largest websites who indicated that they lived in one of the 50 US states or in the District of Columbia. Participants were recruited without respect to reported sexual orientation or sexual behavior. This message provided a brief description of the study as well as the link to the study's website. At the website, individuals read a detailed description of the study and were given the opportunity to proceed to the study consent form if interested. Those who consented to participate in the study were directed to the questionnaire; completion took approximately 20 min. Participants were not given incentives to participate in this portion of the study.

Following completion of this baseline questionnaire, participants were given an opportunity to participate in the second phase of the study in which they would be e-mailed instructions on how to complete 30-day sexual diaries. Participants were informed that they would receive daily e-mail reminders that would ask them to return to the study website each day to complete a short survey about their sexual behaviors over the course of 4 weeks. Participants were eligible to enter a drawing for a \$100 Visa gift card each day they participated in the daily diary portion of the study. Included in the daily reminder e-mails was a link to the daily survey. These surveys took approximately 5 min to complete. These diaries measured daily occurrence of a range of sexual behaviors, including manual, oral, and insertive and receptive anal sex behaviors, as well as external characteristics associated with each individual event, including whether or not condoms were used. Additional questions associated with each sexual behavior that which not used for the purposes of this study included partner's gender and age, whether or not lubricants or enemas were used, where the sexual act occurred and how long it lasted, how pleasurable and satisfying the behavior was, and whether or not the participant had difficulty attaining or maintain an erection. Additional data collected as a part of the daily diaries that were not used in this study included measures of Internet behaviors and sexual experiences.

Of the 32,831 men who completed the baseline survey, 13.5 % ( $n = 4439$ ) opted to participate in the daily diary phase of the study and completed some portion of the 30 diaries ( $M = 11$  days,  $SD = 15$  days).

## Statistical Analysis

Links between daily mood and anal intercourse without a condom could potentially exist at both the within-person level (Level 1) and between-person level (Level 2), reflecting the multilevel structure of the data where days were nested within people. To examine relations at both levels of analysis, we used a multilevel latent covariate model that has been shown to offer higher power to detect contextual effects relative to more traditional multilevel regression models [28]. This model separated daily mood ratings into latent within- and between-person components, permitting tests of links between mood and sexual behavior at both Level 1 and Level 2. The model implicitly centers the Level 1 predictor (mood) at the person mean. We interpreted the latent between-person component as a measure of trait affect because it represented the part of daily affect that was stable for each participant over the course of the study. Robust standard errors were used in all analyses. A negative binomial model was used to model the outcomes, as is recommended for overdispersed count variables such as the anal intercourse variables in the present study [29]. Each dimension of mood was tested in a separate regression model due to convergence difficulties that occurred when testing the three mood variables simultaneously.

The model building strategy started with the most basic model investigated, which was a random intercepts regression featuring a mood variable as a predictor of one of the sexual risk-taking variables. Regression intercepts were allowed to randomly vary across participants (reflecting individual differences in sexual behavior), and could be interpreted as a person's average levels of condomless anal intercourse on a day when the person had his average level of state affect. Regression slopes were estimated at both Level 1 and Level 2. After estimating this model, a test was conducted to determine whether the within-person relation between mood and CAS (i.e., the Level 1 slopes) varied randomly across participants. Variability in these slopes would indicate that participants differed from one another in the link between state mood and sexual behavior. When significant variability was detected in Level 1 slopes, these slopes were allowed to vary randomly across participants in all subsequent analyses. The most complex models tested were those in which Level 2 variables (trait affect, relationship to partner) were examined as potential moderators of the within-person relation between affect and sexual risk-taking. Such

moderation effects are referred to as cross-level interactions because they feature an interaction between a Level 2 variable (e.g., tendency to have sex with a serious relationship partner) and a Level 1 variable (e.g., state Hostility). Cross-level interactions were investigated only in cases where the Level 1 slope was found to vary across participants.

We modeled cross-level interactions in slightly different ways depending on the moderator variable and its relation to the predictor. Tests in which the predictor and moderator variables were the same dimension of mood involved a simple extension of the simpler main effect model. Consider, for example, the model testing the main effects of Joviality on CAS. In this model Joviality was split into latent state and trait components, wherein the state Joviality was a predictor of within-person variability in CAS and trait Joviality was a predictor of participants' average daily frequency of CAS (i.e., predictor of intercepts). In the moderation model, trait Joviality was also included as a predictor of the Level 1 relation between state Joviality and instances of CAS (i.e., predictor of slopes). A slightly different strategy was used, however, when the predictor and moderator were different dimensions of mood. In such a case, the moderator was divided into latent state and trait affect components, and the measure of trait affect was then included as a predictor of the random intercepts and slopes at Level 2. Consider, for example, a cross-level interaction model similar to the one described above, but where the moderator was trait Hostility rather than trait Joviality. In this case Hostility was split into latent state and trait components, and the measure of trait Hostility was included as a predictor of both intercepts (i.e., participants' average daily frequency of CAS) and slopes (i.e., participants' slopes for the Level 1 relation between state Joviality and daily CAS). Finally, including the relationship type variables as moderators was straightforward because they were computed as Level 2 variables (e.g., proportion of days in one had insertive CAS with a serious relationship partner). In this case, we simply entered the moderator as a predictor of both intercepts and slopes.

A Bonferroni correction was used to control the experiment-wise Type 1 error rate of the 42 hypothesized effects. Specifically, we specified an experiment-wise error rate of .05, which corresponded to an individual test alpha level of .0012.

## Results

### Data Management

The original dataset contained 4439 participants and 29,773 cases (a case representing one daily entry for one

participant). Data cleaning involved removal of 1497 participants who only completed 1 day of the survey because at least two observations per person is required to examine within-person variation. In addition, 97 cases (0.3 %) were removed because all daily diary data were missing, and 117 cases (0.4 %) were removed because all but the mood variables were missing. In sum, this process of data cleaning led to removal of 1830 cases (6.14 %) from the original dataset. Because the resulting dataset had a low rate of missing data (1.72 %), we deleted the remaining cases with missing data to minimize convergence problems in the computationally intensive analyses featured in this study.

### Descriptive Statistics

In the final sample of 2871 MSM, the mean number of daily diaries completed was 9.73 ( $SD = 8.39$ ), for a total of 27,943 days of diary entries. Across all participants and all days of diary entries, participants reported 1534 days (5.6 %) on which at least one instance of insertive anal intercourse occurred. Participants reported their condom use for 1976 instances of insertive anal intercourse across all days of diary entries; of these instances, 1267 (64.1 %) occurred without a condom. Participants reported 2584 days (9.2 %) on which at least one instance of receptive anal intercourse occurred. Participants reported their condom use for 1861 instances of receptive anal intercourse across all days of diary entries; of these instances, 1279 (68.7 %) occurred without a condom.

Across all participants and all days of diary entries, 492 instances (24.9 %) of insertive anal intercourse occurred with someone with whom the participant was in a serious relationship, 1,058 instances (53.5 %) occurred with a casual partner, and 351 instances (17.8 %) occurred with a friend. For instances of receptive anal intercourse, 394 (21.2 %) occurred with a serious partner, 871 (46.8 %) occurred with a casual partner, and 382 (20.5 %) occurred with a friend. See Table 1 for descriptive statistics for predictor and outcome variables.

### Development of Mood Subscales

Before conducting data analyses related to hypotheses and research questions, it was necessary to investigate the latent dimensions of affect underlying participants' responses to the mood items using a series of multilevel exploratory factor analyses. A major goal of these analyses was to determine the number and content of factors at each level of analysis. Factor analyses were conducted using the robust maximum likelihood estimation capabilities of Mplus software, version 7.1 [30], as were all subsequent multilevel analyses.

**Table 1** Person-level descriptive statistics for predictor and outcome variables (N = 2871)

	ICC	M	SD	Median	Min.	Max.
<b>Predictors</b>						
Joviality	0.50	2.93	0.67	2.91	1	4
Hostility	0.44	1.87	0.54	1.80	1	4
Sadness	0.58	1.75	0.64	1.58	1	4
<b>Outcomes</b>						
Daily instances of insertive CAS		0.06	0.22	0	0	3
Daily instances of receptive CAS		0.06	0.20	0	0	3
<b>Moderators</b>						
<b>Insertive anal sex</b>						
Serious relationship		0.02	0.12	0	0	3
Friend		0.02	0.09	0	0	2
Casual relationship		0.05	0.18	0	0	3
<b>Receptive anal sex</b>						
Serious relationship		0.02	0.09	0	0	2
Friend		0.01	0.08	0	0	1
Casual relationship		0.04	0.16	0	0	3

As recommended by Reis et al. [25], intraclass correlation coefficients (ICCs) for each of the affect items was examined prior to factor analysis to ensure variability at both the within- and between-persons levels of analysis (see Table 2). This analysis of item variance supported the use of a multi-level factor analysis. We explored factor solutions with different combinations of factors at the two levels of analysis, ranging from 1 to 4 factors at each level. Goodness-of-fit was assessed using the following guidelines for good fit suggested by Hu and Bentler [31] with respect to covariance structure analysis: RMSEA ( $\leq .06$ ), SRMR ( $\leq .08$ ), and CFI ( $\geq .95$ ). The model with three factors at each level of analysis clearly had the best profile of fit indices: RMSEA = .06,

SRMR(within-person) = .03, SRMR(between-person) = .03, and CFI = .96.

Given this favorable profile relative to the other models, along with a clear and interpretable factor structure, this model was used as the basis for the multilevel confirmatory factor analysis. Structure coefficients indicated that the structure and meaning of factors were the same at the within-person and between-person levels (see Table 2). Inspection of these coefficients led us to name the three factors Joviality, Hostility, and Sadness. Affect variables were scored by averaging across all items within each factor. “Stressed” and “Anxious” were not included in any of the subscales because they did not load cleanly onto any of the factors.

**Table 2** Structure coefficients for multilevel factor analysis of mood items

Item	ICC	Within person			Between person		
		1	2	3	1	2	3
Happy	0.43	-0.28	<b>0.79</b>	-0.33	-0.25	<b>0.98</b>	-0.53
Sad	0.40	0.37	-0.26	<b>0.57</b>	0.67	-0.44	<b>0.91</b>
Angry	0.35	<b>0.64</b>	-0.21	0.32	<b>0.86</b>	-0.25	0.65
Irritable	0.35	<b>0.69</b>	-0.23	0.28	<b>0.94</b>	-0.29	0.63
Stressed	0.41	0.50	-0.26	0.30	0.72	-0.30	0.71
Cheerful	0.43	-0.23	<b>0.60</b>	-0.28	-0.17	<b>0.87</b>	-0.41
Anxious	0.44	0.36	-0.19	0.33	0.67	-0.31	0.74
Depressed	0.50	0.36	-0.31	<b>0.74</b>	0.59	-0.51	<b>0.93</b>
Lonely	0.55	0.22	-0.24	<b>0.50</b>	0.49	-0.42	<b>0.81</b>

Bolded structure coefficients indicate that the item was retained  
 ICC Intraclass correlation coefficient

**Main Effects of Daily Mood on Sexual Risk-Taking**

Hypothesis 1 specified that positive affect would be negatively associated with sexual risk-taking at the within-person level. To test this hypothesis, multilevel models were estimated using daily Joviality as a predictor of the number of instances of insertive CAS and receptive CAS per day. Within-person slopes between Joviality and CAS were found to vary randomly across people for both insertive CAS ( $z = 10.16, p < .001$ ) and receptive CAS ( $z = 9.52, p < .001$ ), indicating that links between state happiness and risky sexual behavior varied across participants. Tests of Level 1 slopes indicated that Hypothesis 1 was not supported (see Table 3). In fact, the opposite relation was found: Regardless of trait positive affect levels, state Joviality was positively associated with both insertive CAS ( $B = 0.353, p < .001$ ) and receptive CAS ( $B = 0.490, p < .001$ ).

Research Question 1 focused on the relation between negative affect and CAS at the within-person level. We first present results for Hostility. Within-person slopes between Hostility and sexual risk-taking were found to vary randomly across people for both insertive CAS ( $z = 10.21$ ,  $p < .001$ ) and receptive CAS ( $z = 11.69$ ,  $p < .001$ ). Regardless of trait Hostility, state Hostility was negatively associated with both insertive CAS ( $B = -0.388$ ,  $p < .001$ ) and receptive CAS ( $B = -0.340$ ,  $p < .001$ ).

Within-person slopes between Sadness and CAS varied randomly across people for both insertive CAS ( $z = 7.56$ ,  $p < .001$ ) and receptive CAS ( $z = 8.65$ ,  $p < .001$ ). Regardless of trait Sadness, state Sadness was negatively associated with insertive CAS ( $B = -0.381$ ,  $p < .001$ ) and receptive CAS ( $B = -0.491$ ,  $p < .001$ ).

Although between-person main effects of affect on CAS were not hypothesized relations in this study, we report between-person results at the .05 level here to contrast with the within-person findings. Trait Joviality was negatively associated with receptive CAS ( $B = -0.383$ ,  $p = .049$ ). No significant association emerged between trait Joviality and insertive CAS; in addition, no significant association was found between trait Hostility and receptive CAS. However, greater trait Hostility was positively associated with insertive CAS ( $B = .379$ ,  $p = .021$ ). There was no significant association between trait Sadness and insertive CAS; however, greater trait Sadness was found to be positively associated with receptive CAS ( $B = 0.357$ ,  $p = .023$ ).

In short, positive state affect was positively related to sexual risk-taking, whereas negative state affect was negatively related to sexual risk-taking. These within-person associations were found to vary significantly across participants, indicating that the strength or direction of these associations may depend on characteristics of participants (such as the proposed moderators examined below).

### Cross-Level Interactions: Trait Affect as a Moderator

Research Question 2 concerned the possibility that trait affect may explain individual differences in within-person links between state affect and sexual risk-taking (i.e., that trait affect interacts with state affect in predicting sexual behavior). These questions involved testing 18 cross-level interactions (3 moderators  $\times$  3 predictors  $\times$  2 outcomes), and probing all statistically significant interactions. Each of the three potential moderators was tested separately due to problems with convergence when they were tested simultaneously. All significant interaction effects were probed by examining the simple slopes at low (one standard deviation below the mean), moderate (at the mean), and high (one standard deviation above the mean) values of the trait affect moderator variable.

Given the number and complexity of findings, we summarize here only the statistically significant results (all results are summarized in Table 4). The positive relation between state Joviality and CAS was stronger for those with lower levels of trait Joviality and higher levels of trait

**Table 3** Insertive and receptive CAS: within- and between-person effects

Predictors	Outcomes					
	Instances of insertive CAS			Instances of receptive CAS		
	<i>B</i>	<i>SE</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>p</i>
Joviality (Level 1)	0.35	0.05	.000	0.49	0.05	.000
Residual	0.39	0.01	.000	0.39	0.01	.000
Joviality (Level 2)	0.07	0.15	.602	-0.38	0.46	.049
Intercept variance	0.38	0.01	.000	0.38	0.01	.000
Slope variance	0.52	0.05	.000	0.21	0.02	.000
Hostility (Level 1)	-0.39	0.06	.000	-0.34	0.08	.000
Residual	0.33	0.01	.000	0.33	0.01	.000
Hostility (Level 2)	0.38	0.16	.021	0.33	0.28	.239
Intercept variance	0.25	0.01	.000	0.25	0.01	.000
Slope variance	0.43	0.04	.000	0.65	0.07	.000
Sadness (Level 1)	-0.38	0.04	.000	-0.49	0.07	.000
Residual	0.28	0.01	.000	0.28	0.01	.000
Sadness (Level 2)	0.13	0.13	.331	0.36	0.16	.023
Intercept variance	0.36	0.01	.000	0.36	0.01	.000
Slope variance	0.18	0.02	.000	0.52	0.06	.000

Level 1 refers to within-person effects; Level 2 refers to between-person effects



Sadness. A number of interactions were found for state Hostility. The generally negative relation between state Hostility and CAS was stronger for those with higher levels of trait Hostility and, when receptive CAS was the outcome, lower levels of trait Joviality. The interaction between trait Sadness and state Hostility indicated that the relation between state Hostility and insertive CAS was negative for low trait Sadness but positive at high trait Sadness. Finally, only two interactions were found for state Sadness: The negative association between state Sadness and insertive CAS was stronger at lower levels of trait Hostility, and the negative association between state Sadness and receptive CAS was stronger at higher levels of trait Sadness.

### Cross-Level Interactions: Relationship Type as a Moderator

We next tested Hypothesis 2, that the relation between positive and negative affect and CAS at the within-person level will be weakened when the relationship to partner is considered serious than when the relationship is more casual. This involved testing 18 cross-level interactions (3 moderators  $\times$  3 predictors  $\times$  2 outcomes), and probing all statistically significant interactions using the strategy described above. Results are summarized in Table 5.

For interactions in which Serious Relationship was the moderator, the hypothesis was supported only for state Joviality. The interactions with state Hostility were nonsignificant for both outcomes; the interaction with state Sadness was nonsignificant for insertive CAS and showed the opposite pattern for receptive CAS (i.e., the association between Sadness and receptive CAS was stronger with more serious partners). For interactions in which Casual Relationship was the moderator, the hypothesis was not supported. The interaction with state Hostility was nonsignificant for receptive CAS; the interaction with state Sadness was nonsignificant for insertive CAS. All other interactions with positive and negative state affect were significant and in the opposite than expected direction. As instances of anal sex with casual partners increased, the association between affect and CAS grew weaker.

Hypothesis 2 did not specifically address interactions with Friend because it was not clear whether or not someone who is a friend would be considered a serious or casual partner. However, for interactions that were statistically significant, Friend appeared to moderate the association between affect and CAS in the way that was hypothesized for a casual partner. The association between state Joviality and CAS grew stronger for greater numbers of partners who were friends. This same pattern was found for state Hostility with respect to insertive CAS and for state Sadness with respect to receptive CAS; the other

interactions between Friend and negative affect were nonsignificant.

## Discussion

Models of sexual risk-taking have not emphasized the role of affect, although it is reasonable to believe that mood would play a role in decision making around sexual behavior [8–11]. The present study is one of a small handful of investigations examining within-person associations between affect and sexual risk-taking among MSM, a population that has been disproportionately impacted by HIV and continues to see increases in HIV infection in subgroups [32]. Results from a large sample of MSM recruited online supported the notion that daily affect is linked with day-to-day differences in sexual risk behavior. A number of the relations found, however, differed from both expected directions and previous research. Moreover, as described below, most of the within-person associations between affect and sexual behavior were moderated by trait affect and relationship to partner.

### Main Effects of Daily Mood on Sexual Risk-Taking

We hypothesized that positive affect would be negatively associated with CAS at the within-person level. Results indicated that the opposite relation was found: Regardless of trait positive affect levels, state positive affect was positively associated with CAS. This result is more consistent with the probability perspective than with the subjective utility perspective. Specifically, when experiencing a relative spike in positive affect, participants' willingness to have CAS may have been more influenced by decreases in their assessed likelihood of becoming infected with an STI (e.g., HIV) than by increases in the perceived negative impact of contracting an STI from that sexual encounter. Thus, participants experiencing positive affect believed they were less likely to contract an STI and were consequently more likely to have CAS.

Scholars have argued that positive affect encourages behavior that is more conservative or self-protective in situations where there is a real threat of loss [13–15]. However, the studies on which these conclusions are based were conducted using gambling paradigms, which may not be generalizable to sexual behaviors. Also, participants may not have viewed their sexual encounters in terms of a "real threat of loss" because they were more focused on the benefits they would receive from engaging in sexual behavior than on the potential losses they might experience (i.e., becoming infected with HIV). This possibility seems especially likely for men who use sex-oriented websites to find sexual partners. Additionally, Isen et al. [15]

**Table 4** Simple effects of state affect on condomless anal sex: trait affect as a moderator

State affect	Trait affect															
	Joviality			Hostility			Sadness			High						
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High				
<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>			
<b>Joviality</b>																
Insertive CAS	.58*	.09	.26	.08	-.07	.10	-.	-.	-.	-.	.24*	.04	.53*	.04	.82*	.05
Receptive CAS	.73*	.06	.58*	.06	.44*	.08	-.	-.	-.	-.	.53*	.03	.68*	.02	.83*	.03
<b>Hostility</b>																
Insertive CAS	-.	-.	-.	-.	-.	-.	-.15	.08	-.42*	.07	-.68*	.09	-.01	.03	.17*	.04
Receptive CAS	-.58*	.02	-.46*	.04	-.34*	.07	.21	.10	-.20	.09	-.61*	.13	-.	-.	-.	-.
<b>Sadness</b>																
Insertive CAS	-.	-.	-.	-.	-.	-.	-.41*	.07	-.20*	.06	.00	.07	-.	-.	-.	-.
Receptive CAS	-.	-.	-.	-.	-.	-.	-.	-.	-.	-.	-.64*	.09	-.79*	.08	-.94*	.08

“-” indicates that the interaction was nonsignificant, and thus were not probed, or unable to converge on a solution. Trait affect variables were created using aggregates of daily affect variables. Low, moderate, and high levels of trait affect represent one SD below the mean, the mean, and one SD above the mean, respectively

\* *p* < .0012

**Table 5** Simple effects of state affect on condomless anal sex: relationship type as a moderator

State affect	Relationship type											
	Serious partner			Friend			Casual partner			High		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Joviality												
Insertive CAS	.62*	.05	.56*	.05	.50*	.05	.47*	.06	.56*	.05	.65*	.05
Receptive CAS	.55*	.07	.47*	.05	.39*	.06	.41*	.07	.47*	.05	.53*	.05
Hostility												
Insertive CAS	-	-	-	-	-	-	-.33*	.07	-.45*	.06	-.58*	.06
Receptive CAS	-	-	-	-	-	-	-	-	-	-	-	-
Sadness												
Insertive CAS	-	-	-	-	-	-	-	-	-	-	-	-
Receptive CAS	-.53*	.05	-.62*	.04	-.70*	.05	-.53*	.05	-.62*	.04	-.70*	.05

“-” indicates that the interaction was nonsignificant, and thus was not probed. Low, moderate, and high levels of partners of each relationship type represent one SD below the mean, at the mean, and one SD above the mean, respectively

\*  $p < .0012$

acknowledged that positive affect participants in their experiment, which also used a gambling paradigm, may have been more inclined to make riskier decisions if the probability of outcomes had been unknown to them. This seems more likely to apply to participants of the present study, because it is unlikely that they would be aware of the probability of contracting HIV from any given sexual encounter.

Because affect and sexual behavior were assessed concurrently, it is important to consider the possibility that sexual experiences may have influenced affect rather than the reverse. For example, it could be that engaging in sexual behavior, regardless of whether or not condoms are used, increased positive affect in participants. Or it could be that engaging in CAS, specifically, increased positive affect, taking into account research that has shown that anal sex is thought to be more pleasurable when condoms are not used [33].

The association between negative affect and CAS at the within-person level was also investigated. Results for both Hostility and Sadness indicated that, regardless of trait negative affect, state negative affect was inversely associated with CAS. These results are consistent with Johnson and Tversky’s [12] finding that the experience of negative affect is related to an increased perception of the probability of risk, which was expected to lead to more conservative, less risky behavior. Of course, these results could also be attributed to the effects of negative affect on sexual interest, consistent with results from one study in which the majority of MSM reported decreased sexual interest when experiencing negative affect [34]. Similarly, Mustanski [10] found that state anxiety, characterized by feelings of anxiety, fear, and jitteriness, was significantly negatively associated with having a sex partner. Thus, participants in this study may have been generally less likely to have sex of any kind when experiencing negative affect.

Many results were different from those of Mustanski [10], which, because of its examination of affect and sexual risk-taking at the within-person level, is one of the only studies to which the present study can be meaningfully compared. Mustanski found a negative relation between positive affect and sexual risk-taking, and no relation between negative activation and sexual risk-taking. The discrepancy in findings could be due to differences in measurement. For example, there was very little overlap in mood items between the two studies. It could be that the results of the present study apply only to the specific facets of mood that were measured, and that when examining other dimensions of affect, associations with sexual risk-taking variables differ. Outcome variables related to sexual risk-taking were also measured differently. Mustanski found that positive affect was negatively

related to a composite risk behavior variable, which took into account not only insertive and receptive anal sex, but also a variety of other behaviors with little or no risk involved (i.e., hand-genital contact; giving or receiving oral sex with and without condoms). It could be that the pattern of results found in the present study relate specifically to decisions about sexual behaviors that carry a higher level of risk (i.e., insertive CAS and receptive CAS), particularly since it appears that they were supported by theory involving the relation between affect and risk perception.

### Cross-Level Interactions: Trait Affect as a Moderator

Many of the results indicated that high or moderate levels of trait negative affect and low levels of trait positive affect intensify the effects of state affect on CAS. From the probability perspective on risk-taking, participants with typically high negative and low positive affect may have experienced a relatively greater impact of state affect on perceptions of risk, which, in turn, led to stronger effects on CAS. This finding seems similar to evidence that the effects of daily stress on positive and negative affect are greater for individuals with a history of depression than for others [35]. In both cases, a trait-like vulnerability to distress may have increased links between everyday experiences and affect.

An alternative explanation taking into account the reverse causal direction could be that for those who are typically low in positive affect and high in negative affect, having sex is particularly powerful in increasing state positive affect. This is supported by findings from Bancroft et al.'s [34] study on affect and sexual behavior: "Increased sexual activity when depressed was not only reported as a consequence of increased sexual interest, but in some cases explained as a need for contact with or validation from another person, and in other cases because *sex improved the depressed mood* if only transiently" (emphasis added, p. 240).

Interestingly, for those with low levels of trait Hostility, state Hostility was unrelated to insertive CAS and positively to receptive CAS. These results, along with the cross-level interactions between state Hostility and trait Sadness, as well as state Sadness and trait Hostility, are more challenging to interpret. The relation between state Hostility and insertive CAS shifted from negative, to zero, to positive as levels of trait Sadness increased from low, to moderate, to high. Similarly, the relation between state Sadness and insertive CAS shifted from negative to zero as levels of trait Hostility increased from low, to moderate, to high. Neither interaction was statistically significant for receptive CAS.

The variation in results for Hostility and Sadness could potentially be explained by Lerner and Keltner's [36] finding that dimensions of negative affect have different relations to risk-taking. The authors theorized that specific emotions are associated with specific appraisals of a given situation, which, in turn, affect behavior. Their study investigated differences between fear and anger, which are both negatively valenced but differ in cognitive appraisals of *control* (belief in one's ability to influence a situation) and *certainty* (belief in one's understanding of a situation). Fear is characterized by low control and uncertainty, whereas anger is characterized by high control and certainty. Lerner and Keltner [36] found that fearful participants were more risk averse, and angry participants were more risk-seeking.

These opposite patterns of risk preference for fearful and angry participants resemble, in some ways, the atypical findings for cross-level interactions with Hostility and Sadness in the present study (particularly because sadness is theorized to have a similar profile to fear on the dimensions of control and certainty) [37]. For example, Lerner and Keltner's [36] perspective could explain the result that the negative relation between state Sadness and insertive CAS weakened to nonexistence as levels of trait Hostility increased from low to moderate to high. It could be that any potential tendency for state Sadness to increase risk aversion is negated by high trait Hostility, which would be associated with a general preference for risk-taking. In contrast, without the counterbalance of high trait Hostility, state Sadness may reduce risk-taking—similar to the fearful participants in Lerner and Keltner's [36] study. This explanation, however, contradicts the interaction between trait and state Hostility, such that the association between state Hostility and CAS was most strongly negative at high levels of trait Hostility, while according to Lerner and Keltner's [36] theory, there should be a stronger positive association. This theory also fails to provide an explanation for the interaction between state Hostility and trait Sadness, or for why these interactions were only significant for insertive CAS.

### Cross-Level Interactions: Relationship Type as a Moderator

Support was mixed for the hypothesis that the association between state affect and CAS would not be as strong when the relationship to partner is considered serious (i.e., boyfriend, significant other, spouse, or domestic partner) than when the relationship is more casual (e.g., casually dating or someone the participant just met). The association between positive affect and CAS did grow weaker with increasing instances of anal sex with serious relationship partners. These results can be explained by the greater

likelihood of CAS in serious relationships, which may be due to greater trust and familiarity of serious partners, the perception that condoms interfere with intimacy, and the negotiation of agreements about acceptable sexual behaviors for the partners as a strategy to increase safety [20]. Therefore, it seems that the general tendency not to use condoms with serious partners makes the relation between affect and condom use less relevant. However, the association between state Sadness and receptive CAS grew stronger with more instances of anal sex with serious partners, contrary to hypothesis. Moreover, as instances of anal sex with casual partners increased, the association between affect and CAS grew weaker, also contrary to hypothesis.

The findings related to casual relationship partners could be explained by evidence that with partners met through the Internet (many of whom are likely to be considered casual partners), condom use was more likely than with other types of partners [38]. This finding is particularly relevant to this sample of MSM who were recruited from a sex-oriented website and likely met many of their sex partners via the Internet. The majority (71.5 %) of participants in that study also reported that they “always” or “almost always” used a condom with new sex partners. In this way, anal sex with serious partners and casual partners have in common a weak relation between affect and CAS because they both involve a particular condom use tendency, either in the direction of CAS (with serious partners), or in the direction of anal sex in which condoms are used (with casual partners).

A third relationship type, Friend, was examined separately from serious or casual relationship type moderators because it was unclear whether “friends” would be viewed as more similar to serious relationship partners or to casual partners. All significant interactions indicated that the link between affect and CAS was stronger for those who had more instances of anal sex with partners who were considered friends. This pattern, which was the opposite of that found for serious and casual partners, may indicate that there is less of an established protocol for condom use with someone who is considered a friend than for other partners.

### Limitations

It is important to consider the generalizability of the results of this study, given that participants were all recruited from a website designed for use by MSM seeking sex partners. It is unclear how the results would generalize to MSM who find sex partners through different services (including those catering to different subpopulations) or other means altogether. If the sample been recruited through less sex-oriented channels, fewer instances of anal sex may have been reported overall, and, in turn, fewer instances of insertive

CAS and receptive CAS. This type of sample could also result in more reports of sex with serious relationship partners, and thus less condom use, which could weaken the main effects of affect. Also, because reporting on one’s sex life was a requirement for full participation, the sample may overrepresent MSM who are willing to disclose such personal information and who, compared to others, may feel less shame in reporting instances of anal sex in which condoms were not used. This raises the possibility that, in a sample of MSM who felt more shame around having sex without condoms, positive affect would not have been associated with more instances of CAS. The sample is also composed mostly of White men; this raises questions about the generalizability of results to MSM of color, who carry a disproportionate burden of HIV infection [39]. One study found that Black MSM reported significantly less CAS than other racial groups [40], which could indicate that the association between affect and CAS could differ in a more ethnically diverse sample.

Another limitation of this study is its inability to provide information about direction of influence or causality. Although the daily diary method is able to establish a closer temporal association between mood and CAS relative to many other research methods, significant findings may reflect a situation in which having CAS could affect mood rather than vice versa. Lastly, the items used to measure mood in this study were not drawn from an existing scale (despite some overlap with tested scales) and were limited in variety. Also, although the items “anxiety” and “stressed” were included in the survey, they were not used in the analyses because they did not load cleanly onto any of the three mood factors.

### Implications and Future Research

The findings of this study indicate that affect is connected to sexual risk-taking, and should be considered in conjunction with other theoretical models that have attempted to explain why individuals engage in risky sexual behavior. Existing models tend to focus on cognitive variables such as knowledge, attitudes, behavioral intentions, or perceptions of others. The present results raise the possibility that affect, a noncognitive variable, may influence perceptions of others. For example, positive affect could change perceptions of others (e.g., that an individual is less likely to have HIV, and therefore one is less likely to contract HIV from having condomless anal sex with that person), which could in turn influence sexual risk-taking behavior [41]. Models intended to explain processes driving risky behavior could therefore be made more comprehensive by including variables related to affect in addition to those related to knowledge, attitudes, and perceptions.

The results of this study also have implications for interventions geared toward promoting condom use, which could involve a psychoeducational component about links between affect and decision-making, and more specifically links between affect and sexuality. This could help make people aware of their own sexual risk-taking tendencies during different affective states, and encourage use of emotion regulation practices to lessen the influence of mood on decisions to have risky sex.

This study also has implications for future research conducted on the association between affect and sexual risk-taking among MSM. Additional research should be conducted to address limitations of the present study by using more varied recruitment methods to achieve a more representative sample of MSM, along with a more well-established mood measure with better psychometrics, such as the PANAS-X [22]. In order to establish direction of causality, future research could incorporate methods such as ecological momentary assessment (EMA) [42], which could allow for assessments of mood immediately before and after sexual behaviors, rather than once per day. Along with assessments of mood, EMA could assess perceptions of risk (e.g., “How likely do you think it is that you will contract HIV from this sexual encounter?”) to test whether this is, in fact, the process whereby affect influences sexual risk-taking, as these results suggest. Also, additional research should investigate condom use norms for friends, perhaps using a qualitative approach to get a richer perspective on the nature of this somewhat ambiguous relationship type.

#### Compliance with Ethical Standards

**Conflict of Interest** Elissa L. Sarno, Jonathan J. Mohr, and Joshua G. Rosenberger declares that they have no conflict of interest

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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