

# Sexual Compulsivity, State Affect, and Sexual Risk Behavior in a Daily Diary Study of Gay and Bisexual Men

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Researchers have identified a strong link between sexual compulsivity (SC) and risky sexual behavior among men who have sex with men (MSM). Meanwhile, affect/mood has also been connected with negative sexual health outcomes (sexually transmitted infection/human immunodeficiency virus [HIV] transmission, sexual risk, sex under the influence of drugs/alcohol). Given that SC is characterized by marked distress around one's own sexual behavior, affect may play a central role in SC and HIV risk behavior. Data were taken from the *Pillow Talk Project*, a pilot study conducted in 2008–2009 with 50 highly sexually active MSM (9 or more male sex partners,  $\leq 90$  days), of which half displayed SC symptoms and half did not. Forty-seven men completed a daily diary online for 30 days ( $n = 1,060$  diary days), reporting on their sexual behavior and concurrent affect: positive activation, negative activation, anxious arousal, and sexual activation. We conducted HLM analyses using daily affect (Level 1, within subjects) and SC and HIV status (Level 2, between subjects) to predict sexual behavior outcomes. Increased negative activation (characterized by fear, sadness, anger, and disgust) was associated with reduced sexual risk behavior, but less so among sexually compulsive MSM. Sexual activation was associated with increased sexual risk taking, but less so among sexually compulsive MSM. Anxious arousal was associated with increased sexual behavior, but not necessarily sexual risk taking. Findings indicate that affect plays key roles in sexual behavior and sexual risk taking; however, the association between affect and behavior may be different for sexually compulsive and non-sexually compulsive MSM.

*Keywords:* sexual compulsivity, affect, mood, men who have sex with men, HIV risk

Sexual compulsivity (SC) is characterized by sexual fantasies and behaviors that increase in frequency and intensity, interfering with personal, interpersonal, or vocational pursuits (Bancroft, 2008; Black, 1998; Kafka & Prentky, 1994). Those with SC report distress resulting from persistent preoccupations with sexual thoughts, strong desires or urges for sex, and feelings of losing control (Black, 1998; Coleman, 1992). Although SC has been linked to risky sexual behavior in a variety of populations (Dodge, Reece, Cole, & Sandfort, 2004; Gullette & Lyons, 2005; Kalichman & Rompa, 1995; McBride, Reece, & Sanders, 2007, 2008), this association is particularly strong among men who have sex

with men (MSM; Grov, Parsons, & Bimbi, in press; Kalichman, Greenberg, & Abel, 1997; Reece, 2003; Smolenski, Ross, Risser, & Simon Rosser, 2009). This connection includes a variety of negative sexual outcomes such as unprotected anal sex with multiple partners, episodes of marathon sex, lower condom use self-efficacy, lower likelihood of human immunodeficiency virus (HIV) status disclosure, higher incidence of HIV and other sexually transmitted infections (STIs; Reece, 2003; Semple, Zians, Strathdee, & Patterson, 2009), lower risk-reduction intentions (Kalichman & Rompa, 1995), sex under the influence of club drugs, self-identification as a barebacker (intentionally seeking out

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unprotected anal sex), and increased temptation for unsafe sex (Grov et al., 2010).

Much prior research on SC among MSM has not distinguished between the roles of behavioral versus psychological factors in HIV risk. Most studies compared sexually compulsive MSM with other MSM without controlling for general rates of sexual behavior or numbers of partners. Some suggest that there are significant numbers of MSM who are behaviorally similar to sexually compulsive MSM (i.e. they have equivalent numbers of sexual partners and engage in sexual behavior with equivalent frequency), but do not report distress about their sexual behavior, loss of control, or that their sexual behavior is interfering with their personal and professional lives (Grov et al., 2010; Levine & Troiden, 1988). These men—highly sexually active, but non-sexually compulsive MSM—could provide a critical window into the mechanisms by which SC is associated with greater risk for HIV. Identifying factors that distinguish highly sexually active sexually compulsive MSM from highly sexually active non-sexually compulsive MSM could allow for the identification of factors that may make sexually compulsive men more vulnerable to high-risk sexual behavior and inform the development of HIV prevention interventions for both populations.

### Affect and HIV Risk

Researchers have suggested there may be direct effects of affective/mood states and HIV risk behavior (Bousman et al., 2009; Mustanski, 2007). Given that SC is characterized by marked distress around one's own sexual behavior, affect *may* play a central role in SC and HIV associated risk behavior. Researchers have identified two broad affective factors that constitute the major dimensions of emotional structure: positive activation (PA), and negative activation (NA; Diener, 1999; Russell, 2003; Watson & Clark, 1997; Watson & Tellegen, 1985). High PA is characterized by joy, enthusiasm, energy, and alertness, while low PA is a state of anhedonia and lethargy. High NA is characterized by emotions such as fear, sadness, anger, and disgust, while low NA is a state of calmness and serenity. These two dimensions are only weakly negatively correlated (Russell & Carroll, 1999; Tellegen, Watson, & Clark, 1999; Watson & Tellegen, 1999), providing support for their conceptualization as distinct constructs and experiences. Researchers have suggested that when a situation poses risks that are realistic and highly self-relevant, people in whom PA has been induced are more risk averse, compared with people in control conditions (Arkes, Herren, & Isen, 1988; Isen, 2000; Isen & Geva, 1987; Isen & Patrick, 1983). However, in situations in which the risk is low or less self-relevant, PA inductions actually produce more risk behavior than control conditions (Arkes et al., 1988; Isen & Patrick, 1983).

Less research has been conducted on the effects of NA on risk taking. On one hand, some data suggest that NA leads to increased risk taking, including sexual risk taking, across situations (Leith & Baumeister, 1996; Mustanski, 2007). NA is also believed to impair self-regulation (e.g., people in NA states such as fear, sadness, or anger are more likely to act impulsively and less likely to make reasoned decisions; Leith & Baumeister, 1996). In contrast, other data suggest NA can lead to risk aversion in hypothetical situations (Deldin & Levin, 1986; Smoski et al., 2008). Yuen and Lee (2003) induced negative mood by showing participants a sad movie clip.

Their study noted that individuals with an induced depressed mood were significantly more conservative in taking risks than those in a neutral mood. In relation to sexual risk, some have suggested NA may inhibit sexual responsiveness (Bancroft, Janssen et al., 2003a, 2003b; Bancroft, Janssen, Strong, & Vukadinovic, 2003). It is unclear if those prone to out-of-control sexual behavior will experience this inhibition.

Clark and Watson (1991) extended research on PA and NA, proposing a third factor related to anxiety (anxious arousal: AA). In decision-making tasks, anxiety increased people's preferences for low-risk, low-reward options (Lerner & Keltner, 2000, 2001; Raghunathan & Pham, 1999). In regards to sexual risk taking, these data would suggest that those experiencing AA would be less likely to engage in sexual risk behavior. However, research on AA's association with sexual risk behavior is limited. Cantor, Zillmann, & Bryant (1975) performed an experiment in which individuals engaged in high levels of physiological excitation (i.e., exercise) and then were asked to rate an erotic film. Those who believed they had recovered from the exercise (but in reality had maintained substantial excitatory residues from the exercise) reported being more sexually aroused by the film and evaluated the film more positively. Cantor et al. concluded that residual excitation enhanced emotional responses to unrelated, immediately present stimuli only when the prevailing arousal could be attributed to its actual source (e.g., exercise). Mustanski (2007) found increases in AA were related to more sexual risk taking in some MSM and hypothesized that the arousal components of AA (e.g., jittery, keyed up) may be linked to feelings of excitement that could potentiate risky behavior, as hypothesized by anxiety transfer theory (Zillmann, 1983; Zillmann, Katcher, & Milavsky, 1972). Given the limited data and divergent ways in which AA may be related to sexual behavior, this is an area in need of further research.

Finally, a fourth mood component that may interact with SC and HIV risk behavior is sexual activation/arousal (SA; Mustanski, 2007). Bancroft et al. (2003b) proposed that rational decision-making can become impaired during a state of sexual arousal. In essence, when individuals are not sexually aroused, they can recognize that specific sexual behavior may be risky and thus should be avoided. In contrast, during sexual arousal, there is less concern about sexual risks. Mustanski (2007) reported that increases in SA corresponded to increases in risky sexual behavior. Taken together, research suggests that there may be an important link between affective factors and sexual risk taking, underscoring the importance of examining these factors among sexually compulsive MSM.

### Current Focus

Because SC has been characterized as out of control sexual behavior in addition to marked psychological distress around one's sexual behavior (Skegg, Nada-Raja, Dickson, & Paul, 2009), it is very likely that PA, NA, AA, and SA *may* act differently for those experiencing SC symptoms. As discussed, researchers have connected PA, NA, and AA with risk behavior; however, some findings have been mixed. To our knowledge, there is no published research elucidating the roles of PA, NA, AA, and SA on sexual behavior among sexually compulsive MSM, or research investi-

gating how this association may differ from MSM who are highly sexually active, but not sexually compulsive.

## Methods

### Participants and Procedure

Data for this study are taken from the *Pillow Talk Project*, a longitudinal pilot study investigating SC and HIV risk behavior among a sample of 50 highly sexually-active gay and bisexual men (Groves, Golub, & Parsons, in press). The sample was stratified such that half of men demonstrated symptoms of SC (Sexual Compulsivity Scale [SCS] score  $\geq 24$ ) and half did not (SCS  $< 24$ ). Although the SCS (Kalichman et al., 1994) is not a clinically diagnostic tool, scores above 24 are indicative of SC symptomology (Groves et al., 2010; Parsons, Bimbi, & Halkitis, 2001).

Participants were recruited using targeted sampling (Watters & Biernacki, 1989), whereby the research team first used ethnographic mapping to identify venues and times where gay and bisexual men gathered in New York City. Then recruitment teams were sent to these venues and systematically approached potential participants, asking them to take part in a brief anonymous survey conducted on hand-held devices. Eligibility criteria for the project were embedded in the survey, and those eligible were invited to join. In addition, and consistent with our sampling approach, we took advantage of Internet-based recruitment (advertising for the study on several websites and sex blogs geared toward gay and bisexual men), respondent driven sampling (RDS), snowball sampling, and tear-off flyers.

All potential participants were rescreened via telephone prior to their baseline appointment: a qualitative and quantitative assessment conducted at the project's research center. Assessments took, on average, 2.5 hours to complete, and participants were compensated \$40. The research team collected participants' email addresses at the end of their baseline assessment. Then, each day, for 30 days, participants received an email linking them to a secure website which hosted a brief survey (i.e., the daily diary). Participants were compensated \$1 for every day they completed a diary and a \$10 bonus if they completed at least 28 diaries. All procedures were reviewed and approved by the sponsoring center's Institutional Review Board.

Eligibility criteria included:  $\geq 9$  male sex partners in the last 90 days, aged 18 or over, biologically male, English speaking, free from serious cognitive or psychiatric impairments (no participants were excluded based on this criteria), have Internet access, and gay or bisexually identified. Our operationalization of  $\geq 9$  recent male sex partners to indicate "high sexual activity" was based on prior work with both sexually compulsive and non-sexually compulsive gay and bisexual men (Groves et al., 2008; Groves et al., 2010; Parsons et al., 2001; Parsons et al., 2008; Parsons, Kelly, Bimbi, Muench, & Morgenstern, 2007). This rate is approximately triple the average number of male sex partners found among sexually active NYC MSM in the Urban Men's Health Study (L. Pollack, personal communication, May 18, 2009; Stall et al., 2003; Stall et al., 2001).

During the enrollment period, 130 men were screened via telephone for the study, of which 74 were invited to join. Of the 56 ineligible, 29 met criteria, but did not exceed threshold for SC (i.e., SCS score  $\geq 24$ ), and the non-sexually compulsive cohort had already reached its targeted recruitment goal ( $n = 25$ ). Among

others ineligible, 22 reported fewer than 9 recent sex partners, and 5 were excluded because they did not have daily Internet access. Among the final sample of 50 participants, 29 were recruited via field contact, 14 via RDS or snowball sampling, three from the Internet, and two via tear-off flyers. Two participants did not disclose how they heard about the study. Participants' SCS scores did not significantly differ by where they were recruited.

### Measures

**Within-subject measures: Level 1.** Starting one day after their baseline visit, participants were sent an automated email at 8 p.m. each day for 30 days. The email linked participants to an online survey (the daily diary) that asked about their concurrent sexual behavior and mood/affect for that day. Participants were instructed to complete the survey prior to going to bed that night.

**Sexual behavior with male partners.** Participants were asked first if they had oral or anal sex with a main male partner (boyfriend or lover) that day, followed by specific questions about their behavior with this partner. Then they were asked if they had oral or anal sex with a non-main male partner (someone who was not their boyfriend/lover) that day, followed by how many non-main male partners they had that day (1, 2, 3, 4, or 5 or more). Participants were then asked partner-specific HIV-risk behavior (e.g., anal sex without a condom with non-main partner number one, non-main partner two, etc.). If a participant reported "5 or more" casual partners in a given day, he was asked specific questions about each of his first four partners, and then general questions about the remaining partners.

**Daily affect.** Similar to Mustanski (2007), participants completed four scales indicating their state affect for PA (6-items,  $\alpha = .83$ ), NA (5-items,  $\alpha = .90$ ), AA (5-items,  $\alpha = .91$ ), and SA (3-items,  $\alpha = .95$ ). PA and NA were measured using items from the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Participants were told, "Indicate to what extent you have felt this way today." Items on PA included "alert," "enthusiastic," and "excited." Items on NA included "discouraged," "upset," and "depressed." The PANAS has been used widely in daily diary and ecologically based research (Mustanski, 2007). State AA was measured using items adapted from the Mood and Anxiety Symptom Questionnaire (MASQ; Watson & Clark, 1991). Items on AA included "anxious," "jittery," and "nervous." Mustanski's (2007) measure of state SA was used and included the items "sexually interested," "sexually aroused," and "horny." All scale items ranged from 1 to 5 (1 = very slightly/not at all, 5 = extremely). Scales were calculated as the mean of each scale's items, for each participant, for each day.

**Between-Subject Measures: Level 2.** When calling to screen/enroll in the *Pillow Talk Project*, participants completed the 10-item Sexual Compulsivity Scale (SCS; Kalichman et al., 1994),  $\alpha = .87$ . The SCS is a self-administered questionnaire that assesses the impact of sexual thoughts on daily functioning and the inability to control sexual thoughts or behavior. Items on the SCS are scripted in a Likert-type fashion (e.g., "My sexual thoughts and behaviors are causing problems in my life," "I struggle to control my sexual thoughts and behavior," 1 = Not like me, 4 = Very much like me) and summated scores can range from 10 to 40. Participants' scores ranged from 12 to 39 ( $M = 26.56$ ,  $SD = 7.54$ ,  $IQR = 17.00 - 29.25$ ). Per study design, 50% ( $n = 25$ ) demon-

strated scores at or above 24 on the SCS and 50% were below this value.

## Analyses

We conducted multilevel modeling using HLM v. 6.3 (Raudenbush & Bryk, 2002). Multilevel modeling accounts for the dependency in observations when data have a nested, multilevel structure such as days (Level 1) nested within person (Level 2). First, we assessed the proportion of variability in affect within, versus between, participants by calculating the intraclass correlations for each of the dimensions of affect. Next, we tested for effects of SC (Level 2 predictor) on daily levels of affect (outcomes) across the course of the diary study. Third, we used HLM modeling to identify daily co-variation among affect scales. In so doing, we ran six models such that one affective state was treated as the outcome and another affective state was entered as a Level 1 predictor.

Finally, we used HLM to identify multivariate associations between sexual behavior outcomes, affect, SC, and HIV status (similar to a procedure described by Mustanski, 2007). We looked at five outcomes:

- A. Sexual behavior with a male partner that day (1 = yes, 0 = no).
- B. Unprotected anal intercourse with a risky male partner (defined as a HIV serodiscordant main partner, or a non-main partner regardless of his status; 1 = yes, 0 = no).
- C. Number of sex acts with male partners (oral and anal, giving and receiving) in a given day (values ranged from 0 to 14).
- D. Number of male partners in a given day (one main partner plus non-main partners). Because participants who reported five or more non-main partners in a given day were capped at five, values ranged from 0 to 6 (main partner + up to 5 non-main).
- E. Sex under the influence of alcohol/drugs with a risky male partner (defined as a HIV serodiscordant main partner, or a non-main partner regardless of his status; 1 = yes, 0 = no). Drugs included ketamine, MDMA/ecstasy, GHB, cocaine, crack, methamphetamine, heroin, marijuana, or prescription drugs (without a prescription).

The four affect scales were entered as Level 1 variables. Affect variables were individual-centered so that the intercept represents an individual's average level of sexual risk taking on a day when the individual had his average level of state affect. SC and HIV status (1 = HIV positive) were included in each model as Level 2 variables to identify how these variables impacted the slopes and intercepts of Level 1 variables (i.e., intercepts and slopes as outcomes model). In an effort to maximize on its variability, we kept the SCS as a continuous measure (Raudenbush & Bryk, 2002). In our models, each Level 1 term had a corresponding Level 2 equation. In that Level 2 equation, each of the Level 1 terms were estimated as a function of the sample mean for the Level 1 outcome variable, predictor variables, and an error term. The *p* values for corresponding parameter estimates were based on esti-

mates of robust standard errors. For the binary dependent variables (outcomes A, B, and E), the Bernoulli outcome with LaPlace estimation was used, as recommended by Raudenbush and Bryk (2002), which produces estimates of the odds ratio for the binary outcome. For count items (outcomes C and D), we used over-dispersed Poisson models, which produce estimates of event rate ratios for the outcome. Finally, although all effects would be estimated ideally as random, problems with model convergence precluded this. Thus, as per recommendations by Nezlek (2001) and consistent with published research (e.g., Cooper, 2010), effects were estimated as either fixed or random on the basis of the significance of random error terms when estimated individually in a set of preliminary analyses.

## Results

### Sample Characteristics

Table 1 reports sample characteristics. Of the 50 men who completed a baseline visit, three declined to participate in the daily diary. We report data on the remaining 47 men. Participants were ethnically diverse (49% were men of color), and mean age was 36.2 (range 22–72). Seven men (15%) were bisexual, and the remainder identified as gay. Eighteen participants were HIV positive and sexually compulsive men were more likely to be HIV

Table 1  
*Sample Characteristics of Highly Sexually Active Gay and Bisexual Men (n = 47), New York City, 2008–2009*

	<i>n</i>	%
HIV positive	18	(38)
Race/ethnicity		
Caucasian	24	(51)
Non-Caucasian	23	(49)
Employment status		
Full-time (40 hours per week)	20	(43)
Part-time (less than 40 hours per week)	10	(21)
Permanent or temporary disabled	5	(11)
Unemployed	12	(26)
Education		
High school or less	10	(21)
Some college or associates degree	9	(19)
College degree or graduate school	28	(60)
Relationship status		
Married, partner, or a lover	6	(13)
Boyfriend or a girlfriend	6	(13)
Single	35	(74)
Income		
Less than \$19,999	19	(40)
\$20,000 to \$49,999	14	(30)
\$50,000 to or more	14	(30)
Lifetime STI exposure		
Any STI	35	(74)
Syphilis	15	(32)
Chlamydia	13	(28)
Gonorrhea	14	(30)
Genital warts	13	(28)
Genital herpes	7	(15)
Urethritis	6	(13)
Hepatitis A	5	(11)
Hepatitis C	2	(4)
Any illicit drug use, <3 months	32	(68)

positive than non-sexually compulsive men, 56% v. 21%,  $\chi^2(1) = 6.3$ ,  $p < .05$ . Two thirds (68%) reported using illicit drugs in the 3 months prior to joining the study: 49% inhalants (including poppers); 43% marijuana; 34% cocaine/crack; 21% hallucinogens; 19% methamphetamine; 17% tranquilizers; 11% sedatives/hypnotics; 9% opiates; 4% stimulants other than methamphetamine; and 2% heroin.

The median number of diaries completed was 26 ( $M = 22.5$ ,  $SD = 8.3$ ), for a total of 1,060 days of diary entries out of a possible total of 1,410 (75% response rate). Because the HLM program allows for missing data at Level 1, all participants were included in analyses regardless of the number of diaries completed; therefore, all available data were used. There were no missing data at Level 2.

Across all participants and all days of diary entries, men reported 313 (29.5%) days of sex (oral or anal) with a male partner, and 188 (17.7%) days of anal sex with a male partner. On 14.4% (45 of 313) of these days, participants reported sex with a main male sex partner, and on 90.4% (283 of 313) of these days participants reported sex with one or more non-main male sex partners. These totals exceed 100%, indicating some days where sex occurred both with a main and non-main partner. On 61.0% (191 of 313) of days that participants reported sex, men had one casual male sex partner, and on 29.4% (92 of 313) of these days, participants reported more than one casual male sex partner. Across all participants and all days of diary entries, men reported unprotected receptive or insertive sex with either a HIV serodiscordant main sex partner or a casual male sex partner on 9.9% (105 of 1060) of days they completed a diary, 33.5% (105 of 313) of the days in which they reported sex, and 55.9% (105 of 188) of the days in which they reported anal sex.

### Within- Versus Between-Subject Variability in Affect

We assessed the proportion of variability in affect within, versus between, participants using intraclass correlations (ICCs) for each of the dimensions of affect. The proportions of variability in affect that was distributed within- and between-participants warranted the use of a multilevel modeling approach ( $ICC_{AA} = .55$ ,  $ICC_{NA} = .43$ ,  $ICC_{PA} = .43$ ,  $ICC_{SA} = .34$ ). The ICC's demonstrate that 34% to 55% of the variance in affect was at the between subjects level (i.e. individual variability) and 45% to 66% of the variance in affect was within subjects (i.e. daily fluctuation). These findings support our conceptualization of affect as variable for each participant over the daily diary period, with some intrapersonal consistency over time.

### Variability in Affect as it Related to SC

Next, we tested for variability in state affect as it related to SC, whereby we ran four HLM models using SC to predict each measure of affect. SC was unrelated to daily levels of AA or PA. There was a trend between SC and NA, such that men higher on SC trended toward experiencing higher daily levels of NA ( $\beta = .02$ ,  $p = .09$ ). There was a significant association between SC and SA such that men higher in SC generally reported lower daily levels of SA ( $\beta = -.03$ ,  $p = .04$ ).

### Bivariate Associations Between Affect Scales

Reported in Table 2 are six HLM models illustrating covariation between each of the affective scales. For each model, one affective state was treated as the outcome and another affective state was entered as a Level 1 predictor. Daily variation in PA was negatively associated with daily variation in NA and positively associated with SA. In addition, daily variation in NA was positively associated with daily variation in AA.

### Modeling Affect, SC, and HIV on Sexual Behavior Outcomes

**Model 1: Any sex with a male partner (Yes/No).** The results of the hierarchical model predicting the odds of having sex with a male partner in a given day (yes/no) are show in Table 3. In the column labeled "Intercept" on the row marked "Level 1 (daily reports)," .43 represents the odds of having sex with a male partner when the participants reported average levels of state affect. SC and HIV status (Level 2) were not associated with having sex (i.e., the intercept).

Continuing across the row labeled "Level 1 (daily reports)" are the average daily effects of state PA, NA, AA, and SA on the odds of having sex with a male partner. Each unit increase in state NA was associated with 36% reduced odds of having sex ( $= 1 - .64$ ). Each unit increase in state AA was associated with 1.48 increased odds of having sex, and each unit increase in state SA was associated with a 2.87 increased odds of having sex. In other words, going from a report of *not at all* to a *little* on the SA scale nearly tripled the odds of having sex with a male partner that day.

There was a significant SC by state SA interaction on sex with a male partner. Controlling for other variables, increases in SA were associated with increased odds of sex; however, this increase

Table 2  
Matrix of Bivariate Associations Between Affective (Daily Diary) Variables Using HLM Modeling

	Positive activation		Negative activation		Anxious arousal		Sexual activation	
	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$	$\beta$	$p$
Positive activation	—	—	<b>-0.15</b>	0.05	0.04	0.56	<b>0.32</b>	<.001
Negative activation			—	—	<b>0.63</b>	<.001	-0.01	0.90
Anxious arousal					—	—	0.11	0.25
Sexual activation							—	—

Note.  $\beta$  = Coefficients representing the unstandardized regression weights. Significant coefficients and trends (based on t-tests) are in bold type.

Table 3  
Parameter Estimates of Multilevel Models Predicting Sexual Behavior Outcomes From Affect and Sexual Compulsivity

Effect	Intercept		Positive activation		Negative activation		Anxious arousal		Sexual activation	
	OR	<i>p</i>	OR	<i>p</i>	OR	<i>p</i>	OR	<i>p</i>	OR	<i>p</i>
Model 1 - Outcome: Any sex with a male partner today (yes/no)										
Level 1 (daily reports)	0.43		0.99	0.92	<b>0.64</b>	0.004	<b>1.48</b>	0.03	<b>2.87</b>	<.001
Level 2										
Sexual Compulsivity (continuous)	0.99	0.60	0.99	0.40	1.02	0.07	0.98	0.12	<b>0.97</b>	0.02
HIV Status (1 = HIV+)	0.49	0.10	1.19	0.47	1.21	0.36	0.94	0.84	<b>1.82</b>	0.02
Model 2 - Outcome: Had unprotected anal with serodiscordant main male partner, or any non-main partner (yes/no)										
Level 1 (daily reports)	0.05		0.91	0.52	<b>0.39</b>	0.01	1.80	0.12	<b>1.95</b>	<.001
Level 2										
Sexual compulsivity (continuous)	0.99	0.62	1.02	0.31	<b>1.05</b>	0.01	1.00	0.86	0.98	0.11
HIV Status (1 = HIV+)	<b>2.09</b>	0.04	1.01	0.98	1.72	0.06	0.48	0.07	<b>2.12</b>	<.001
Model 3 - Outcome: Number of sex acts (oral and anal, giving and receiving) in a given day, male partners										
Level 1 (daily reports)	0.69		0.98	0.81	<b>0.59</b>	<.001	<b>1.78</b>	<.001	<b>1.96</b>	<.001
Level 2										
Sexual compulsivity (continuous)	1.00	0.97	0.98	0.17	<b>1.03</b>	0.01	0.98	0.14	<b>0.97</b>	<.01
HIV Status (1 = HIV+)	0.70	0.27	0.96	0.83	1.24	0.32	1.06	0.83	<b>1.55</b>	<.01
Model 4 - Outcome: Number partners in a given day (main + non-main), 5 + non-main partners capped at 5										
Level 1 (daily reports)	0.38		0.995	0.97	<b>0.65</b>	<.001	<b>1.67</b>	<.001	<b>2.06</b>	<.001
Level 2										
Sexual compulsivity (continuous)	0.998	0.91	<b>0.98</b>	0.05	<b>1.02</b>	0.03	0.98	0.06	0.98	0.08
HIV Status (1 = HIV+)	0.59	0.11	0.99	0.95	1.30	0.08	<b>0.95</b>	0.83	<b>1.34</b>	0.05
Model 5 - Outcome: Sex with a serodiscordant main or any non-main that was under the influence of any drug or alcohol (yes/no)										
Level 1 (daily reports)	0.09		0.99	0.97	<b>0.59</b>	<.01	1.53	0.07	<b>2.01</b>	<.001
Level 2										
Sexual compulsivity (continuous)	1.02	0.36	1.02	0.31	<b>1.05</b>	<.01	0.996	0.85	0.99	0.397
HIV Status (1 = HIV+)	1.02	0.97	1.08	0.81	1.55	0.13	0.77	0.50	<b>1.84</b>	<.001

Note. The Level 1 effects are the main effects for state affect. The Level 2 effects represent the main effects of sexual compulsivity and HIV status, and the interactions between state affect and sexual compulsivity and HIV status. Level 1 effects have been individual-centered. For count outcomes (Model 3 and 4), coefficients represent event rate ratios (ERR); for dichotomous outcomes (Models 1, 2, and 5), the coefficients represent odds ratios (OR). See text for additional interpretation of coefficients. Significant ( $p < .05$ ) coefficients and trends (based on  $t$  tests) are in bold type. Variance components were fixed with the following exceptions: Model 1, Sexual Activation; Model 3, Positive Activation, Negative Activation, Sexual Activation; Model 4, Sexual Activation.

was less pronounced in men with above average levels of SC. This association is shown in Figure 1.

**Model 2: Unprotected sex with a risky partner (Yes/No).** The second series of variables in Table 3 reports the odds of having unprotected anal sex with a risky partner (defined as a HIV serodiscordant main partner, or a non-main partner regardless of his status). The Level 1 intercept (.05) represents the odds of having unprotected sex with a risky partner when the participants reported average levels of state affect. SC (Level 2, trait) did not have a significant association with average frequency of having unprotected sex with a risky partner (i.e., the intercept). In contrast, HIV status (Level 2, trait) did: HIV positive men were more likely to report unprotected sex with a risky partner. State SA showed a significant association, with each unit increase in state SA being associated with 1.95 increased odds of having unprotected sex with a risky partner. In addition, each unit increase in state NA was associated with 61% decreased odds of having unprotected sex ( $1 - .39 = .61$ ).

There was a significant SC by state NA interaction on unprotected sex with a risky partner. Controlling for other variables, increases in NA were associated with decreased odds of unprotected sex; however, this decrease was less pronounced in men with above average levels of SC. This association is shown in Figure 2.

**Model 3: Number of sex acts with male partners (oral and anal) in a given day.** The third series of variables in Table 3 corresponds to the number of sex acts with male partners (oral and anal, receptive and insertive) in a given day. All effect estimates are event rate ratios. SC and HIV status (Level 2, trait) did not have significant associations with average frequency of sex acts in a given day (i.e., the intercept). Similar to Model 1, each unit increase in state NA was associated with a 41% reduced event rate of the number of sex acts ( $1 - .59 = .41$ ). Each unit increase in state AA was associated with 1.78 increased event rate of the number of sex acts, and each unit increase in state SA was associated with a 1.96 increased event rate of the number of sex acts.

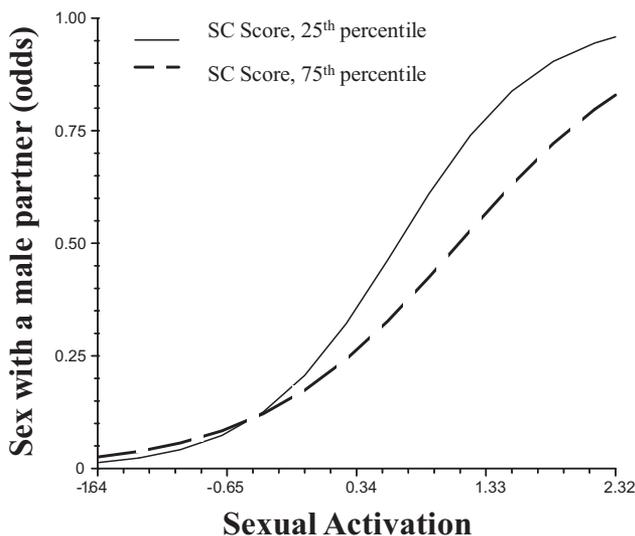


Figure 1. SA and odds of having sex with a male partner.

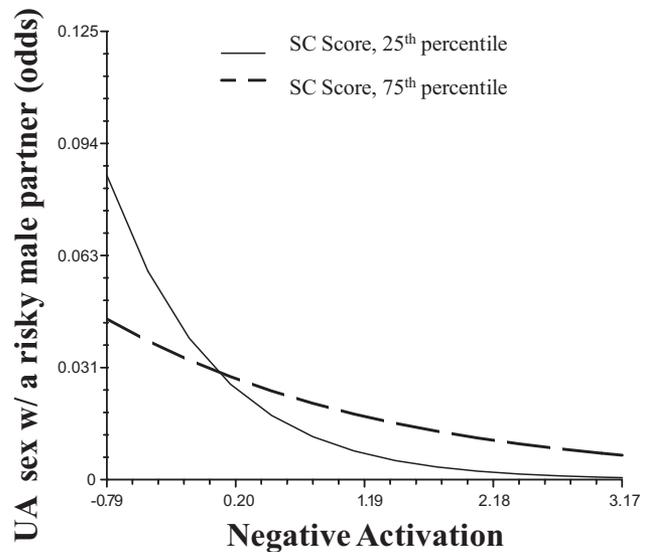


Figure 2. NA and odds of unprotected anal sex with a risky male partner.

There was a significant SC by state NA interaction on number of sex acts performed in a given day. Controlling for other variables, increases in NA were associated with a decreased event rate for the number of sex acts; however, this decrease was less pronounced in men with above average levels of SC. This pattern is similar to that shown in Figure 2.

Additionally, there was a significant SC by state SA interaction on the number of sex acts performed in a given day. Controlling for other variables, increases in SA were associated with an increased event rate of the number of sex acts; however, this increase was less pronounced in men with above average levels of SC. This association is shown in Figure 3.

**Model 4: Number of male partners in a given day.** The fourth series of variables in Table 3 corresponds to the number of male sex partners in a given day (main + non-main). All effect estimates are event rate ratios. SC and HIV status (Level 2, trait) did not have significant associations with the average number of sex partners in a given day (i.e., the intercept). Similar to Model 3, increases in NA were associated with a decreased event rate for the number of male partners. In addition, increases in AA and SA were associated with increased event rate for the number of male partners in a given day (1.67 and 2.06 respectively).

There was a significant SC by state NA interaction on number of sex partners in a given day. Controlling for other variables, increases in NA were associated with decreased event rate for number of partners; however, this decrease was less pronounced in men with above average levels of SC. This association is similar to that shown in Figure 2.

There was also a significant SC by state PA interaction on the number of sex partners in a given day. Controlling for other variables, increases in PA were associated with increased numbers of sex partners for men with below average levels of SC. In contrast, the opposite was the case for men with above average

levels of SC: increases in PA corresponded with decreases in the number of partners. This pattern is shown in Figure 4.

**Model 5: Sex with a risky partner while under the influence of alcohol or drugs (Yes/No).** The final series of variables in Table 3 corresponds to the presence/absence of sex under the influence of any drug or alcohol with a risky partner (defined as a HIV serodiscordant main partner, or a non-main partner regardless of his status). The intercept estimate, .09, represents the odds of having sex under the influence when the participants reported average levels of state affect. SC and HIV status (Level 2, trait) did not have significant associations with the average frequency of having sex under the influence (i.e., the intercept). In this model, increases in NA were associated with decreased odds of having sex under the influence (OR = 0.59). In addition, increases in SA were associated with increases in sex under the influence (OR = 2.01).

There was a significant SC by state NA interaction on odds of sex under the influence. Controlling for other variables, increases in NA were associated with decreased odds of sex under the influence; however, this decrease was less pronounced in men with above average levels of SC. This association is shown in Figure 5.

Finally, there was a significant HIV status by state SA interaction on the odds of sex under the influence. Controlling for other variables, increases in SA were associated with increased odds of sex under the influence and this effect was more pronounced for HIV positive men. This pattern is similar to that depicted in Figure 1.

**Discussion**

In contrast to prior research, higher levels of SC were not associated with increased sexual behavior or sexual risk taking (i.e., the intercept for each outcome variable). This finding seems to contradict prior research demonstrating that sexually compulsive men are more likely than non-sexually compulsive men to report high risk sexual behavior (Benotsch, Kalichman, & Pink-

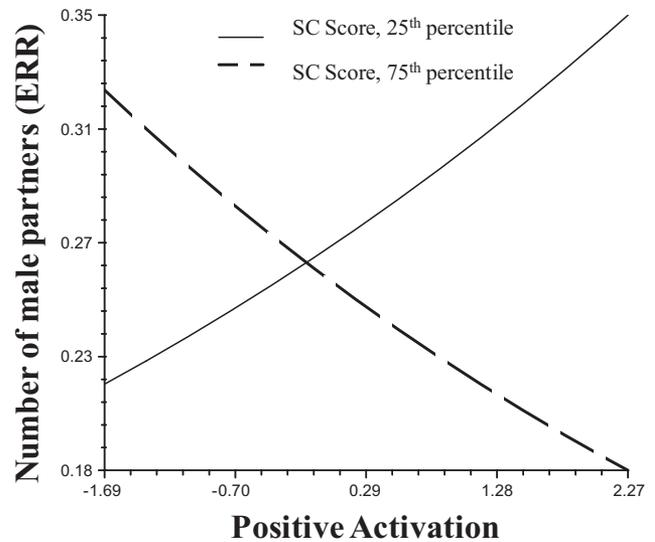


Figure 4. PA and event rate for the number of male partners in a given day.

erton, 2001; Grov et al., 2010; Kalichman et al., 1997; O’Leary et al., 2005; Reece, 2003; Semple et al., 2009). However, it is important to note that the comparison groups of non-sexually compulsive men in past research were often men who reported relatively low rates of sexual behavior. The sample in this study was constructed to insure that SC score was independent of participants’ frequency of sexual behavior. In addition, researchers have often used retrospective “recall” methods for assessment (e.g., summary assessment of behavior over an extended period of time). In our study, data were collected using a daily diary method. Thus, these findings have implications both for understanding how

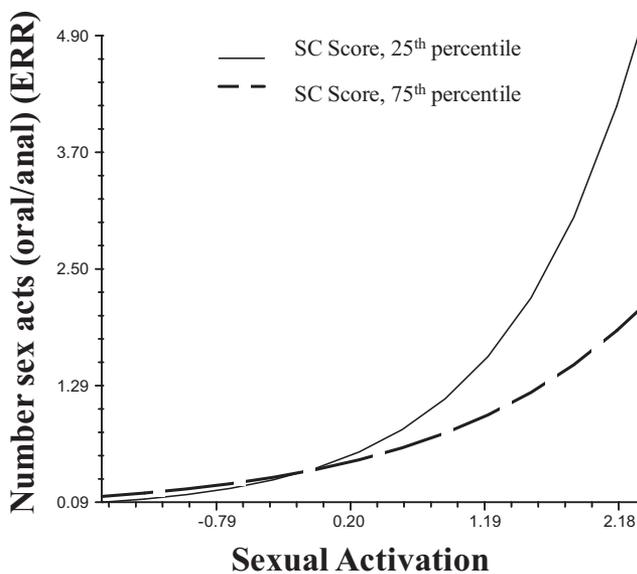


Figure 3. SA and the event rate for the number of sex acts with male partners performed in a given day.

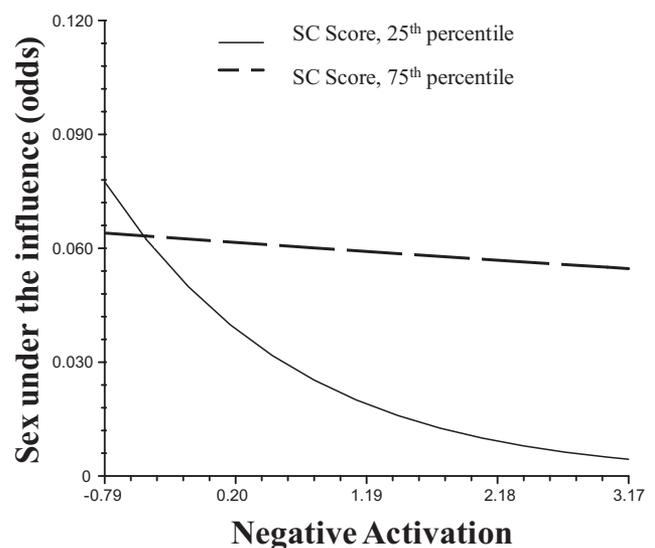


Figure 5. NA and odds of sex with a risky partner while under the influence of alcohol or drugs.

SC is associated with risky behavior and for the methods in which behavior is assessed.

Our data indicated that negative activation was associated with decreased sexual behavior and sexual risk taking, which contradicts some research (Leith & Baumeister, 1996; Mustanski, 2007). We found that the association between NA and sexual behavior differed based on men's SC scores, with the trend indicating less of an association between NA and sexual behavior among men with above average levels of SC. In addition, there was marginal evidence ( $p < .10$ ) suggesting that men higher in SC generally reported higher NA. Perhaps variation in NA is less relevant to men higher in SC because it is more of a pervasive experience. Collectively, these findings highlight the need to explore better the role that NA may have in sexual behavior and sexual risk taking, and indicate that NA may play a different role in the sexual lives of sexually compulsive MSM.

As would be expected, sexual activation was consistently associated with increased sexual behavior and sexual risk taking, and thus remains an important variable to consider in future research. Interestingly, for two of the five outcomes (and with a marginally significant effect [ $p < .10$ ] on a third outcome), the association between SA and sexual behavior/risk was less pronounced among men higher on SC. Men higher on SC also reported generally lower levels of SA. Although these findings seem counterintuitive, SA was operationalized as feeling "sexually aroused," "sexually horny," and "sexually interested;" three factors that do not fully encompass the global experience of SC (which also includes feeling loss of control over one's sexual thoughts and behaviors). Some have suggested SA may lead to sexual risk behavior (Mustanski, 2007), and others have suggested that components of SA (e.g., feeling horny, aroused) comprise essential features of SC (Black, 1998; Coleman, 1992). Our data suggest SA may be an important factor in understanding risky sexual behavior, and much more so among non-sexually compulsive men who are highly sexually active. Further, these data suggest we may need a more nuanced way to assess the type of sexual activation associated with sexual behavior and risk among sexually compulsive men.

In this study, across participants, AA was associated with increased odds of having sex, number of sex acts, and number of sex partners in a given day. In contrast, it was unassociated with unprotected sex and sex under the influence. Researchers have suggested that anxiety may increase people's preferences for low-risk, low-reward options (Lerner & Keltner, 2000, 2001; Raghunathan & Pham, 1999); however, others have noted that the arousal component of anxiety might share features with sexual arousal and potentiate sexual risk taking (Cantor et al., 1975; Mustanski, 2007; Zillmann, 1983). Our findings suggest AA may be associated with sexual behavior, but not necessarily sexual risk taking.

In bivariate analyses, SC was unrelated to daily levels of PA (i.e., men high on SC and low on SC both reported similar levels of PA across the assessment period). However, there was an interaction between PA, SC, and number of sexual partners in a given day. For men with high levels of SC, reporting *low* PA (characterized by anhedonia and lethargy) was associated with having more partners. In contrast, for men with low levels of SC, reporting *high* PA (characterized by joy, enthusiasm, and energy) was associated with more partners. These results highlight the differential role that PA may play for sexually compulsive versus non-sexually compulsive MSM and suggest the need for further

research to characterize the role of anhedonia and other low PA emotions in the sexual behavior of men with SC.

### Limitations

This study has several limitations. First, this project was based on a nonrepresentative sample of gay and bisexual men, limiting generalizability. Although the number of participants was modest, the use of daily diaries enhanced our ability to capture a large number of data points, resulting in a vast array of sexual events over an extended period of time. In addition, a strength of this study was the utilization of a comparison group of MSM who were highly sexually active (i.e., behaviorally similar) but not sexually compulsive (i.e., psychologically different).

Second, although our use of online daily diaries was an innovative method through which to collect data, we were unable to control for outside stimuli that may have influenced/distracted participants when completing their diaries. On the other hand, this methodology may have assessed affective variables in a more ecological valid manner (i.e., truly capturing how a person feels when assessed in their own environment, versus an unfamiliar research/clinical setting). Third, our findings are limited to the days that participants completed diaries. It is possible that participants may have not completed diaries when their affect was excessively poor or overly positive. Fourth, although we have reported longitudinal data, we urge caution when interpreting the direction of findings. Participants reported on their concurrent mood and sexual behavior in a given day, and it is just as possible for sexual behavior to influence mood (e.g., anxiety resulting from one's behavior that day) as it is for mood to influence behavior (e.g., sex as a means to distract from negative mood). Finally, all of the typical limitations of self report data apply.

### Conclusion

Researchers have characterized SC as distress associated with sexual behavior/thoughts; however, there has been little evaluation attempting to describe the experience of distress that is inherent to SC within the major dimensions of mood. Knowing that mood and SC are both independently related to sexual behavior, and that SC is characterized in terms of distress around sexual thoughts/behaviors, one might hypothesize that mood variation would play a salient role in sexually compulsive men's sexual experiences. Indeed, we found that mood played a role; however, daily fluctuations in mood seemed to be less salient among sexually compulsive men (relative to highly sexually active men who are not sexually compulsive). These findings highlight the need to explore further the role of mood on sexual behavior and its confluence with SC. Future research may explore the value of including specific emotions (e.g. guilt) in addition to attending to the major dimensions of affect. Such findings would have implications for researchers and care providers seeking to address the association between SC and HIV risk.

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