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Positive Affect and Processes of Recovery among Treatment-Seeking Methamphetamine Users

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Abstract

Background—Revised Stress and Coping Theory proposes that positive affect serves adaptive functions, independent of negative affect. However, scant research has examined whether, how, and under what circumstances positive affect is associated with decreased substance use.

Methods—Eighty-eight methamphetamine-using men who have sex with men (MSM) completed the baseline assessment for substance abuse treatment outcome study which included measures of positive and negative affect, cognitive-behavioral change processes (i.e., approach-oriented coping, self-efficacy for managing methamphetamine triggers, and abstinence-related action tendencies), abstinence-specific social support, and self-reported substance use. Participants also provided a urine sample for toxicology screening.

Results—After controlling for demographic characteristics and negative affect, higher positive affect was independently associated with greater approach-oriented coping, abstinence-related action tendencies, and abstinence-specific social support. Positive affect was also independently associated with greater self-efficacy for managing methamphetamine triggers, but only at lower levels of negative affect. Through these cognitive-behavioral and social pathways, positive affect was indirectly associated with lower frequency of stimulant use in the past 30 days, lower odds of reporting stimulant use two or more days in a row, and lower odds of providing a urine sample that was reactive for stimulant metabolites. On the other hand, negative affect was not indirectly associated with any measure of stimulant use.

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Contributors: AWC, WJW, MDS, and MVD designed and executed the treatment outcome study from which data for the present paper were drawn. AWC, JTM, and NM developed study hypotheses in collaboration with all other authors. AWC, SED, and TBN were the primary individuals responsible for data analysis. Interpretation of findings was coordinated by AWC with feedback from the entire team. Detailed comments on draft manuscripts prepared by AWC were provided by the entire team.

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Conclusions—Clinical research is needed to examine the pathways whereby positive affect may predict better substance abuse treatment outcomes.

Keywords

Cocaine; Coping; HIV; Methamphetamine; Negative Affect; Positive Affect; Self-Efficacy; Social Support

1. Introduction

There is increasing recognition that difficulties with affect regulation play an important role in the development and maintenance of substance use disorders, but the underlying pathways that account for these effects are not well understood (Kassel, Stroud, & Paronis, 2003). Consistent with negative reinforcement models of addiction, prior research has focused extensively on negative affect as a risk factor for continued substance use and relapse (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). On the other hand, research examining the role of positive affect in substance use has yielded discrepant results (Carrico, in press; De Wit & Phan, 2010). Greater positive affect encompasses more frequent experiences of positive emotions that can be further differentiated by high (e.g., excitement, joy) and low (e.g., contentment, gratitude) levels of arousal (Watson, Wiese, Vaidya, & Tellegen, 1999). Although high arousal positive affect is commonly conceptualized as a trigger for relapse (McKay, Rutherford, Alterman, Cacciola, & Kaplan, 1995), greater positive affect has been shown to predict *decreased* substance use following formal treatment (Hall, Havassy, & Wasserman, 1990; Hall, Havassy, & Wasserman, 1991). Lending additional support to its potentially beneficial effects, other studies observed that positive affect is independently associated with decreased craving and it buffers against the deleterious effects of negative affect on substance use (McHugh, Kaufman, Frost, Fitzmaurice, & Weiss, 2013; Wills, Sandy, Shinar, & Yaeger, 1999). Further research is needed to determine whether, how, and under what circumstances positive affect may reinvigorate and sustain the processes of recovery from a substance use disorder.

Revised Stress and Coping Theory as well as the Broaden-and-Build Theory of positive emotions delineate the cognitive, behavioral, and social pathways whereby positive affect may serve adaptive functions (Folkman & Moskowitz, 2000; Fredrickson, 2001). The experience of positive affect may sensitize individuals to non-drug-related sources of reward, resulting in the activation of the mesocorticolimbic and nigrostriatal dopamine systems (Ashby, Isen, & Turken, 1999). Elevations in dopamine during reward processing may partially account for the “broadening” function of positive affect which leads to enhanced cognitive capacity (Dreisbach & Goschke, 2004; Lyubomirsky, King, & Diener, 2005) and behavioral action tendencies (Fredrickson & Branigan, 2005). Positive affect has also been shown to reinvigorate coping efforts and bolster self-efficacy (Lyubomirsky et al., 2005; Moskowitz, Hult, Bussolari, & Acree, 2009). The relevance of coping processes is supported in part by prior research where increased substance use coping mediated the associations of lower positive affect and higher negative affect with greater substance use (Carrico et al., 2012; Wills et al., 1999). Prior clinical research has also established that approach-oriented coping and self-efficacy for managing triggers for substance use are

important determinants of better substance abuse treatment outcomes as well as increased 12-step, self-help involvement (Carrico, Gifford, & Moos, 2007; Gifford, Ritscher, McKellar, & Moos, 2006). Taken together, the experience of positive affect may directly decrease risk for substance use and it could also support the sustained implementation of cognitive-behavioral change processes to avoid substance use.

Positive affect is also theorized to build social resources that assist individuals with effectively managing stressful life circumstances (Folkman & Moskowitz, 2000; Fredrickson, 2001). This is supported by findings that the daily experience of positive emotions is prospectively linked to increased personal and social resources which, in turn, predict greater life satisfaction (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008). Among individuals with substance use disorders, abstinence-specific social support has been shown to predict better substance abuse treatment outcomes (Havassy, Hall, & Wasserman, 1991) and increased odds of alcohol use disorder remission following formal help-seeking (Moos & Moos, 2007). Thus, greater abstinence-specific social support represents another theory-based pathway whereby greater positive affect may indirectly decrease substance use.

Consistent with Revised Stress and Coping Theory as well as the Broaden and Build Theory of positive emotions (Folkman & Moskowitz, 2000; Fredrickson, 2001), we propose a model where positive affect plays a unique, beneficial role in decreasing substance use (Carrico, in press). In the present study, we hypothesized that positive affect would be directly associated with decreased stimulant use, greater cognitive-behavioral change processes (i.e., approach-oriented coping, self-efficacy for managing methamphetamine triggers, and abstinence-related action tendencies), and higher abstinence-specific social support after accounting for negative affect. Because the adaptive significance of positive affect is theorized to be heightened during periods of increased stress (Folkman & Moskowitz, 2001; Zautra, Berkhof, & Nicolson, 2002), we also tested whether negative affect moderated the associations of positive affect with stimulant use, cognitive-behavioral change processes, and abstinence-specific social support. Informed by these findings, we examined the extent to which positive affect was indirectly associated with decreased stimulant use via cognitive-behavioral change processes and abstinence-specific social support (see Figure 1).

2. Methods

2.1. Procedures

The Stonewall Treatment Evaluation Project (STEP) is a treatment outcome study which followed a cohort of methamphetamine-using men who have sex with men (MSM) that was receiving outpatient, cognitive-behavioral substance abuse treatment. Located in San Francisco, the Stonewall Project is implementing cognitive-behavioral substance abuse treatment from a harm reduction perspective with substance-using MSM (Siever & Discepolo, 2013). Participants receiving treatment at Stonewall were eligible to enroll in STEP up to: 1) 60 days after treatment initiation; or 2) 60 days following re-initiation after more than 30 days out of treatment. No formal exclusion criteria were employed in this community-based participatory research project.

Prospective participants completed a consent to contact form during outpatient treatment. After eligibility was verified using treatment records, participants were contacted to schedule a baseline visit. Participants were recruited from July of 2010 through June of 2012. Of the 97 individuals who were eligible, 88 (91%) enrolled in STEP. Seven participants were not enrolled because their period of eligibility expired, one participant was excluded because he was unable to complete the baseline assessment after two attempts, and one individual declined to participate.

At the baseline study visit, participants completed a signed informed consent followed by an interviewer-administered, computer-based survey (Questionnaire Development System; Nova Research Company; Bethesda, MD) to assess positive and negative affect as well as cognitive-behavioral and social change processes that were hypothesized to be relevant to substance abuse treatment outcomes. Then, participants completed a self-administered, computer-based measure of substance use and provided a urine sample at the end of the study visit to screen for recent substance use (Redicup®; Redwood Toxicology Laboratory; Santa Rosa, CA). Participants were reimbursed with a \$50 pre-loaded debit card for their time and travel expenses. Study procedures were approved by the University of California, San Francisco Committee on Human Research.

2.2. Measures

2.2.1. Demographics—Age, ethnicity, education, income, sexual orientation, and HIV status were assessed by questionnaire.

2.2.2. Positive and Negative Affect—The modified Differential Emotions Scale (DES) was administered to assess state positive and negative affect (Fredrickson, Tugade, Waugh, & Larkin, 2003). Participants rated how frequently they felt a particular affect in the past week. The DES includes items assessing high as well as low arousal positive and negative affects. The 11 positive affect items (Cronbach's $\alpha = .91$; $M = 24.6$, $SD = 8.1$) and 8 negative affect items (Cronbach's $\alpha = .87$; $M = 14.1$, $SD = 6.6$) demonstrated adequate internal consistency.

2.2.3. Approach-Oriented Coping—The 6-item positive reappraisal (Cronbach's $\alpha = .67$; $M = 18.6$, $SD = 3.2$) and 6-item problem solving (Cronbach's $\alpha = .79$; $M = 18.5$, $SD = 3.6$) subscales of the Coping Responses Inventory were administered to examine how often participants used approach-oriented coping strategies in the past three months to manage the concerns that brought them to treatment (Moos, 1993).

2.2.4. Self-Efficacy for Managing Methamphetamine Triggers—The 50-item Drug Taking Confidence Questionnaire was administered to examine confidence in one's ability to resist the urge to use methamphetamine in response to internal (e.g., unpleasant emotions, physical discomfort) and external (e.g., social pressure, pleasant times with others) triggers (Annis, Sklar, & Turner, 1997). The composite score (Cronbach's $\alpha = .97$; $M = 62.3$, $SD = 22.3$) is a global measure of self-efficacy for managing triggers for methamphetamine use.

2.2.5. Abstinence-Related Action Tendencies—The University of Rhode Island Change Assessment was administered to assess stages of change (McConaughy,

Prochaska, & Velicer, 1983). For the present study, the 8-item action subscale (Cronbach's $\alpha = .79$; $M = 34.6$, $SD = 3.5$) was selected to assess the extent to which participants reported taking concrete steps to reduce methamphetamine use.

2.2.6. Abstinence-Specific Social Support—The Processes of Change measure for cocaine users was adapted to examine strategies that may be employed to avoid methamphetamine use (Prochaska et al., 1994). The helping relationships and reinforcement management subscales were selected because they index perceived social support for abstinence. An exploratory factor analysis using maximum likelihood estimation and varimax rotation observed a single Eigenvalue greater than one (i.e., 3.54). The six items loaded on a single factor (.62 – .90) that accounted for 59% of the variance and had adequate internal consistency (Cronbach's $\alpha = .86$; $M = 20.4$, $SD = 6.1$).

2.2.7. Self-Reported Stimulant Use—Consistent with Addiction Severity Index (McLellan et al., 1992), participants reported the number of days that they used various substances in the past 30 days. The composite score for frequency of stimulant use is the largest number of days participants reported using cocaine, crack, or methamphetamine. Participants also reported the longest number of days in a row they used cocaine, crack, or methamphetamine in the past 30 days. Informed by previous research with methamphetamine users (Semple, Patterson, & Grant, 2003), participants who reported using any of these stimulants two or more days in a row were classified as engaging in binge use (1) and compared to those who reported using one day at a time or no use in the past 30 days (0).

2.2.8. Urine Toxicology Screening—Participants who provided a urine sample that was reactive for cocaine or methamphetamine (1) were compared to those who provided a urine sample that was not positive for recent use of these stimulants (0).

2.3. Statistical Analyses

Informed by prior research examining stimulant use among MSM (Carrico et al., 2012; Grov, Bimbi, Nanin, & Parsons, 2006; Halkitis & Jerome, 2008), the following covariates were included in all statistical analyses: age, ethnicity, HIV status, and negative affect. Linear and logistic regression analyses examined if positive affect was independently associated with lower frequency of stimulant use, lower odds of any binge stimulant use, or lower odds of providing a urine sample that was reactive for stimulant metabolites. Next, linear regression analyses examined whether positive affect was independently associated with cognitive-behavioral change processes and abstinence-specific social support. Although the interaction term for negative and positive affect was initially included in all of the above models, it was only retained if statistically significant. Where the interaction of negative and positive affect was significantly significant, the Johnson-Neyman method was utilized to determine regions of significance for the moderation effect (Pedhauzer, 1997). Finally, linear and logistic regression analyses were conducted to examine the extent to which cognitive-behavioral change processes and abstinence-specific social support were independently associated with indicators of decreased stimulant use.

Informed by the results of the above analyses, we examined whether positive affect was indirectly associated with lower stimulant use via cognitive-behavioral change processes and abstinence-specific social support. As shown in Figure 1, we estimated the total standardized indirect effect of positive affect for each indicator of stimulant use separately. The total indirect effect is the sum of the specific indirect effects of positive affect on stimulant use via each mediator included in the model. Even in the absence of a direct effect of positive affect on stimulant use, it is possible for the total indirect effect (via the hypothesized mediators) to be statistically significant (Preacher & Hayes, 2004). The total indirect effect for the frequency of stimulant use (β_{indirect}) was estimated with bootstrap-based, bias-corrected 95% confidence intervals using the structural equation modeling command in Stata 12.0 (Mackinnon, Lockwood, & Williams, 2004; Shrout & Bolger, 2002). Because this model was saturated with zero degrees of freedom, model fit indices were not available. Similarly, the user-written command in Stata 12.0 (KHB) calculated the total indirect effects of positive affect on binary indicators of stimulant use (i.e., any binge use and reactive urine toxicology results for stimulant metabolites). KHB compares coefficients of nested, non-linear probability models to obtain the total indirect effect (OR_{indirect}) with 95% confidence intervals (Kohler, Karlson, & Holm, 2011).

Because 14 separate multivariate analyses were conducted in the present study, an alpha of .01 or less was selected as the threshold for statistical significance in all analyses examining direct effects. Interaction effects and indirect effects are often underpowered in psychological research. Consequently, an alpha of less than .05 was selected as the threshold for statistical significance for these analyses. Due to the negligible amount of missing data (< 5%), listwise deletion was employed in models with incomplete data (Little & Rubin, 2002).

3. Results

3.1. Participant Demographics

The mean age of the 88 participants was 43 (SD = 9; Range = 23 – 66) years. Sixty-seven percent of participants were Caucasian, 14% were Hispanic/Latino, 11% were African American, and 2% were Asian or Pacific Islander. The majority of participants (78%) completed at least some college and 66% made less than \$16,000 per year. Most participants described their sexual orientation as exclusively gay (82%) and 66% were HIV-positive. Ninety percent of participants had initiated outpatient substance abuse treatment at the Stonewall Project within the past 60 days. Participants reported using stimulants for an average of 5.7 (SD = 7.9) days in the past 30 days, half (50%) reported engaging in binge stimulant use in the past 30 days, and 31% (27 of 84) provided a urine sample that was reactive for stimulants at the study visit.

3.2. Linear and Logistic Regression Analyses

As shown in Table 1, neither positive affect nor negative affect was directly associated with any indicator of stimulant use in multiple linear and logistic regression analyses ($p > .01$). The interaction of negative and positive affect was not significantly associated with any indicator of stimulant use and was not included in the final models ($p > .05$). Using five

separate multiple linear regression models, higher positive affect was independently associated with greater positive reappraisal and problem solving coping, abstinence-related action tendencies, and abstinence-specific social support (see Table 2). The interaction of negative and positive affect was significantly associated with self-efficacy for managing methamphetamine triggers ($\beta = -0.60$, $t = -2.24$, $p < .05$). Posthoc probing of this interaction was conducted to examine the association of positive affect with self-efficacy for managing methamphetamine triggers at varying levels of negative affect (see Figure 2). Findings indicated that positive affect was associated with greater self-efficacy below the mean for negative affect (Beta = 0.64, 95% CI = 0.03 – 1.25; $t = 2.09$, $p < .05$). Above the mean for negative affect, positive affect was not significantly associated with self-efficacy (Beta = 0.60, 95% CI = 0.00 – 1.21; $t = 1.99$, $p > .05$). Because the interaction of negative and positive affect was not significantly associated with other outcomes ($p > .05$), it was not retained in the final models.

As shown in Table 3, cognitive-behavioral change processes and abstinence-specific social support were independently associated with indicators of decreased stimulant use. Higher abstinence-specific social support was independently associated with decreased frequency of stimulant use. Greater self-efficacy for managing triggers for methamphetamine use and higher abstinence-specific social support were independently associated with lower odds of reporting any binge stimulant use. Finally, greater self-efficacy for managing triggers for methamphetamine use and abstinence-related action tendencies were associated with lower odds of providing a urine sample that was reactive for stimulant metabolites.

3.3. Indirect Effects of Positive Affect on Stimulant Use

Positive affect was indirectly associated with lower frequency of self-reported stimulant use in the past 30 days ($\beta_{\text{indirect}} = -.37$; 95% CI = $-.60 - -.14$; $p < .01$), lower odds of reporting any binge stimulant use ($OR_{\text{indirect}} = 0.09$; 95% CI = 0.02 – 0.45, $p < .01$), and lower odds of providing a urine sample that was reactive for stimulant metabolites ($OR_{\text{indirect}} = 0.22$; 95% CI = 0.07 – 0.64, $p < .01$) via cognitive-behavioral processes and abstinence-specific social support. Negative affect was not indirectly associated with frequency of self-reported stimulant use in the past 30 days ($\beta_{\text{indirect}} = -.03$; 95% CI = $-.21 - .16$; $p > .05$), reporting any binge stimulant use ($OR_{\text{indirect}} = 0.81$; 95% CI = 0.25 – 2.57, $p > .05$), or providing a urine sample that was reactive for stimulant metabolites ($OR_{\text{indirect}} = 0.95$; 95% CI = 0.43 – 2.11, $p > .05$).

4. Discussion

Substance-induced positive affect has been theorized to serve as positive reinforcement for continued substance use and the experience high arousal positive affect is commonly conceptualized as a trigger for relapse (Koob, 2006; McKay et al., 1995). Informed by Revised Stress and Coping Theory as well as the Broaden-and-Build Theory of positive emotions (Folkman & Moskowitz, 2000; Fredrickson, 2001), the present study challenges these dominant paradigms that have traditionally informed research on positive affect and substance use. Neither positive affect nor negative affect were directly associated with stimulant use. Interestingly, however, greater positive affect was independently associated

with cognitive-behavioral change processes and abstinence-specific social support, both of which have previously been linked to long-term reductions in alcohol and substance use (Gifford et al., 2006; Havassy et al., 1991; Moos & Moos, 2007). Positive affect was indirectly associated with decreased stimulant use via these theory-based pathways in the present study. On the other hand, negative affect was not indirectly associated with any measure of stimulant use. These findings indicate that positive affect could serve unique, adaptive functions among individuals seeking treatment for substance use disorders because it may reinvigorate cognitive-behavioral change processes and build social relationships that support abstinence.

The beneficial consequences of positive affect are theorized to be heightened during periods of increased stress (Folkman & Moskowitz, 2000; Zautra et al., 2002). Contrary to this hypothesis, the relationship between greater positive affect and increased self-efficacy for managing methamphetamine triggers was *less* pronounced at higher levels of negative affect. A key limitation of the present study is that it was cross-sectional with a modest sample of treatment seeking methamphetamine users. Thus, it is not possible to draw definitive conclusions about the nature and direction of the associations among affect and stimulant use. Further longitudinal research with larger samples is needed to elucidate the implications of the dynamic interplay of positive and negative affect for substance use. In addition, a more nuanced understanding of the role of affect in processes of recovery may be achieved by taking into account the degree of arousal that characterizes positive and negative affect. Relatively little attention has been devoted to examining if there are differential effects of high versus low arousal positive affect. High arousal positive affect (e.g., excitement, elation) could serve as a trigger for relapse because it more closely resembles prior substance-induced pleasurable experiences. On the other hand, low arousal positive affect (e.g., contentment, gratitude) may sensitize individuals to non-drug-related sources of reward and pleasure without inducing craving or triggering substance use. This should be examined in future longitudinal research.

It is also plausible that positive affect serves different functions during the initiation, development, and maintenance of substance use disorders (Carrico, in press). Consistent with hedonic models of addiction (Koob, 2006), substance-induced positive affect may serve as positive reinforcement for continued substance use among recreational users. However, individuals with substance use disorders experience profound neurobehavioral changes that leave them hyper-responsive to drug-related cues and hypo-responsive to natural rewards (Goldstein & Volkow, 2011). Positive affect may sensitize individuals to non-drug-related rewards as well as support the sustained implementation of cognitive-behavioral and social change processes that assist individuals with avoiding substance use. Because the present study was cross-sectional with a modest sample size of treatment-seeking methamphetamine users, further clinical research is needed to elucidate what (if any) role distinct types of positive affect play in the initiation, development, and maintenance of substance use disorders. It is also noteworthy that the variability in positive and negative affect, cognitive-behavioral and social change processes, and stimulant use in the present study could have been influenced by the duration of previous exposure to substance abuse treatment. Further

clinical research is needed to examine the pathways whereby positive affect may predict better substance abuse treatment outcomes.

Taken together, the present study will inform clinical research to examine whether, how, and under what circumstances positive affect may predict better substance abuse treatment outcomes. Longitudinal research with larger samples is needed to examine if positive affect reinvigorates cognitive-behavioral change processes, builds abstinence-specific social support, and predicts reductions in stimulant use. Emerging evidence also suggests that positive affect interventions have the potential to increase psychological adjustment and promote health behavior change (Moskowitz, 2011; Saslow, Cohn, & Moskowitz, in press). Randomized controlled trials should examine the efficacy of interventions designed to cultivate low arousal positive affect in order to determine if they boost the effectiveness of evidence-based approaches to substance abuse treatment.

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Figure 1.
Proposed theory-based pathways whereby positive affect may decrease stimulant use.

Figure 2.

Association of positive affect with self-efficacy for managing methamphetamine triggers at varying levels of negative affect.

Table 1

Multiple linear and logistic regression analyses examining direct associations of positive and negative affect with indices of stimulant use (N = 88).

	Frequency of Use (Past 30 Days)	Any Binge Use	Reactive Urine Screen for Stimulants
	β	OR (95% CI)	OR (95% CI)
Age	-.02	1.01 (0.96 – 1.07)	1.02 (0.97 – 1.08)
Caucasian	-.05	0.93 (0.36 – 2.44)	0.86 (0.32 – 2.32)
HIV-Positive	.14	1.85 (0.70 – 4.92)	1.66 (0.60 – 4.58)
Negative Affect	.14	1.80 (1.01 – 3.23)	1.34 (0.77 – 2.35)
Positive Affect	-.07	0.84 (0.47 – 1.50)	0.86 (0.48 – 1.52)

Note: The threshold for statistical significance was $p = .01$

Table 2

Multiple linear regression analyses examining direct associations of positive and negative affect with processes of recovery (N = 88)

	Positive Reappraisal	Problem Solving	Self-Efficacy	Action Tendencies	Abstinence-Specific Social Support
	β	β	β	β	β
Age	-.10	-.12	-.15	-.06	-.02
Caucasian	-.03	.07	-.09	.03	.14
HIV-Positive	-.04	.02	-.14	.03	-.01
Negative Affect (NA)	.10	.03	.33	.20	.10
Positive Affect (PA)	.66**	.59**	.72**	.39**	.59**
NA $\times$ PA	-	-	-.60*	-	-

*
p < .05;

**
p < .01

Table 3

Multiple linear and logistic regression analyses examining direct associations of processes of recovery with stimulant use (N = 88)

	Frequency of Use (Past 30 Days)	Any Binge Use	Reactive Urine Screen for Stimulants
	β	OR (95% CI)	OR (95% CI)
Age	-.05	0.99 (0.93 – 1.05)	1.00 (0.94 – 1.07)
Caucasian	-.02	0.98 (0.28 – 3.51)	0.93 (0.25 – 3.48)
HIV-Positive	.11	2.23 (0.65 – 7.60)	1.46 (0.42 – 5.11)
Positive Reappraisal	.07	0.57 (0.24 – 1.35)	0.94 (0.42 – 2.13)
Problem Solving	.14	1.57 (0.65 – 3.81)	1.29 (0.56 – 2.97)
Self-Efficacy	-.22	0.41 (0.21 – 0.80)*	0.39 (0.19 – 0.77)*
Action Tendencies	-.19	0.42 (0.20 – 0.91)	0.39 (0.19 – 0.80)*
Abstinence-Specific Support	-.43*	0.33 (0.14 – 0.74)*	0.42 (0.19 – 0.90)

* p < .01;

Note: The threshold for statistical significance was p < .01