Positive and negative affect in cocaine use disorder treatment: Change across time and relevance to treatment outcome

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Abstract

Background: Cognitive-behavior therapy (CBT) for substance use disorder is empirically supported, and may be associated with change in affect over time.

Objectives: Understanding the role of affect in cocaine use disorder could help to improve CBT outcomes.

Methods: This secondary analysis included 140 adults with cocaine use disorder, 57.9% female, drawn from two randomized controlled studies of web-based cognitive-behavior therapy who completed the Positive and Negative Affect Scale (PANAS) before and during treatment.

Results: In mixed-effects regression models, baseline negative affect (NA) scores were not associated with self-reported cocaine use during treatment, but baseline PA scores were associated with less frequent cocaine use ($\beta = -0.04$, $p = .02$). During treatment, NA scores reduced over time in CBT and treatment as usual ($\beta = -0.27$, $p < .01$), although PA scores did not change. Higher weekly NA scores were associated with weekly cocaine use ($\beta = 0.02$, $SE = 0.01$, $t(746.15) = 2.37$, $p = .02$), although weekly PANAS PA scores were not associated with weekly cocaine use.

Discussion and Conclusions: Results indicated that individuals with higher baseline PA were more likely to abstain from cocaine use during treatment, even when controlling for baseline cocaine use frequency. Although baseline NA was not associated with cocaine use, NA during treatment was associated with greater cocaine use.

Scientific Significance: PA at baseline and NA during treatment were associated with cocaine use. If findings are replicated, treatment developers may wish to include treatment interventions to boost early PA and reduce NA throughout treatment.

Cognitive-behavior therapy (CBT) is an empirically supported treatment for substance use disorder (SUD), including cocaine use disorder¹. However, effect sizes for CBT for cocaine

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use disorder remain modest (meta-analysis pooled effect size for cocaine, opioid, or stimulant use disorder $g = 0.13$, 95% CI [0.01, 0.24])². Understanding factors related to cocaine use during treatment may facilitate development of more effective treatments. One such potential factor is affect, which can be defined as two separate dimensions reflecting subjective distress and unpleasant engagement (negative affect; NA) and subjective pleasure, engagement, and energy (positive affect; PA)³. Within individuals with SUD, affect has been shown to vary when measured frequently (i.e., five times per day)⁴. However, high temporal stability in NA and PA ratings has indicated that even momentary affective states are, to some extent, indicative of a trait level of general affect³.

The literature suggests that both NA and PA may be implicated in SUD. High levels of NA and low levels of PA are thought to facilitate risky drug use⁵. NA may function as a relapse trigger, or individuals may use drugs to avoid the NA associated with withdrawal⁶. While this latter ‘negative reinforcement theory’⁶ and the role of NA in addiction have been extensively studied, PA has been less frequently studied⁵. High PA may be a risk factor for the development of SUD, although low PA may also make an individual vulnerable to substance use⁵. Individuals may initially experience acutely increased PA immediately after drug use, but may become less sensitive to non-drug reinforcers that would otherwise elicit PA⁷. Across substances of abuse, low PA (anhedonia) has been reported during addiction⁵ and has also been described as a hallmark of withdrawal⁸. In cocaine use disorder, intoxication may include acutely elevated PA⁹, while withdrawal may include dysphoria (elevated NA), possibly with anhedonia⁹. Anhedonia was also more prevalent among individuals with a remitted stimulant use disorder¹⁰. Given the complex relationships between NA and PA and substance use, further exploration of these relationships before and during SUD treatment is warranted and may lead to further avenues for improving existing SUD treatment.

Previous studies have used a variety of measures and timeframes for correlating affect and drug use. Young adults with cocaine dependence reported greater NA scores ($N = 34$, $M = 21.38$) on the PANAS³ compared with non-dependent cocaine users ($N = 90$, $M = 19.94$) and with ‘non-users’ ($N = 883$, $M = 18.29$), but the groups did not differ on PA¹¹. However, higher PA on the modified Differential Emotions Scale¹² was indirectly associated with lower stimulant use among 88 treatment-seeking men¹³. Higher PA on the Ryman mood questionnaire¹⁴ was correlated with lower cocaine relapse likelihood in the next week in retrospective reports among 104 adults¹⁵. Within-person increases in past-hour boredom, anger, worry, discomfort, and sadness on a four-point Likert-type scale were reported prior to cocaine use in 112 treatment-seeking adults¹⁶.

Baseline predictors of SUD treatment outcome like drug-negative urine toxicology screens have been associated with end-of-treatment outcomes¹⁷. Consistent with prior study of affect in SUD^{13,15,16} and with theory⁵, baseline affect at the time of treatment-seeking may also be a potential treatment outcome predictor. Specifically, baseline NA may correlate with higher baseline cocaine use severity and future cocaine use. While less research exists to guide hypotheses about PA, available research suggests that baseline PA may negatively correlate with prior cocaine use severity and future cocaine use.

An additional consideration is whether affect changes during SUD treatment. CBT for SUD helps clients identify situations or triggers, which could be external (e.g., people, places) or internal (e.g., changes in NA or PA) that could precede or follow cocaine craving or use¹⁸. CBT teaches clients to use drug refusal skills and to avoid decisions which could lead to substance use. Although clients exposed to CBT may be expected to experience reduced NA and increased PA as they learn to navigate situations that would otherwise lead to distress or drug use, few studies have examined affective changes during CBT. PANAS NA scores reduced among 43 cocaine-using individuals on methadone maintenance after an intensive six-month psychosocial treatment including CBT¹⁹. Negative mood on the Profile of Mood States assessment²⁰ showed a linear decrease in 776 individuals with alcohol use disorder during 16-week CBT, with a slight increase near treatment end²¹. However, in a randomized pilot of 77 negative-affect-drinkers participating in 12-week CBT, only those exposed to supplemental affect regulation training experienced reduced PANAS NA scores at post-treatment ($d = .87$)²². Only one study has evaluated PA change during CBT: in 43 cocaine-using adults on methadone, no pre-post PA changes were found after six months of intensive psychosocial treatment containing CBT¹⁹.

This is the first study to evaluate relationships of baseline and weekly within-treatment NA and PA to cocaine use frequency during outpatient CBT. We pooled data from two randomized controlled trials comparing web-based CBT (CBT4CBT) to cocaine use disorder treatment as usual (TAU). We calculated correlations between baseline NA and PA scores and cocaine use outcomes, and hypothesized that: (1a) baseline cocaine use would be positively correlated with baseline NA and (1b) negatively correlated with baseline PA; and (2a) within-treatment cocaine use would be positively correlated with baseline NA and (2b) negatively correlated with baseline PA. We further hypothesized that (3a) weekly NA would reduce during CBT, consistent with two of three prior studies^{19,21}, and (3b) weekly PA would increase during CBT as participants gained new skills. We further hypothesized that lower weekly cocaine use would be associated with (4a) lower NA that week, and (4b) higher PA that week.

Method

Participants

Participants were English-speaking adults drawn from two randomized controlled trials of CBT4CBT^{23,24}, a computerized cognitive-behavioral treatment for cocaine use disorder. Study 1 participants were recruited from a community outpatient clinic and met criteria for any SUD with some substance use within the past 30 days; these analyses included only those with cocaine dependence ($N = 41$). Study 2 participants ($N = 99$) were recruited from a methadone maintenance clinic, were on a stable methadone dose for a minimum of two months, and met current DSM-IV criteria for cocaine dependence. In both studies, exclusion criteria were minimal (unstable/untreated psychotic disorder, current suicidal or homicidal ideation, inability to read at 6th grade level) to allow for a representative sample of treatment-seeking adults.

Procedures

All participants were screened by research assistants and provided written informed consent as approved by the Yale University School of Medicine Human Investigations Committee. A computerized urn randomization program²⁵ balanced randomization with respect to gender, ethnicity, primary substance use (Study 1 only), and baseline cocaine use frequency (Study 2 only).

Interventions

CBT4CBT.—Participants randomized to CBT4CBT were given an individualized log-in code for a password-protected computer in a private clinic room. CBT4CBT was developed to present CBT concepts in an accessible, interactive format and was based on a well-researched treatment manual¹⁸. The program presented an introduction, followed by six modules illustrating CBT concepts. As described previously^{23,24}, the program included games and interactive exercises to teach skills. Videos for each module presented characters (played by actors) who experienced a common risky situation. After the skill was presented, the characters demonstrated using the skill to avoid substance use. Each module included a review and a homework assignment. A module on HIV risk reduction was available in Study 2.

TAU.—TAU consisted of weekly group and individual drug counseling (Study 1) or weekly group treatment at the methadone clinic and daily methadone dosing (Study 2). See the original reports for further detail^{23,24}.

Assessments

Participants were assessed at baseline, twice each week during treatment, and at study end by independent research assistants. At baseline, the Structured Clinical Interview for DSM-IV²⁶ was used to assess the presence of SUD and other mental health disorders, and a urine toxicology screen was obtained. During study treatment, participants completed twice-weekly urine toxicology screens. Self-reported cocaine use was assessed at baseline and weekly during treatment using the Substance Use Calendar, similar to the Timeline Follow-Back interview²⁷. Urine toxicology screens were used as secondary measures; lab samples were tested for cocaine metabolites and data are reported as dichotomous (positive / negative). Affect was assessed at baseline and weekly visits using the 20-item PANAS³, which assessed how much the participant felt various positive and negative mood states using a 5-point scale. The PANAS has good test-retest reliability, and convergent and discriminant reliability in individuals with SUD²⁸. At all administrations, the PANAS was administered with the timeframe “in the past week” and yielded total NA and PA scales.

Data Analysis

Studies 1 and 2 were compared on baseline demographic and clinical scores using *F* tests and chi-square tests to determine whether data could be combined. Correlations between baseline NA and PA, baseline frequency of substance use in past 28 days, and study outcomes were calculated. Bivariate logistic regression tests were used to test whether baseline NA or PA predicted dichotomous indicators of treatment outcome: whether

individuals completed treatment and were abstinent in the last week, and whether they achieved at least 3 weeks of cocaine abstinence. To examine the relationship between baseline NA and PA scores and cocaine use during treatment, mixed effects models with weekly self-reported cocaine use as the dependent variable and time, treatment condition, their interaction, study, baseline cocaine use frequency, and baseline NA or PA scores were conducted. These and all subsequent mixed models included participant as a random factor with random intercept and a variance components covariance structure.

To examine change in NA and PA during treatment, mixed effects regression models were used with weekly NA or PA scores as the dependent variable and predictor variables including time, treatment condition, their interaction, study, and baseline NA or PA scores. To evaluate whether weekly NA or PA scores were associated with weekly cocaine use, mixed effects models were conducted with weekly cocaine use frequency as the dependent variable and predictor variables including time, treatment condition, their interaction, baseline cocaine use frequency, study, and weekly NA or PA scores as time-varying covariates. For interpretation, a two-tailed alpha level was used in all analyses ($p < .05$).

Results

Sample Description

Baseline characteristics are summarized by study in Table 1. The combined sample was 57.9% female ($N = 81$) and the majority were Caucasian (51.4%, $N = 72$) with smaller numbers of participants identifying as African-American (37.1%, $N = 52$), Hispanic (9.3%, $N = 13$), Native American (1.4%, $N = 2$), or multiracial (0.7%, $N = 1$). The majority of participants had a high school education or GED (70.0%, $N = 98$) and were unemployed (75.7%, $N = 106$). The mean age was 41.81 ($SD = 9.29$) and participants had been using cocaine for a mean of 12.25 ($SD = 8.74$) years. Study samples did not differ in duration of cocaine use disorder, lifetime mental health diagnoses, or recent marijuana or cigarette use. Participants in Study 2 were more likely to be Caucasian, on public assistance, or unemployed, and reported more frequent cocaine use and less frequent alcohol use. Rates of treatment completion did not differ. Study 2 participants had fewer self-reported days of abstinence and more cocaine-positive urine toxicology screens.

No study differences were observed in baseline NA scores (Table 1). Mean NA scores for the combined sample ($M = 23.07$, $SD = 8.90$) were similar to other treatment-seeking individuals with SUD^{29,30} although slightly lower than psychiatric inpatients³ and individuals with depression³¹.

Participants in Study 2 reported lower baseline PA than participants in Study 1. Participants in Study 2 had mean PA levels similar to other methadone-maintained populations ($M = 25.8$ and 26.4 for two groups, SD not reported³²). Participants in Study 1 had mean PA levels similar to other samples of treatment-seeking individuals with SUD at baseline: $M = 31.05$, $SD = 8.84$ ³⁰ and $M = 30.00$, $SD = 8.50$ ²⁹.

Baseline PANAS NA and PA, Pre-Treatment Cocaine Use and Treatment Outcome

We first examined the relationship between baseline NA and PA and indicators of pre-treatment cocaine use (hypotheses 1a-b). Baseline NA scores were not associated with cocaine-positive urine toxicology screen at baseline ($t(137) = -1.16, p = .25$, 95% confidence interval of the difference $[-5.35, 1.40]$) nor with cocaine use in the 28 days prior to treatment ($r = .09, p = .28, n = 140$). Consistent with hypotheses, baseline PA scores were negatively associated with cocaine-positive urine toxicology screen at baseline ($t(136) = 3.36, p < .01$, 95% confidence interval of the difference $[2.23, 8.59]$) and with self-reported cocaine use in the 28 days prior to treatment ($r = -.25, p < .01, n = 139$).

Baseline NA and PA scores were also examined for their relationship to indicators of treatment outcome. Higher baseline NA scores were associated with fewer days retained in treatment ($r = -.25, n = 139$), a shorter maximum duration of cocaine abstinence during treatment ($r = -.20, n = 136$), and more cocaine-positive urine toxicology screens during treatment ($r = .17, n = 130$, all $p < .05$). Similarly, lower baseline NA was associated with completing treatment and being abstinent in the last week ($B = -0.07, SE B = 0.03, \chi^2(1, N = 123) = 5.75, p = .02, \beta = 0.93$, 95% CI $[0.88, 0.99]$), although there were no statistically significant baseline NA differences in those who achieved 3 consecutive weeks of cocaine abstinence and those who did not ($B = -0.04, SE B = 0.02, \chi^2(1, N = 140) = 3.19, p = .07, \beta = 0.96$, 95% CI $[0.92, 1.00]$). Baseline PA was associated with more days of cocaine abstinence ($r = .33, n = 138$), greater maximum duration of cocaine abstinence ($r = .34, n = 135$), and fewer cocaine-positive urine toxicology screens ($r = -.30, n = 129$, all $p < .05$). Higher baseline PA scores characterized those who completed treatment and were abstinent in the last week ($B = 0.11, SE B = 0.03, \chi^2(1, N = 122) = 14.38, p < .01, \beta = 1.12$, 95% CI $[1.06, 1.19]$) and those who achieved at least 3 weeks of cocaine abstinence ($B = 0.09, SE B = 0.03, \chi^2(1, N = 139) = 13.03, p < .01, \beta = 1.09$, 95% CI $[1.04, 1.15]$). Correlations between baseline PANAS and age at first substance use, years of substance use, and days of marijuana or cigarette use in the past 28 days were nonsignificant.

To evaluate whether baseline NA or PA scores were related to self-reported cocaine use during treatment (hypotheses 2a-b) mixed-effects regression analyses were conducted (Table 2). The effects of study were significant, with greater cocaine use in the methadone sample. The effect of time was significant with negative estimates of fixed effects, indicating cocaine use decreased over time. Effects for baseline NA scores were nonsignificant. However, higher baseline PA was associated with less cocaine use during treatment.

Change in NA and PA during Treatment

To evaluate change in affect during treatment, mixed effects regression models were conducted with weekly NA and PA as the dependent variables and time, treatment condition (CBT vs TAU), their interaction, study, and baseline NA or PA scores as fixed effects and subject as a random effect (Table 2; hypotheses 3a-b). For NA, there was a significant effect for time with a negative fixed effects estimate indicating NA reduced during treatment. Higher baseline NA was correlated with higher NA during treatment. There was no effect for treatment condition. For PA, there was no effect for time or treatment condition, although

higher PA occurred in the outpatient study and higher baseline PA score was correlated with higher PA during treatment.

Relationship between Weekly NA and PA Score and Weekly Cocaine Use

Figure 1 presents weekly NA and PA scores for individuals who did or did not establish at least three weeks of cocaine abstinence during treatment. Higher PA scores occurred among those who had at least three weeks of cocaine abstinence. To evaluate the relationship between NA and PA and weekly cocaine use, mixed effects models were conducted with weekly cocaine use frequency as the dependent variable and time, treatment condition, their interaction, study, baseline cocaine use frequency, and weekly NA or PA scores as time-varying covariates and subject as a random factor (Table 3; hypotheses 4a-b). Baseline cocaine use frequency and being in the methadone sample were associated with weekly cocaine use, however, neither time, treatment condition, nor their interaction was associated with weekly cocaine use. Higher weekly PANAS NA scores were associated with weekly cocaine use ($\beta = 0.02$, $SE = 0.01$, $t(733.85) = 2.44$, $p = .02$), although weekly PANAS PA scores were not associated with weekly cocaine use.

Discussion

In this secondary analysis of PANAS scores and their relationship to cocaine use in a combined sample of individuals from two randomized clinical trials of computerized CBT, primary findings were as follows: at baseline, NA scores were high and PA scores were low relative to healthy control samples, but consistent with other substance-using samples. Baseline NA was not associated with cocaine use before or during treatment, although baseline PA was negatively associated with cocaine use before and during treatment. NA decreased during treatment, although PA did not change. When including baseline cocaine use frequency, NA scores, and PA scores, computerized CBT was not associated with reduced cocaine use in contrast to previous trials²³. As hypothesized, higher weekly NA scores were associated with weekly cocaine use, although no such relationship was found for PA scores.

Baseline PA was negatively associated with cocaine use prior to and during treatment, consistent with other studies^{13,15,33}. While causality cannot be inferred, this is consistent with theory that low PA (anhedonia) may be a risk factor for stimulant use disorder¹⁰. Given the potentially damaging effect of anhedonia, future treatment development might include bolstering CBT by enhancing PA early in treatment, as demonstrated by Stasiewicz²² and as suggested by two groups who proposed adding behavioral activation³⁴ to reduce anhedonia^{8,10}.

During treatment, NA scores reduced, consistent with hypotheses. CBT was not differentially associated with reduced NA, in contrast to findings that NA reduced after CBT with affect regulation training (in simple slope analyses)²², an intensive multi-modal treatment including CBT¹⁹, and a coping CBT module²¹. The computerized CBT in this study did not specifically focus on affect regulation, was less intensive than Magura's protocol that included self-esteem enhancement, and used a smaller sample than Witkiewicz, reducing power to detect interaction effects.

Although a graph showed that higher weekly PA scores occurred among those who established at least three weeks of cocaine abstinence (Figure 1), the mixed model including baseline cocaine use frequency indicated that during treatment, the level of PA an individual experienced each week did not significantly correlate with their weekly cocaine use (Table 3). It was surprising that distal baseline PA was related to weekly cocaine use in other analyses, but weekly PA fluctuation was not correlated with cocaine use. However, higher weekly NA scores were associated with weekly cocaine use. This may be due to the relationship between cocaine withdrawal and negative mood.

To our knowledge, this is the first study of NA and PA in cocaine use disorder treatment using data from well-controlled randomized controlled trials. Data from two parallel trials increased power and sample heterogeneity, but also may influence generalizability of results: baseline PA levels in each sample were similar to levels in outpatient or methadone samples. Some study effects occurred in mixed models, and the inclusion of individuals from the methadone clinic sample, who were more clinically severe at baseline, may make results less generalizable. Caution should be used in extrapolating findings to non-methadone-using outpatient samples. The level of temporal resolution in these data did not permit testing to see if change in NA or PA temporally preceded cocaine use; however, this is an important question for future studies.

Why might baseline PA matter in cocaine use disorder treatment? Baseline PA was negatively associated with baseline cocaine use, suggesting individuals with higher PA scores may already have been on an upward trajectory. However, baseline PA maintained its negative association with cocaine use during treatment even when including baseline cocaine use. A second possible explanation is that individuals with higher PA were able to avoid substance use via the association of PA scores with a third variable such as reduced craving or desire for drugs²⁹, increased abstinence-supportive social support¹³, or self-efficacy for abstinence¹³. This is also consistent with findings that anhedonia was associated with craving in individuals with SUD³⁵. Further research that assesses affect concurrently with cocaine use and with craving, social support, or self-efficacy is indicated. If further studies replicate this study's relationship between baseline PA and reduced cocaine use, clinical service providers may need to focus on enhancing PA early in treatment.

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Figure 1.
Weekly NA and PA Scores in Individuals who Did or Did Not Establish Three Weeks of Cocaine Abstinence

Note. *N* for NA = 140, 917 observations. *N* for PA = 140, 912 observations.

Table 1

Sample Description by Study

	Study 1		Study 2		t/χ^2	df	p
	<i>n</i>	%	<i>n</i>	%			
Female	21	51	60	61	1.05	1	.31
Race and Ethnicity *							
White	12	29	60	61	12.50	4	.01
African American	23	56	29	29			
Hispanic	5	12	8	8			
Native American	1	2	1	1			
Multiracial	0	0	1	1			
Less than High School Education	13	32	29	29	0.08	1	.78
Married / Committed Relationship	6	15	12	12	0.16	1	.69
Criminal Justice Referral	13	32	2	2	26.71	1	<.01
On Public Assistance	16	39	77	78	19.53	1	<.01
Unemployed	16	39	90	91	42.45	1	<.01
Lifetime Alcohol Use Disorder	28	68	71	72	0.16	1	.69
Lifetime Major Depression	9	22	28	28	0.60	1	.44
Lifetime Anxiety Disorder	11	27	32	32	0.41	1	.52
Antisocial Personality Disorder	7	17	7	7	3.22	1	.07
Study Completer	26	63	69	70	0.53	1	.47
Cocaine-neg. urine at baseline	20	49	17	17	14.63	1	<.01
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	df	<i>p</i>
Age	41.22	8.76	42.05	9.53	-0.48	138	.63
Years of Cocaine Use	14.13	9.06	11.46	8.53	1.65	138	.10
Days of Drug Use in Past 28 Days							
Cocaine	7.61	7.76	14.59	9.31	-4.23	138	<.01
Alcohol	4.34	7.40	0.40	0.49	5.29	138	<.01
Marijuana	1.66	6.10	2.53	6.42	-0.74	138	.46
Cigarettes	23.85	8.72	25.02	8.34	-0.74	138	.46
Percent Days Abstinent in Study	82.85	18.89	60.26	30.05	4.45	134	<.01
Percent Cocaine-positive Urines	48.45	42.77	75.39	32.69	-3.91	128	<.01
PANAS NA – baseline	23.93	9.19	22.72	8.80	0.73	138	.47
PANAS PA – baseline	31.35	8.98	26.94	8.31	2.77	137	.01

Note.

* 50% of the cells have expected counts of <5, making the statistical value invalid. Bold text denotes statistical significance at $p < .05$. Lifetime alcohol use disorder, major depression, anxiety disorder, and antisocial personality disorder were determined with the Structured Clinical Interview for DSM-IV. PANAS = Positive and Negative Affect Scale. NA = negative affect. PA = positive affect

Table 2.
Change in Weekly Cocaine use and Weekly NA and PA Scores Across Time (Treatment Weeks 1-8)

Outcome	Variable	N, Obs.	Num. Df	Den. df	F	p	Fixed effects β	Standard Error β	95% CI LB	95% CI UB
Weekly cocaine use	Intercept	140, 1094	1	139.48	0.03	.85	0.08	0.51	-0.93	1.10
	Treatment Condition		1	194.16	1.34	.25	-0.35	0.31	-0.96	0.25
	Study		1	135.14	6.88	.01	0.09	0.03	0.02	0.15
	Time		1	956.77	6.01	.01	-0.02	0.02	-0.07	0.03
	Baseline Cocaine Use		1	134.06	50.67	<.01	0.11	0.02	0.08	0.14
Weekly cocaine use	Time X Treatment Condition		1	956.78	1.42	.24	-0.04	0.04	-0.12	0.03
	Baseline NA		1	135.24	0.64	.42	0.01	0.02	-0.02	0.04
	Intercept	139, 1086	1	137.06	4.36	.04	1.53	0.66	0.21	2.84
	Treatment Condition		1	194.43	1.34	.25	-0.35	0.30	-0.95	0.25
	Study		1	134.57	5.06	.03	0.07	0.03	0.01	0.14
NA	Time		1	950.11	5.84	.02	-0.02	0.02	-0.07	0.03
	Baseline Cocaine Use		1	133.37	46.56	<.01	0.11	0.02	0.08	0.14
	Time X Treatment Condition		1	950.02	1.42	.23	-0.04	0.00	-0.12	0.03
	Baseline PA		1	133.87	4.47	.04	-0.04	0.02	-0.07	0.00
	Intercept	128, 777	1	122.88	33.91	<.01	6.71	1.41	3.92	9.51
PA	Treatment Condition		1	178.67	0.12	.72	0.37	1.05	-1.70	2.44
	Study		1	114.30	2.66	.11	1.68	1.03	-0.36	3.72
	Time		1	658.78	11.32	<.01	-0.27	0.10	-0.46	-0.08
	Time X Treatment Condition		1	658.17	0.15	.70	0.06	0.14	-0.23	0.34
	Baseline NA Score		1	118.53	117.57	<.01	0.58	0.05	0.47	0.68
PA	Intercept	127, 768	1	127.99	15.85	<.01	5.99	1.87	2.28	9.70
	Treatment Condition		1	179.53	0.12	.73	0.40	1.16	-1.88	2.69
	Study		1	121.17	4.49	.04	2.51	1.18	0.16	4.85
	Time		1	656.62	0.48	.49	-0.04	0.10	-0.24	0.16
	Time X Treatment Condition		1	656.41	0.03	.87	-0.02	0.15	-0.32	0.27
	Baseline PA Score		1	121.83	130.38	<.01	0.69	0.06	0.57	0.81

Note. NA = negative affect. PA = positive affect. obs. = observations in model. Num. = numerator. Den. = denominator. CI = confidence interval. LB = lower bound. UB = upper bound. Treatment condition fixed effects β indicates the effect of CBT treatment condition.

Mixed Model Examining Weekly Cocaine Use Frequency with Time-Varying PANAS Scores

Table 3

Variable	N, obs.	Num.	Den.	F	p	Fixed effects β	Standard Error	Fixed Effects β	95% Confidence Interval	
									Lower Bound	Upper Bound
Intercept	128, 770	1	246.12	0.73	.39	0.84	0.36		0.12	1.55
Treatment Condition		1	171.81	0.27	.60	-0.16	0.31		-0.76	0.44
Study		1	119.11	9.30	<.01	-0.99	0.33		-1.64	-0.35
Time		1	660.12	1.89	.17	0.00	0.03		-0.05	0.05
Time X Treatment Condition		1	653.44	2.08	.15	-0.05	0.04		-0.13	0.02
Baseline Cocaine		1	121.44	49.44	<.01	0.11	0.02		0.08	0.14
Time-Varying NA		1	733.85	5.95	.02	0.02	0.01		0.00	0.04
Intercept	128, 766	1	323.58	1.26	<.01	1.69	0.40		0.90	2.49
Treatment Condition		1	170.83	0.32	.57	-0.17	0.30		-0.77	0.43
Study		1	118.28	7.09	.01	-0.86	0.32		-1.50	-0.22
Time		1	649.79	3.69	.06	-0.01	0.03		-0.07	0.04
Time X Treatment Condition		1	649.62	1.61	.21	-0.05	0.04		-0.13	0.03
Baseline Cocaine		1	120.53	52.16	<.01	0.11	0.02		0.08	0.14
Time-Varying PA		1	686.64	3.55	.06	-0.02	0.01		-0.03	0.00

Note. PANAS = Positive and Negative Affect Scale. obs. = observations in model. Num. = numerator. Den. = denominator. Cocaine use is operationalized as days of self-reported cocaine use each week. Baseline cocaine use is operationalized as days of self-reported cocaine use in the 28 days prior to study start. NA = negative affect. PA = positive affect. Bold text denotes statistical significance at $p < .05$.