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Practice Makes Progress? Homework Assignments and Outcome in Treatment of Cocaine Dependence

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Abstract

The relationship between treatment outcome and the extent to which participants completed homework assignments was evaluated among 60 cocaine-dependent individuals assigned to cognitive-behavioral therapy (CBT). Homework was assigned in 72% of all sessions and initiated by participants in 48% of the sessions in which it was assigned. Completion of homework was unrelated to participants' baseline characteristics and several indicators of treatment compliance. Participants who completed more homework assignments demonstrated significantly greater increases in the quantity and quality of their coping skills and used significantly less cocaine during treatment and through a 1-year follow-up. These data suggest that the extent to which participants are willing to complete extrasession assignments may be an important mediator of response to CBT.

Keywords

cognitive-behavioral therapy; substance dependence; practice assignments; mediators; mechanisms of action

Cognitive-behavioral therapy (CBT) approaches have comparatively high levels of empirical support across a wide range of mental disorders, and accumulating evidence points to the durability of CBT's effects after treatment ends as a particularly salient feature of CBT (Hollon, 2003). Distinctive features that may contribute to CBT's durability include its emphasis on skills training and strategies for modifying behaviors or cognitions that may play a role in perpetuating problems. In turn, effective acquisition, mastery, and generalization of new behaviors may require that they be practiced outside of treatment. Hence, CBT manuals routinely emphasize extrasession practice, through homework assignments, to encourage implementation and rehearsal of skills outside of sessions.

Homework assignments have been seen as a critical, but understudied, component of CBT for a variety of disorders for which it has been shown to be effective. Early studies that evaluated the role of homework assignments in improving treatment outcome had a number of methodological limitations and often produced inconsistent results. These included failures to evaluate (a) the degree to which therapists assigned homework adequately and consistently; (b) prospectively, the degree to which participants completed assignments (i.e., rather than relying on therapists' retrospective recall); (c) the quality of completion of homework assignments; and (d) the role of possible confounding variables (e.g., symptom severity, motivation) in homework compliance (Primakoff, Epstein, & Covi, 1986). Recent studies have significantly addressed these limitations and have generally found positive relationships between homework completion and outcome in CBT (Bryant, Simons, & Thase, 1999; Burns & Spangler, 2000).

Although accumulating empirical evidence supports the efficacy and durability of CBT for substance use disorders, and homework assignments are a recommended component of virtually all CBT manuals for substance use disorders, the relationship of homework to outcome has received very little evaluation in the substance abuse literature. Using data from a randomized clinical trial evaluating CBT, interpersonal psychotherapy (IPT), and disulfiram for cocaine dependence (Carroll et al., 2004), we evaluated the relationships among participants' completion of homework, skills acquisition, and treatment outcome in CBT. We first conducted exploratory analyses to evaluate (a) the type of participants who were more likely to do homework assignments, (b) therapist variables associated with homework completion, and (c) the relationship between compliance with homework and other process variables. Next, two primary hypotheses were evaluated: First, we hypothesized that better compliance with homework would be related to higher levels of participants' acquisition of coping skills. Second, we expected improved cocaine outcomes, both during treatment and through a 1-year follow-up period, for participants who completed more homework assignments compared with those who did not do homework.

Method

Data for this report come from a 2×2 factorial randomized clinical trial in which 121 cocaine-dependent individuals were assigned to either CBT or IPT and to either disulfiram or placebo (Carroll et al., 2004) delivered over 12 weeks. Participants were recruited from treatment-seeking individuals who met the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*; American Psychiatric Association, 1994) criteria for current cocaine dependence and who provided written informed consent. Homework assignments were not a component of IPT, and thus the remainder of this article focuses only on the 60 individuals randomized to manual-guided CBT (Carroll, 1998), which was delivered by nine doctoral-level therapists. Material discussed during sessions was supplemented with extrasession homework tasks that were intended to foster practice of coping skills. Preprinted homework assignment sheets were provided in the manual for each session topic and included reminders and review of key points for each topic.

Participants completed an assessment battery before treatment, weekly during treatment, at the 12-week treatment endpoint, and at 3-month intervals through 1 year by independent clinical evaluators who were unaware of the participants' treatment condition. The primary outcome measures were frequency of cocaine use and results of urine toxicology screens. The Substance Abuse Calendar, which is similar to the Timeline Follow Back method, was administered weekly during treatment to collect detailed day-by-day self-reports of substance use through the 84-day treatment period. Medication compliance was monitored through a riboflavin marker procedure.

The Cocaine Risk Response Test (CRRT; Carroll, Nich, Frankforter, & Bisighini, 1999) was used to assess changes in coping skills. This test involves audiotaping participants' responses to 10 situations that are commonly associated with relapse to cocaine use; responses are scored as to their quality and the specific type of response articulated, and the CRRT has been shown to have very good reliability and predictive validity (Carroll et al., 1999). The Cocaine Use Inventory (CUI), an adaptation of the Situational Confidence Questionnaire (Breslin, Sobell, Sobell, & Agrawal, 2000), was used to assess participants' self-rated confidence in a variety of high-risk situations for cocaine use. The working alliance was assessed after the second session using the client and therapist versions of the Working Alliance Inventory (Horvath & Greenberg, 1986).

All therapy sessions were videotaped for ongoing supervision as well as for independent evaluation of therapist fidelity to manual guidelines and therapist skill. Five hundred eight

videotapes were rated by evaluators who were masked to the participants' treatment condition, using the Yale Adherence and Competence Scale (YACS; Carroll et al., 2000), which indicated that the study treatments were highly discriminable. The CBT Scale of the YACS, which encompasses six items (e.g., providing training in specific skills, conducting functional analyses), includes two items pertaining specifically to homework: One item assesses the therapist's interventions relating to assigning homework for the next session (e.g., selecting and agreeing on an assignment, discussing the rationale for homework) and the other evaluates the therapist's focus on the participant's experience with the previous week's homework (e.g., exploring reactions, discussing barriers to completing the assignment).

Homework completion was assessed by a weekly clinician session report form, in which clinicians reported whether they had reviewed the participants' homework from the previous session. If homework had been reviewed, the therapist recorded whether, in their judgment, the participant had (a) made no attempt to do the assignment, (b) made some attempt but did not fully complete the assignment, or (c) completed the assignment successfully. Compliance with homework assignments was treated both as a continuous variable (percentage of homework assignments attempted or completed) and as a categorical variable with three levels ("noncompleters," participants who never did homework; "attempters," those who only attempted but did not complete any homework assignments; and "completers," those who completed homework at least once) to facilitate analysis of variance (ANOVA) and chi-square comparisons of baseline variables and treatment process by participants' levels of homework completion. Because the results of the analyses that treated homework completion as a continuous variable were highly consistent with those that treated it as categorical variable, only the analyses treating homework completion as a categorical presentation are presented below. Repeated measures ANOVAs were used to evaluate the relationship among homework completion, skills acquisition, confidence, and within-treatment, cocaine-use outcomes. Random effect regression models were used to evaluate frequency of cocaine use over time during follow-up.

Results

Of 60 individuals randomized to CBT, 57 initiated treatment, 54 completed more than one treatment session and 50 had homework assigned. Twenty-seven of the 50 participants randomized to CBT who were assigned homework completed treatment; of the 23 participants who did not begin or who dropped out of treatment, 19 were successfully tracked and interviewed for the posttreatment assessment. Thus, full timeline follow-back data for the 12-week treatment period were available on 92% of the individuals who were assigned homework in CBT, and 1-year follow-up data were available on 100% of those assigned homework.

Of the 50 participants who were assigned homework, 43 attempted or completed homework and 26 of those completed homework once or more during treatment, on the basis of the therapists' weekly session reports. Homework was assigned by therapists in 72% of all sessions, was attempted or completed by participants in 48% of sessions where it was assigned, and was fully completed in 24% of the sessions in which it had been assigned. Tables 1 and 2 present participant demographic and baseline characteristics by homework completion, treated as a categorical variable. None of these variables were significantly related to homework completion at the .05 level.

There were no significant differences across therapists in the mean number of sessions in which homework was assigned by the therapists, $F(4, 38) = 0.73, p = .58$; the percentage of their participants who completed homework, $F(4, 38) = 2.10, p = .72$; or in their overall percentage of sessions in which homework was attempted or completed, $F(4, 38) = 0.65, p = .63$. The therapists' reports of whether they had assigned homework for the next session closely matched

the independent raters' ratings regarding whether homework had been assigned in that session, $F(1, 271) = 43.20, p < .001$. Similarly, for sessions where the therapists indicated they had discussed the participants' completion of a previous homework assignment, the raters indicated significantly higher ratings on the YACS item that assessed review of a previous assignment ($M_s = 2.6$ vs. 1.5 , respectively), $F(1, 271) = 52.20, p < .001$. There were also strong associations between participants' compliance with homework assignments and ratings of the therapists' overall CBT adherence and skill. That is, compared with session in which homework was not done, there were significantly higher ratings mean ratings of CBT adherence (2.7 vs. 2.2), $F(1, 270) = 20.10, p < .001$, and skill (4.5 vs. 4.2), $F(1, 264) = 8.50, p < .001$, for those sessions in which homework had been completed or attempted, as measured by the six-item CBT Scale of the YACS. As shown in Table 3, homework completion was significantly related to retention, as measured by the number of treatment sessions completed. However, the extent to which participants completed assignments was not strongly associated with other markers of compliance such as total number of weeks in treatment or medication compliance. Level of homework completion was not significantly related to the working alliance from the participants' perspective but was associated with the alliance from the therapists' perspective.

Acquisition of coping skills was assessed before and after treatment by independent ratings of quality and type of coping responses on the CRRT role-playing task. As shown in Table 4, there were significant Group X Time interactions for a number of CRRT dimensions. These interactions suggest that there were greater increases across time in the quality of participants' coping responses and greater reductions in the number of situations in which the participants indicated they were likely to use cocaine, with post hoc Tukey's tests indicating that those completing homework had significantly better responses than those who did not do homework or those who only attempted homework. Similarly, self-reported confidence in a range of high-risk situations, as measured by the CUI, suggested that participants who completed homework reported significantly greater increases in confidence than those who did not do or only attempted homework.

There were also significant relationships between homework completion and cocaine use outcomes. As shown in Table 5, participants who completed homework had a significantly higher percentage of days abstinent from cocaine during treatment and tended to have a higher percentage of cocaine-free urine specimens ($p = .09$) than those who did not do or who only attempted homework. Similarly, the participants' longest period of consecutive abstinence during the 12-week treatment period was strongly associated with their level of homework completion.

Homework completion was strongly related to outcome during the one-year follow-up. As shown in Figure 1, which provides estimates from random regression analyses evaluating frequency of cocaine use across the 1-year follow-up by level of homework completion, participants who completed or attempted homework during treatment used cocaine significantly less frequently during follow-up than those who did not do homework (Homework X Time $z = 2.04, p = .04$). Moreover, the relationship between doing any homework and long-term outcome remained significant even after including number of sessions completed in the model as a covariate (Homework X Time $z = 2.1, p = .04$; covariate $z = 2.6, p = .01$).

Discussion

This evaluation of the role of homework in CBT for cocaine dependence suggests that completion of homework was associated with greater increases in the quantity and quality of coping skills as well as significantly less cocaine use during treatment and through a 1-year follow-up, with best outcomes seen among those who completed homework with some consistency. These results thus provide support of homework as a possible mechanism of action

(i.e., a mediator–process associated with therapeutic change) of CBT in this sample, in that several of the requirements for inferring this relationship (Barron & Kenny, 1986; Kraemer, Wilson, Fairburn, & Agras, 2002) were met: First, data were drawn from a randomized, controlled trial of CBT in which there was a significant main effect of treatment (Carroll et al., 2004), as participants assigned to CBT had significantly greater reductions in the frequency of cocaine use compared with IPT. Second, higher levels of homework completion were associated with significantly greater improvement in coping skills and participants' reported confidence in dealing with high-risk situations, which are consistent with the theoretical underpinnings of CBT for substance use. Finally, completion of homework assignments was strongly associated with immediate posttreatment and 1-year cocaine outcomes, even after controlling for retention.

This inference is also supported by the relative lack of evidence that homework involvement was strongly associated with other variables that might account for the relationship between homework completion and treatment outcome. Completion of homework was not significantly associated with any particular participant characteristic or feature typically associated with differential treatment outcomes, or with participant characteristics that might be expected to be associated with willingness or ability to engage in homework, including educational level, baseline level of coping skills, self-efficacy, source of referral, or level of motivation. Although completion of homework was significantly associated with the number of sessions completed, it was not strongly associated with other indicators of compliance. Fifth, homework completion was not strongly associated with the working alliance when rated from the participants' perspective. That is, participants appeared willing to do homework regardless of the degree to which they reported liking their therapist or indicating the relationship was helpful to them. Completion of homework assignments was, however, significantly related to the working alliance from the perspective of the therapists. Although this might suggest that the therapists were more likely to encourage homework completion in the context of what they perceived as more positive working relationships, it is also possible that the therapists may have perceived participants' willingness to do homework as an indicator that treatment was going well.

Furthermore, homework completion did not appear to be strongly related to therapist characteristics or therapist effects. The degree to which participants completed homework was, however, significantly associated with the degree to which therapists emphasized the importance of homework and spent time reviewing homework assignments, as confirmed by ratings of session tapes by the independent evaluators. Moreover, completion of homework was strongly associated with therapists' overall levels of CBT adherence and competence, suggesting important relationships between general levels of fidelity and skill in implementing CBT and homework completion.

This study addressed several methodological issues noted in previous research, in that homework completion was assessed prospectively and at multiple time points, therapists' self-reports of the degree to which they assigned homework were consistent with ratings from independent evaluators, process variables that might covary with homework completion were assessed, and acquisition of coping skills was measured through independent ratings of skill on a role-play task, not solely through participants' self-reports, which might have been subject to demand characteristics or covaried with participants' perceptions of their own symptomatic improvement. However, it should be noted that important limitations preclude strong inferences of a causal relationship between homework completion and cocaine use outcomes in this trial. First, homework completion was not manipulated in this study. Inferring a causal relationship would require a design where some participants were assigned homework and others not (Kazdin & Nock, 2003). Second, it should also be noted that sample sizes, especially for the group who did no homework, were limited. Although this was addressed to some extent by the strategy of treating homework compliance as both a categorical and continuous variable,

the findings require replication with a larger sample. Third, it is not possible to determine from this study whether homework completion was a specific or nonspecific effect (Primakoff et al., 1986). That is, it cannot be concluded whether the apparent therapeutic benefit of doing homework was associated with participants' practice of specific CBT skills outside of sessions or related to a more general willingness to carry aspects of the therapy into their lives outside the sessions. Nevertheless, these data are significant in that they represent the first evaluation of the importance of homework assignments in CBT for substance dependence and suggest that completing homework may have a strong association with better immediate and long-term outcomes.

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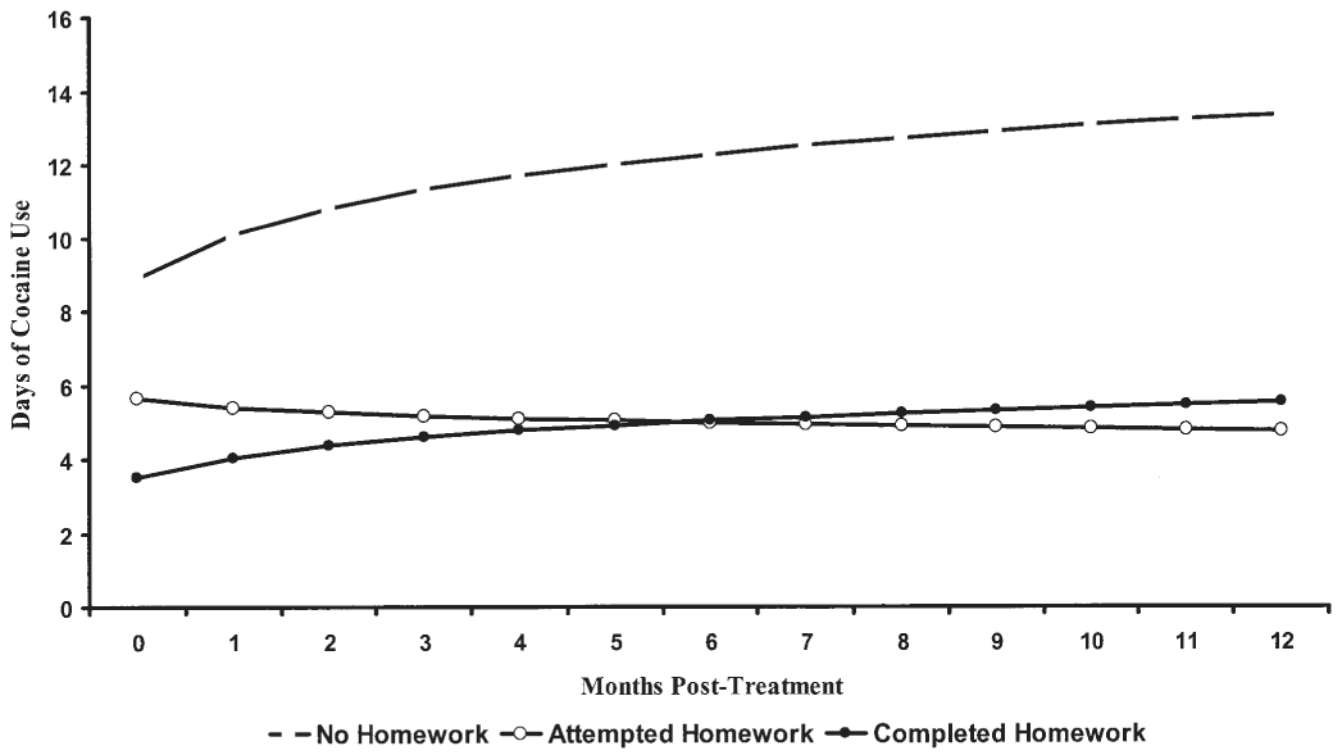


Figure 1. Estimates (based on random regression analyses) of cocaine use during 1-year follow-up by level of homework completion and by month.

Table 1
Demographic and Baseline Characteristics by Level of Homework Completion

Variable	Level of homework completion (%)			χ^2
	None	Attempters	Completers	
Female	42.8	11.7	23.0	2.8
Ethnicity				
African American	42.8	29.4	23.0	2.9
Hispanic American	14.3	11.7	3.8	
European American	42.8	58.8	73.1	
Single or divorced	71.4	76.4	76.9	0.1
Unemployed	57.1	41.1	34.6	1.2
Referred to treatment by criminal justice system	28.5	11.7	19.2	1.0
On probation or parole	28.5	29.4	23.0	0.2
Education level				
Did not complete high school	42.8	11.7	19.2	3.1
High school graduate	28.5	35.2	34.6	
Some college	28.5	52.9	46.1	
Any previous substance abuse treatment	57.1	41.1	61.5	1.8
Meet lifetime DSM-IV criteria for the following:				
Alcohol abuse or dependence	71.4	64.7	84.6	2.3
Any Axis I affective disorder	42.8	23.5	42.3	1.7
Any Axis I anxiety disorder	28.5	17.6	23.0	0.4
Antisocial personality disorder	42.8	35.2	46.1	0.8
Other personality disorder	71.4	41.1	53.8	3.3

Note. $ns = 7, 17, \text{ and } 26$ for noncompleters, attempters, and completers, respectively, except for CRRT scores, where $ns = 4, 11, \text{ and } 19$, respectively, due to failure of some participants to complete items. DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994); CRRT = Cocaine Risk Response Test (Carroll, Nich, Frankforter, & Bisighini, 1999; number of plans indicate total number of coping plans articulated across 10 situations).

Table 2
Baseline Psychosocial Functioning and Substance Use Variables by Level of Homework Completion

Variable	Level of homework completion					
	None		Attempters		Completers	
	M	SD	M	SD	M	SD
Age (years)	33.9	5.4	32.2	6.6	36.8	7.5
Days of cocaine use, prior 28	14.6	10.3	13.6	13.6	14.9	8.6
Years of regular cocaine use	7.2	5.0	9.6	9.6	12.3	7.6
ASI composite scores						
Medical	0.17	0.16	0.04	0.11	0.06	0.13
Legal	0.11	0.19	0.11	0.20	0.13	0.21
Employment	0.65	0.30	0.40	0.19	0.45	0.26
Alcohol	0.05	0.07	0.13	0.19	0.19	0.20
Drugs	0.07	0.13	0.03	0.06	0.03	0.04
Psychiatric	0.25	0.26	0.15	0.15	0.18	0.16
Family/social	0.26	0.09	0.24	0.13	0.32	0.18
URICA scores						
Precontemplation	14.7	4.3	13.9	3.3	13.7	4.7
Contemplation	37.3	3.0	34.4	3.0	36.4	2.9
Action	35.9	2.7	32.1	3.4	33.4	4.4
Maintenance	30.7	2.8	26.7	5.2	31.6	5.0
CUI scores	2.8	0.6	3.6	0.9	2.7	0.8
Baseline coping skills (CRRT)						
Number of plans	6.0	2.1	6.3	2.1	5.3	2.4
Quality of coping plans	2.7	0.5	3.3	0.5	2.7	0.8

Note. Quality of CRRT plans ratings range from 1 to 7 and are averaged over 10 situations. *ns* are 7, 17, and 26 for noncompleters, attempters, and completers, respectively, except for CRRT scores, where *ns* are 4, 11, and 19, respectively, because of the failure of some participants to complete items. ASI = Addiction Severity Index (McLellan et al., 1992); composite scores range from 0 to 1, with higher scores indicating more problems); URICA = University of Rhode Island Change Assessment (DiClemente & Hughes, 1990); scores range from 8 to 40); CUI = Cocaine Use Inventory (scores range from 1 [*would definitely use*] to 5 [*definitely would not use*], with higher scores indicating greater confidence); CRRT = Cocaine Risk Response Test (Carroll, Nich, Frankforter & Bisighini, 1999; number of plans indicates total number of coping plans articulated across 10 situations).

Table 3
Treatment Compliance and Working Alliance by Level of Homework Completion

Variable	Level of homework completion										F
	None			Attempters			Completers			dfs	
	M	SD		M	SD		M	SD			
Number of sessions completed	6.29	3.25		9.35	4.39		11.19	3.88		2, 47	4.40*
Weeks in treatment	6.53	3.30		8.26	4.74		9.81	3.86		2, 47	2.00
Medication compliance (M % urine samples that tested positive for riboflavin)	0.79	0.17		0.73	0.28		0.82	0.27		2, 37	0.52
WAI—Client Version											
Goals	6.10	1.09		6.15	0.58		5.96	0.87		2, 38	0.23
Tasks	5.89	1.09		6.17	0.50		6.10	0.57		2, 44	0.44
Bonds	5.79	0.92		5.97	0.63		6.02	0.78		2, 44	0.28
Total	5.96	1.05		6.15	0.50		6.02	0.68		2, 38	0.23
WAI—Therapist Version											
Goals	4.16	1.11		4.63	0.84		5.17	0.72		2, 45	3.98*
Tasks	4.48	0.94		4.38	0.73		5.17	0.66		2, 45	6.63**
Bonds	4.08	1.04		4.64	1.02		5.07	0.77		2, 45	3.63*
Total	4.24	0.98		4.55	0.81		5.14	0.68		2, 45	5.09*

Note. *ns* = 7, 14, 26 for noncompleters, attempters, and homework completers, respectively, except for WAI—Therapist Version, where *ns* = 6, 14, and 20, respectively, and WAI—Client Version, where *ns* = 6, 16, and 25, because of failure of some therapists and participants to complete forms. WAI = Working Alliance Inventory (Horvath & Greenberg, 1986; scores range from 1 to 7, with higher scores indicating better alliance).

* $p < .05$.

** $p < .01$.

Table 4
Changes in Coping Skills and Confidence in Responding to High-Risk Situations by Level of Homework Completion

Variable	Level of homework completion											
	None		Attempted		Completed		Group		Time		Group X Time	
	M	SD	M	SD	M	SD	df	F	df	F	df	F
Pretreatment	2.19	0.44	2.97	0.55	2.31	0.85	CRRT: Mean overall quality ratings					
Posttreatment	3.56	0.65	2.98	0.93	4.36	0.89	2, 26	1.35	1, 26	30.55**	2, 26	13.6**
Pretreatment	1.25	1.89	1.10	0.99	0.82	0.95	CRRT: Number of CBT responses					
Posttreatment	3.00	2.16	1.10	0.99	2.88	1.58	2, 28	2.95	1, 28	9.40*	2, 28	3.63*
Pretreatment	3.50	1.00	1.30	1.34	3.24	2.22	CRRT: Number of situations in which participants indicated they would use cocaine					
Posttreatment	2.25	1.71	1.70	2.00	0.64	0.86	2, 28	1.54	1, 28	7.15**	2, 28	6.97**
Pretreatment	2.93	0.49	3.16	0.67	2.83	0.84	CUI: Mean confidence ratings					
Posttreatment	3.38	0.51	3.44	0.83	4.03	0.95	2, 35	0.4	1, 35	13.32**	2, 35	4.29*

Note. For the CRRT, *ns* = 4, 10, 17 because of the failure of some participants to complete forms. Quality rating scores range from 1 to 7, with higher scores indicating better coping responses. *Ns* = 5, 13, and 17. Scores range from 1 to 5, with higher scores indicated higher confidence. CRRT = Cocaine Risk Response Test (Carroll, Nich, Frankforter, & Bisighini, 1999); CBT = cognitive-behavioral therapy; CUI = Cocaine Use Inventory.

* $p < .05$.

** $p < .01$.

Table 5
Cocaine Use Outcomes by Level of Homework Completion

Variable	Level of homework completion						F
	None		Attempters		Completers		
	M	SD	M	SD	M	SD	
% days abstinent from cocaine	0.61	0.37	0.81	0.22	0.87	0.13	2.45
% cocaine-free urine specimens	0.28	0.32	0.55	0.39	0.61	0.32	2.47
Longest period of consecutive abstinence from cocaine in days	14.0	14.2	17.8	16.5	37.9	27.2	2.45
							3.97*
							2.50***
							5.10

Note. *ns* are 6, 16, and 26, for the no homework, attempters, and completer groups, respectively.

* $p < .05$.

*** $p < .01$.