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ARTICLE

Effectiveness of Adjunct Therapies in Crack Cocaine Treatment

ALAN J. RICHARD, MPhil,* ISAAC D. MONTOYA, PhD CMC,†
ROBIN NELSON, PhD,‡ AND RICHARD T. SPENCE, PhD‡

*Affiliated Systems Corporation, Houston, TX;
†Affiliated Systems Corporation and Our Lady of the Lake University, Houston, TX;
‡Texas Commission on Alcohol and Drug Abuse, Austin, TX

Abstract—*Although intensive outpatient therapy is recommended for treatment of cocaine, psychosocial characteristics associated with crack cocaine abuse are also implicated in attrition from outpatient programs. Acupuncture, medications, and brainwave therapy (biofeedback), have all been used to encourage treatment retention and drug use outcomes. The effectiveness of three adjunct therapies in improving retention and drug use outcomes in intensive outpatient cocaine treatment was tested in a primarily young, indigent African-American sample of crack cocaine users at a community hospital in a low-income, high drug use neighborhood in Houston. Subjects were assigned to receive either neurobehavioral treatment alone or neurobehavioral with one of three adjunct therapies. These included acupuncture, anticraving medication, or brainwave therapy. Comparative results indicated that dosage of any adjunct therapy was associated with days in treatment and standard treatment sessions attended, and that standard treatment sessions attended was associated with negative urinalysis results at follow-up. None of the adjunct therapies were directly associated with drug use outcomes.*

Keywords—acupuncture;.adjunct therapies; biofeedback; bromocriptane; crack cocaine treatment; desipramine.

INTRODUCTION

THE DEMOGRAPHIC PROFILE OF COCAINE ABUSE has changed dramatically since the early 1980s. Once associated with wealth and status, cocaine is now among the most maligned of illegal substances. Although the changing image of cocaine can be at least partly attributed to racially-coded media campaigns waged during the so-called War on Drugs (Elwood, 1994), cocaine's "new" image also reflects a real change in the way cocaine is consumed, distributed, and positioned within the urban environment. Data from the 1991 National Household Survey, the most comprehensive source of information on drug use demographics in the United States, show that frequent cocaine users are now more likely to live in large metropolitan areas, to be young, and to be unemployed than were cocaine users responding to the same survey in 1985 (Gfoerer & Brodsky, 1993). Criminological literature suggests that cocaine use has become embedded in an urban "deviance syn-

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Requests for reprints should be addressed to Alan J. Richard at 3104 Edloe, Suite 330, Houston, TX 77027-6022.

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drome," the result of infrastructural decay, overcrowding, and the disintegration of social support networks (Dembo et al., 1990; Donavan & Jessor, 1985; Sampson & Groves, 1989; Wallace, R., 1990).

COGNITIVE-BEHAVIORAL APPROACHES

Proposed crack cocaine treatment modalities are usually derived from existing powder cocaine treatment programs (Wallace, 1991). Clinicians contend that long-term outpatient treatment programs utilizing therapy modalities such as Rawson's neurobehavioral therapy are the most effective means of treating powder cocaine users (Wallace, B., 1990; Washton, 1986; Washton & Stone-Washton, 1990). Programs employing such therapies emphasize cognitive-behavioral techniques for countering specific environmental cues that "trigger" cocaine use (Marlatt & George, 1984).

Clinicians also argue that because cocaine users are particularly prone to relapse after months or even years of abstinence, and because new responses to common environmental cues must be learned in order to avoid relapse (Niegrete & Emil, 1992), short-term inpatient treatment may be a poor way to prepare recovering users for maintaining their abstinence after cessation of treatment (Fogle, 1990). Studies suggest that aftercare treatment retention and post-treatment abstinence rates after intensive outpatient cocaine treatment compare favorably with those obtained after inpatient treatment (Washton, 1989) and that cognitive-behavioral therapy is more effective than interpersonal therapy (Carroll, Rounsaville, & Gawin, 1991). However, data also show that non-Whites (Agosti, Nunes, Stewart, & Quitkin, 1991; Kleinman et al., 1992), persons living alone or in a dysfunctional household (Gainey, Wells, Hawkins, & Catalano, 1993; Means et al., 1989), and persons with a lower level of education (Kleinman et al., 1992) are at high risk for early attrition from long-term outpatient programs.

Rawson's neurobehavioral therapy is an example of cognitive-behavioral techniques in the service of outpatient cocaine treatment (Rawson, 1990; Rawson, Obert, McCann, & Ling, 1991; Rawson, Obert, McCann, Smith, & Ling, 1990). Rawson's therapy applies these techniques to a model of cocaine use that emphasizes a specific sequence of stages marking the passage to recovery from cocaine abuse. These stages—withdrawal, honeymoon, "the wall," adjustment, and resolution—are matched to treatment stages of descending intensity. During each phase of treatment, clients are exposed to educational groups, stabilization groups, 12-step support group meetings, individual counseling sessions, urine tests, and conjoint sessions with family members (Rawson, 1990). The intensity of treatment is lowered between the first and second months, between the third and fourth months, and between the sixth and seventh months. Rawson and colleagues (1991) reported that encouraging preliminary results have been found in a controlled clinical trial to evaluate the effectiveness of this model.

ADJUNCT THERAPY

Therapies to alleviate the anxiety, depression, and other debilitating emotional effects associated with the initial period of abstinence in chronic cocaine users have been recommended as useful adjuncts to cognitive-behavioral approaches in cocaine treatment (Wallace, 1991). Three of the most popular adjunct therapies are acupuncture, anticraving medications (desipramine, bromocriptine, and related agents), and brainwave therapy (biofeedback).

Acupuncture has been touted as effective in the treatment of addictive disorders (Porkert & Ullman, 1988). Some empirical studies have supported these claims. Counseling alone, counseling plus frequent urine testing, and counseling plus frequent urine testing plus acupuncture were compared in an unblinded trial at the University of Miami School of Medicine (McLellan, Grossman, Blaine, & Haverkos, 1993). The group receiving acupuncture obtained clean urines sooner, and maintained a higher level of clean urines over time, than the other two groups. Bullock (1989) tested acupuncture against acupuncture placebo (needle application in theoretically nonspecific points) on a sample of 80 severe recidivist alcoholics. Twenty-one of 40 treatment patients completed the project, as compared to 1 of 40 controls, and controls had more than twice the number of both drinking episodes and admissions to a detoxification center. However, a subsequent three-group study by Worner and colleagues (1992), where subjects were randomized to either point-specific acupuncture, acupuncture placebo, or standard care (control), failed to replicate Bullock's results. Washburn and associates (1993) found that subjects assigned to standard acupuncture were retained longer in treatment than subjects assigned to a placebo condition but found no evidence that those who successfully completed the study detoxified from heroin. The only two published studies of acupuncture and crack cocaine of which we are aware held little support for the use of acupuncture in this context. Brewington (1991) administered auricular acupuncture treatment or placebo daily for 1 month to crack cocaine abusers and found no significant between-group differences in either self-reported cocaine use or attendance data. Lipton, Brewington, and Smith (1994) found significantly lower cocaine metabolite levels during treatment in subjects receiving acupuncture than in subjects receiving placebo but no significant differences in retention or self-reported drug use outcomes between the groups.

Anticraving medications have gained theoretical support from the central role ascribed to dopamine re-

ceptors in mediating cocaine euphoria (Dackis, 1985; Gawin & Ellinwood, 1988), and from research suggesting that cocaine users often exhibit classic symptoms of clinical depression (Gawin & Kleber, 1986a; Khantzian, 1985). In particular, bromocriptine (Dackis & Gold, 1985) and desipramine (Gawin & Kleber, 1984) have demonstrated effectiveness in relieving symptoms associated with the first few weeks of cocaine abstinence. However, Kolar and associates (1992) found no differences in retention and outcome between study participants receiving desipramine and those receiving placebo. In treatment, the use of desipramine has been shown to reduce the rate of attrition from treatment programs but has not demonstrated an advantage over psychotherapy alone in inducing long-term abstinence (Gawin & Kleber, 1986b).

Stress reduction using alpha(α)-theta(θ) neurofeedback BrainWave Therapy (BWT) has been used by Peniston and Kulkosky (1989) to treat chronic alcoholics. Compared to a nonalcoholic control group and a group of alcoholics receiving psychotherapy alone, alcoholics receiving BWT showed sharp reductions in self-assessed depression (Beck's Depression Inventory; BDI) compared to controls. Long-term follow-up studies at 13 months confirmed lower levels of relapse for alcoholics receiving BWT than for alcoholics receiving psychotherapy alone. However, Peniston's and Kulkosky's study suffers from several inadequacies, including uncontrolled administration of antidepressants to members of both alcoholic groups.

Of the above therapies, only acupuncture and anticraving medications have previously been tested on subjects in treatment for cocaine addiction and only acupuncture has previously been tested on crack cocaine addicts. Results of these tests have been mixed, with anticraving medication producing only short-term relief of initial symptoms associated with the cessation of cocaine use and acupuncture showing no measurable results with crack cocaine users. Even if adjunct therapies had produced remarkable results in other contexts moreover, extending success claims to indigent crack cocaine users, recovering from addiction amidst the specific environmental stressors they often face, would be premature. Almost all of the published outcome studies of cocaine treatment to date rely on samples primarily made up of Anglo, middle-income powder cocaine users (Gainey et al., 1993; Miller, Millman, & Keskinen, 1990; Washton, 1986), and where studies have been designed to include larger percentages of minorities and lower-income people, samples are still demographically remote from the vulnerable users described in the epidemiological literature on crack cocaine abuse (Means et al., 1989).

The urgency of the crack cocaine problem, coupled with the challenges presented by the context of crack cocaine abuse, makes the randomized field experiment, which tests program components as they are implemented in a "real world" setting, the most appropriate means for developing and testing treatments for crack cocaine addiction (Dennis, 1993; Wallace, 1991). Such an experiment was conducted in a hospital-based outpatient program for crack cocaine addiction in Houston. Three adjunct therapies—acupuncture, anticraving medication, and brainwave therapy—were combined with an intensive outpatient program employing a modified version of Rawson's neurobehavioral treatment model. Baseline, process, and follow-up data were collected to test whether any of the three adjunct therapies, when combined with neurobehavioral treatment, could improve long-term outcomes for indigent crack cocaine users as compared to neurobehavioral treatment alone.

Because the previous studies cited have examined the effects of various adjunct therapies on both retention and drug use outcomes, because the bulk of the empirical support of adjunct therapies derives from their association with improved retention, and because retention has been independently associated with drug use outcomes in some studies (Hubbard et al., 1989; Simpson, 1979, 1981), this article examines three related research questions: (1) Do acupuncture, anticraving medication, or brainwave modification improve retention in intensive outpatient neurobehavioral treatment for crack cocaine addiction?; (2) Does retention improve drug use outcomes at nine months after entry into intensive outpatient neurobehavioral treatment for crack cocaine addiction?; (3) Do these adjunct therapies directly improve drug use outcomes, above and beyond effects attributable to retention?

METHOD

Sample

Data for this study were collected between April 1992 and August 1994 from a targeted sample of crack cocaine abusers who had been admitted to Riverside General Hospital's Choices Drug Treatment Program in Houston. Choices is an intensive outpatient treatment program employing state-licensed addiction specialists and addiction credentialed health care clinicians. The program aims at providing a planned, theory-driven regimen of treatment for crack cocaine users in Houston. The cocaine treatment model implemented at Choices is adapted from Rawson's neurobehavioral model. Although Rawson has recommended the use of this model for treating crack cocaine addiction, Choices is the first program to attempt to adapt this model to an indigent urban population of crack cocaine users. The program offers outpatient treatment composed of neurobehavioral group and individual counseling therapies, either alone or in combination with one of three adjunct therapies. The intensive outpatient design was chosen because it enabled clients to

interact with their everyday environment while receiving the benefits of a structured, programmatic therapeutic milieu (McAuliffe & Albert, 1992).

Choices is open to all adults residing within the City of Houston. However, young, unemployed crack cocaine users whose drug use has placed them at risk for further involvement in antisocial behaviors are the targeted population for treatment. The sample used for the evaluation study consisted of 228 crack cocaine users from Southeast Houston who enrolled in treatment between April 1992 and August 1993.

Recruitment

Volunteers for the study were recruited from the population of program applications. Requirements for admission into the treatment program were residence in Harris County, TX (which included the city of Houston), a diagnosis of crack cocaine addiction as determined by a state-certified admissions counselor, and a minimum age of 18 years. Participants were required to sign an informed consent form which authorized researchers to collect and analyze personal data, data from treatment records, interview data, and a urine sample. Refusal to sign the informed consent form resulted in being dropped from the experiment. Refusal to provide sufficient relocation follow-up information also rendered the participant ineligible. All applicants agreeing to these terms, and meeting program eligibility requirements, were enrolled in the study. Choices clients volunteering for participation in the evaluation study were offered an explanation of their assigned treatment modality and their role in the study. Participants dropped from the experiment remained eligible for neurobehavioral treatment at Choices.

Participants were randomly assigned to one of four treatment modalities, consisting of either neurobehavioral treatment alone, neurobehavioral treatment plus acupuncture, neurobehavioral treatment plus anticraving medication, or neurobehavioral treatment plus brainwave modification. After random assignment had been made, baseline data were collected by a Choices counseling intern using interviewer- and self-administered instruments. A total of 227 Choices' clients sampled at intake received intake interviews, and were randomly assigned to the four conditions (see Table 1).

TABLE 1
Characteristics of Sample

Variable	Sample Retained for Analysis (n = 186) n (%)	Sample Recruited (n = 228)				
		Acupuncture n (%)	Anti-Craving Medication n (%)	Brainwave n (%)	Neurobehavioral Only n (%)	Total n (%)
Gender						
Female	72 (38.7)	20 (41.7)	20 (37.7)	24 (34.3)	23 (40.4)	87 (38.2)
Male	114 (61.3)	25 (58.3)	33 (62.3)	46 (65.7)	34 (59.6)	141 (61.8)
Age						
18-25	38 (20.4)	10 (20.8)	10 (18.9)	10 (14.3)	14 (24.6)	44 (19.3)
26-30	48 (25.8)	11 (22.9)	15 (28.3)	26 (37.1)	13 (22.8)	65 (28.5)
31-35	52 (28.0)	14 (29.2)	13 (24.5)	17 (24.3)	13 (22.8)	57 (25.0)
36-40	29 (15.6)	10 (20.8)	10 (18.9)	9 (12.9)	10 (17.5)	39 (17.1)
41-51	19 (10.2)	3 (6.3)	5 (9.4)	8 (11.4)	7 (12.3)	23 (10.1)
Race/Ethnicity						
African-American	172 (92.5)	45 (93.8)	47 (88.6)	64 (91.4)	51 (89.5)	207 (90.7)
Anglo-Caucasion	6 (3.2)		3 (5.7)	4 (5.7)	4 (7.0)	11 (4.8)
Hispanic	8 (4.3)	3 (6.2)	3 (5.7)	1 (1.4)	2 (3.5)	9 (3.9)
Other				1 (1.4)		1 (1.4)
Employment						
Not working	72 (38.7)	24 (50.0)	22 (41.5)	29 (41.4)	26 (45.6)	101 (44.3)
Part-time work	47 (25.3)	6 (12.5)	12 (22.6)	10 (14.3)	14 (24.6)	42 (18.4)
Full-time work	67 (36.0)	18 (37.5)	19 (35.8)	31 (44.3)	17 (29.8)	85 (37.3)
Education						
<12 years	71 (38.2)	19 (39.6)	23 (43.4)	24 (34.3)	22 (28.6)	88 (38.6)
12 years	67 (36.0)	17 (35.4)	21 (39.6)	30 (42.8)	16 (28.1)	84 (36.8)
>12 years	48 (25.8)	12 (25.0)	9 (17.0)	16 (22.9)	19 (33.3)	56 (24.6)
Treatment						
Acupuncture	41 (22.0)					
Anticrav. Medic.	40 (21.5)					
Brainwave	57 (30.6)					
Control*	48 (25.8)					

* Neurobehavioral only.

PROGRAM DESCRIPTION

Neurobehavioral Treatment

Every Choices client received neurobehavioral treatment (Rawson et al., 1990). Many of the scheduled sessions—individual counseling (1 h per week), group counseling (2 h per day, 5 days per week), educational group (as scheduled), stabilization group (1 h per week), 12-step group meeting (7 days per week), family education (1 h per week), and conjoint (as scheduled)—reflected those in the neurobehavioral model, but Choices administrators enhanced the model with culturally appropriate materials, lectures, and activities. Individual counseling sessions focused on environmental cues that trigger cravings for cocaine, and on training the client to recognize and counteract such cues. Group counseling sessions facilitated client recognition of addictive behaviors through guided peer interaction. Like Rawson's program for upper middle-class, predominantly Anglo, powder cocaine abusers, Choices encountered significant barriers when attempting to engage family members for conjoint counseling sessions. This is not surprising given epidemiological evidence linking crack cocaine abuse to the fragmentation of low-income family and neighborhood support networks (Sampson & Groves, 1989; Wallace, R., 1990). In the absence of opportunities for conjoint sessions, family education sessions placed addiction in the context of family of origin and current living environment. A variety of addiction education sessions used lectures by physicians and counselors, along with films and videos focusing on addiction, to inform clients of the psychological, social, and physiological aspects of addiction, and to emphasize the importance of abstaining from illicit substances. Spirituality, recovery dynamics, life skills, parenting skills, women's issues, and HIV/AIDS education were also addressed in specialized sessions. Urine specimens were collected as a therapeutic tool whenever staff determined that client behavior indicated recent drug use. The mean number of urine specimens collected per client during treatment was five. Unlike Rawson's model, Choices did not take weekly urine screens.

The Choices program used a phased-treatment plan, based on Rawson's neurobehavioral model, and adapted to the financial and employment needs of the program's targeted population. For instance, Rawson reduced treatment intensity three times during the course of treatment (after 30 days, after 90 days, and after 6 months). Choices Program administrators had to balance treatment intensity with the economic demands placed on clients, and the income/employment needs of clients. A day treatment regimen as long and intense as Rawson's program would have jeopardized the jobs or employment potential of Choices clients. Thus, in the Choices program, treatment intensity was reduced from 20 h per week to 1 day per week after the first 90 days. Thereafter, participants were offered neurobehavioral and self-help aftercare services 1 day per week, continuing for up to 1 year after intake.

Adjunct Therapies

Study participants in the auricular acupuncture modality were scheduled to receive acupuncture treatment while seated in a reclining chair using a set of 5 needles in the five standard positions for drug detoxification treatment (McLellan et al., 1993). Four state-certified counselors, who had also been trained and certified as Acupuncture Detoxification Specialists, were assigned the task of administering the treatment. During the first 10 days of treatment, clients received one 30-min session per treatment day. Over the next 10 days, 3 sessions per week were provided. This was decreased to 3 sessions per week for the next 10 days. Additional sessions were provided at the request of participants in the acupuncture modality. For clients remaining active in this modality, the number of treatments received ranged from 24 to 28. Like participants in the other modalities, participants in the acupuncture modality also received neurobehavioral therapy.

Study participants in the anticraving modality were scheduled to receive neurobehavioral therapy plus treatment with bromocriptine, a fast acting nonaddictive anticraving medication, and desipramine, a slow acting antidepressant. Immediately after intake, prescriptions were written by the physician overseeing anticraving medication therapy. A registered nurse completed orientation of all participants, advising them of planned regimens for each medication and possible side effects. The regimen for bromocriptine was one-half of a 2.5 mg tablet 4 times per day for the first 2 days, decreased on Days 3 and 4 to one-half tablet 3 times per day. Dosage for the 5th and 6th days was one-half tablet 2 times per day, decreased to one-half tablet per day for Days 7 and 8. Thereafter, the dosage was determined by the physician on the basis of an evaluation of client symptoms. Clients requiring greater doses for severe cravings were allowed from 1 to 3 tablets every 3 to 4 h. Desipramine was also provided shortly after intake to clients in the anticraving modality. Clients were directed to self-administer one 50 mg tablet prior to going to bed each night. This dosage was increased by one tablet every other night until 5 tablets were being taken each night at bedtime. This dose was continued for approximately 6 to 9 months. For patients experiencing side effects, dosage was decreased by one tablet every other night until the side effects ceased.

Along with neurobehavioral therapy, study participants in the brainwave modality received alpha biofeedback training over a 30-day period using EEG equipment. During the first brainwave session, subjects

in this modality were given a brief introduction to EEG brainwave biofeedback and were told how to interpret audio feedback sounds. Prior to receiving biofeedback, brainwave participants received pretraining in temperature control, believed to stimulate production of the "theta state" (Peniston & Kulkosky, 1989). During subsequent sessions, EEG equipment was operated, and sessions were monitored, by a trained and certified brainwave technician, who was also a state-certified substance abuse counselor. Sessions were conducted in a darkened room and reclining chairs were provided to participants to minimize stress. Client brainwaves were captured by EEG, processed on a microcomputer and transmitted to the participant by auditory tone.

Process Data Collection

Choices staff tracked each client's participation in various program sessions recording it as part of the client's treatment file. Choices staff kept records of all sessions received by study participants to document the duration and intensity of program participation. At 3 months and again at 9 months after intake, a trained research assistant completed a process summary on each client with data drawn from a review of client treatment files.

Follow-Up Assessment

Nine months after intake, clients were relocated for a follow-up assessment. The assessment consisted of an interviewer-administered questionnaire, a self-rated survey, and a urine sample. A research assistant completed the assessment in a confidential setting, usually at the client's home or the Choices facility. Follow-up assessments were administered to all subjects who could be located regardless of whether they had completed treatment or had withdrawn from treatment prior to completion. Participants who completed the interview portion of the follow-up assessment were remunerated at the rate of $20 per participant. Participants who agreed to submit urine specimens for analysis were compensated an additional $5. A total of 196 participants, or 86% of the intake group, were relocated for follow-up assessments. Urine results for 32 cases were not received from the laboratory. An additional 44 cases did not have urine results, either due to the treatment program's failure to provide specimen containers acceptable to the laboratory or due to participant refusal to provide urines. Urine results were recorded for a total of 120 study participants.

T-tests were performed to determine whether study dropouts differed significantly from subjects who were relocated. Results indicated these groups did not differ according to age, gender, education, psychosocial profile at intake, or adjunct therapy assignment. One case was excluded from the analysis because the participant received treatment before being admitted. Another case was excluded because the participant received two therapy modalities. An additional 8 cases were excluded due to missing or out of range data. Characteristics of the resulting sample of 186 participants are given in Table 1. The sample was 92.5% African-American, 3.2% Anglo, and 4.3% Hispanic. Almost two-thirds of the sample (61.3%) was male. Three-fourths (74.2%) had completed high school. Forty-six percent (46.2%) were 30 years of age or younger. Thirty-eight percent (38.7%) were unemployed, 25.3% were employed part-time, and 36.0% were employed full-time.

A chi-square test of random assignment was performed to see whether participants assigned to the four modalities differed according to gender, age, education, drug use at intake, arrest history at intake, or psychological and social functioning at intake. Participants assigned to the four modalities were not found to differ significantly in any of these characteristics.

Measures

Matched intake and follow-up data collection instruments were designed by the Institute of Behavioral Research at Texas Christian University (Simpson, 1991a,b; 1992a,b). The interviewer-administered instruments, the Drug Abuse Treatment for AIDS Risk Reduction (DATAR) Intake Form and its follow-up version were designed to collect sociodemographic, family, peer, psychosocial functioning, criminal, drug, and AIDS-risk behavioral data. Self-reported drug use/last 30 days and self-reported drug use/last 6 months were measured by single items rated on a 10-point scale. Possible responses on these items were 0 (*never*), 1 (*not used*), 2 (*only one to three times*), 3 (*about one time per month*), 4 (*about two to three times per month*), 5 (*about one time per week*), 6 (*about two to six times per week*), 7 (*about one time per day*), 8 (*about two to three times per day*), and 9 (*about four or more times per day*).

The self-administered instruments, the Self-Rating Form (SRF) and its follow-up version, measured the participant's self-reported psychological and social functioning. The SRF contains 4 psychological functioning scales (self-esteem, depression, anxiety, and decision-making), 3 social functioning scales (risk-taking, social conformity, and hostility), and 2 motivation for treatment scales (drug use problems and desire for help) (Simpson & Joe, 1992).[1] These scales

[1]SRF subscales have repeatedly performed well in reliability analyses. Alpha reliability coefficients from TCU's DATAR sample ($n = 308$) are as follows: self-esteem (.79), depression (.78), anxiety (.80), decision-making (.74), hostility (.83), risk-taking (.77), social conformity (.64), drug problems (.85), and dfor help (.72). Inter-scale correlations within domains have also been shown to be high. For a more detailed report on psychometric properties of the scales, see Knight, Holcom, & Simpson (1994).

had from 7 to 10 items each. Each item was rated on a 5-point scale. All items were rated from 0 (*never*) to 4 (*almost always*). Negative items on each scale had their scores reversed. All items on each scale were then averaged to give a scale score. These scales helped to describe the progress in psychological and social functioning that occurred in the interval from program intake until follow-up. Scores on the scales were combined to yield scores for psychological and social functioning domains.

Process summaries recorded the number of adjunct treatment sessions received by each client, the number of neurobehavioral counseling sessions received, and the first and last date on which clients attended any sessions. Data from the process summaries enabled the computation of days in treatment, a measure of retention. Number of neurobehavioral counseling sessions was used as a secondary measure of retention. Logarithms of both days in treatment and number of neurobehavioral counseling sessions were used in the analyses to reduce the influence of outliers. The dosages of adjunct therapies received by each client, measured by the number of adjunct therapy sessions received, were also drawn from the process summaries.

At follow-up, urine drug screens were used to verify participant reports of recent drug use. Urine screens were assigned values of 0 (*urine negative for cocaine metabolites*) or 1 (*urine positive for cocaine metabolites*). Chi-square tests showed that self-reports of current cocaine use did not differ according to whether clients provided or did not provide urines. Chi-square tests also confirmed that, for those clients providing urines, results tended to confirm self-reports.

RESEARCH QUESTIONS

Because the reduction of symptoms associated with the first few months of abstinence from cocaine is the primary rationale for the use of adjunct therapies, they are often seen as means of improving retention in treatment. Thus, the first question addressed to the data was whether adjunct therapies improved treatment retention. A chi-square test of association was performed to examine whether participation is adjunct therapy was associated with observable differences in retention for distinct stages of neurobehavioral treatment. To test whether the dosage of adjunct therapy received by a participant significantly improved retention over the entire course of treatment, two multiple regressions were performed. Because self-selection is often a problem when analyzing retention (more motivated clients will be more likely to actually attend adjunct therapy sessions *and* to remain in treatment), control variables included motivation for treatment at intake as well as demographic variables. First, the logarithmic transformation for the number of days in treatment was regressed onto dosage of acupuncture, dosage of anticraving medication, and dosage of brainwave, along with education, gender, age, and motivation for treatment at intake as control variables. Because of the ethnic homogeneity of the sample, race/ethnicity was not entered as a control variable into regression equations. Next, the logarithmic measure of number of counseling sessions attended was regressed onto the same variables.

T-tests were performed to determine whether changes in self-reported crack cocaine use, psychological functioning, and social functioning had occurred for clients in the overall sample between intake and follow-up. To test the second research question, whether retention affected drug use outcomes, 8 multiple regressions were performed. Frequency of crack use change scores, 30-day self-reported abstinence from crack cocaine, urinalysis results for any drug, and urinalysis results for cocaine, were each regressed onto the logarithmic transformation for number of days in treatment, controlling for education, gender, age, and motivation for treatment at intake. The same regressions were then performed using the logarithmic transformation for number of counseling sessions attended.

The third research question was whether dosage of any adjunct therapy improved drug use outcomes beyond improvements attributable to retention. Although this is an important question, it also poses methodological difficulties. Because this was a randomized field experiment, subjects received varying dosages of adjunct therapies, depending on their own decisions to attend or not to attend adjunct therapy sessions. Dosage, and not adjunct therapy assignment alone, is thus the most reasonable measure of the adjunct therapy participants actually received. However, the relationship between the number of adjunct therapy sessions a participant received and the number of days a participant was in treatment may pose problems of multicollinearity. A preliminary correlational analysis was performed to rule out this possibility. Results indicated that these measures were not collinear in this sample.

To test for the effects of adjunct therapy dosage on drug use outcomes beyond those of retention, general urinalysis results and cocaine-specific urinalysis results were regressed onto dosage of acupuncture therapy, dosage of anticraving medication therapy, and dosage of brainwave therapy, along with any retention measures for which significant effects were found. As in the other regressions, education, gender, age, and motivation for treatment at intake were entered into the equations as control variables.

RESULTS

Prior to analysis, a crosstabulation was performed to examine whether participants assigned to each modality differed according to the type of treatment (adjunct plus neurobehavioral, neurobehavioral, or none) actually received. The percentages of actual treatment received did differ according to assigned modality, as reflected in Table 2. The data show that 11 partici-

TABLE 2
Cross-Tabulation for Treatment Received by Assigned Treatment Modality

	Assigned Treatment Modality				
Type of Treatment Received	Acupuncture *n* (%)	Anticraving Medication *n* (%)	Brainwave Modification *n* (%)	Neurobehavioral Only *n* (%)	Overall Attendance *n* (%)
No treatment (never returned)	1 (2.4)	2 (5.0)	4 (7.0)	4 (8.3)	11 (5.9)
Neurobehavioral treatment only	13 (31.7)	24 (60.0)	26 (45.6)	44 (91.7)	107 (57.5)
Adjunct therapy	27 (65.9)	14 (35.0)	27 (47.4)	—	68 (36.6)
Total assigned to each modality	41 (100)	40 (100)	57 (100)	48 (100)	186 (100)

pants, or 5.9% of the overall sample, never returned after the 1st day and thus never received any treatment. Almost half (49.2%) of those assigned to adjunct therapies actually received some adjunct therapy. Of participants assigned to the acupuncture modality, 65.9% received at least one adjunct session, 31.7% received only neurobehavioral treatment, and 2.4% left the program. Of participants in the anticraving medication modality, 35% received at least one adjunct session, 60% received only neurobehavioral treatment, and 5% left the program. Of participants in the brainwave modification modality, 47.4% received at least one adjunct session, 45.6% received only neurobehavioral treatment, and 7.0% left the program. Of participants in the neurobehavioral treatment modality, 91.7% received at least one session, and 8.3% left the program.

Our first research question was whether adjunct therapies improved retention. Table 3 shows the effects of adjunct therapy participation on retention during the 1st month. None of the participants who received one or more adjunct therapy sessions failed to return after the 1st day of treatment, as compared to 6 participants (21.7%) who received 1 or more neurobehavioral sessions only on the first day of treatment. Table 3 also reports effects of adjunct therapy on retention beyond the first 30 days. These data indicate that a greater percentage of clients receiving adjunct therapy were retained beyond 30 days than clients receiving neurobehavioral treatment only. Chi-square tests showed this association to be significant ($p < 0.05$).

Figure 1 and Figure 2, comparing the mean number of days in treatment, and the mean number of neurobehavioral sessions attended, for clients receiving adjunct therapy with those for clients receiving only neurobehavioral therapy, illustrate the magnitude of the adjunct therapy effects on length of time in treatment. On average, participants receiving adjunct therapy sessions stayed in treatment almost 60 days longer than controls. Participants receiving adjunct therapy sessions also attended at least 30 more neurobehavioral counseling sessions, on average, than did those receiving only neurobehavioral therapy. Therefore, adjunct therapies appear to have been an efficacious means of improving overall program retention.

The results of regressions testing whether dosage of adjunct therapy was associated with retention are given in Table 4.

Results show that dosage of adjunct therapy was associated with the logarithmic transformation of days in treatment ($F = 6.44$, $p < 0.001$). Significant t scores were found for the standardized regression coefficients (β) for dosage of acupuncture ($p < 0.001$), dosage of anticraving medication ($p < 0.01$), and dosage of brainwave ($p < 0.001$), after controlling for gender, age, education, and baseline motivation for treatment. Table 4 also shows that the dosage of adjunct therapy

TABLE 3
Treatment and Retention

Treatment	*n*	Never Returned (%)	1–15 Days (%)	16–30 Days (%)	31+ Days (%)	Total (%)
Adjunct and neurobehavioral	71	0.0	14.1	7.0	78.9	100
Neurobehavioral only						
$\chi^2 = 5.82$*, df = 1, $p < .05$	48	12.5	16.7	12.5	58.3	100
At least one session of:						
Acupuncture	30	0.0	20.0	10.0	70	100
Anticraving medication	14	0.0	14.3	0.0	85.7	100
Brainwave modification	27	0.0	7.4	7.4	85.2	100

*Chi-square measured dichotomized groups for ≤30 days of treatment versus 31+ days of treatment.

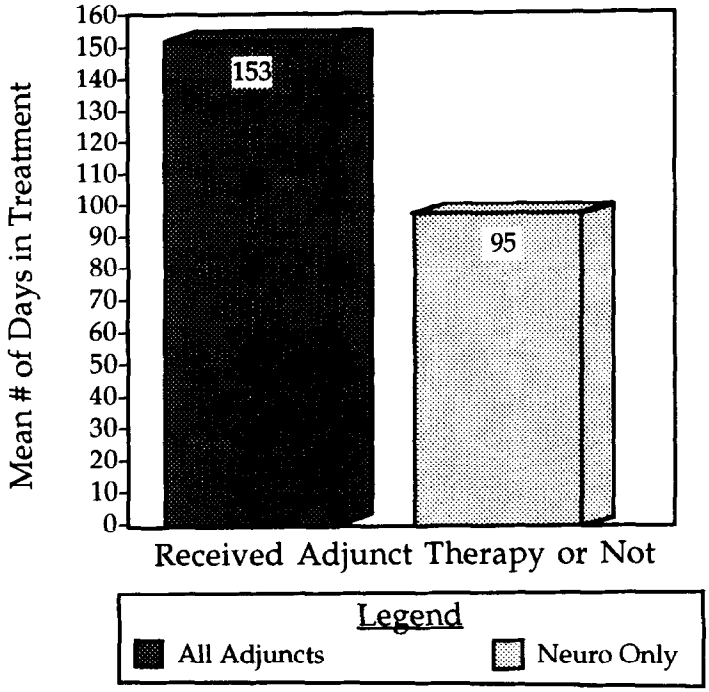

FIGURE 1. Adjunct therapy by mean number of days in treatment.

received predicted the number of neurobehavioral counseling sessions attended ($F = 7.51$, $p < 0.0001$). Again, the betas yielded significant t scores for dosage of acupuncture ($p < 0.001$), dosage of anticraving medication ($p < 0.001$), and dosage of brainwave modification therapy ($p < 0.0001$). The amount of adjunct therapy participants received influenced session attendance and retention in the core neurobehavioral treatment program. The influence was in a positive direction; in general, the more adjunct therapy partici-

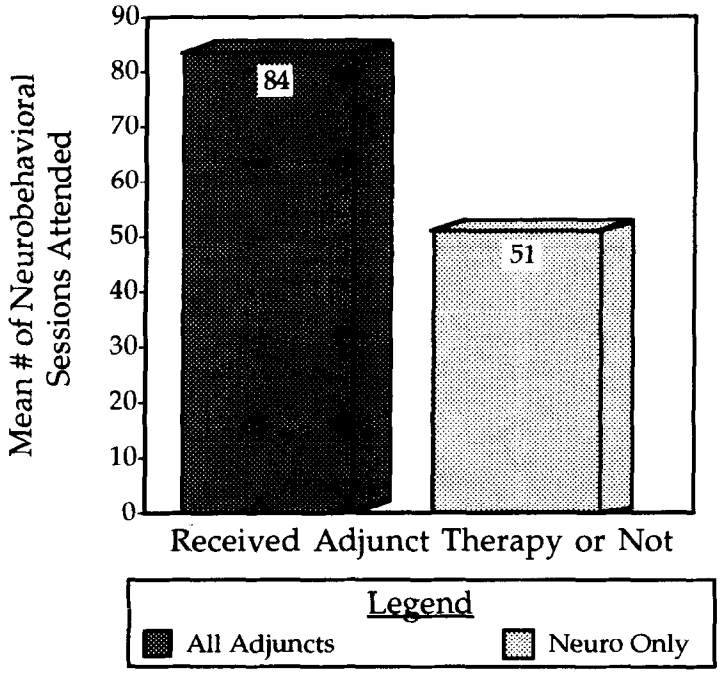

FIGURE 2. Adjunct therapy by number of neurobehavioral sessions.

TABLE 4
Effects of Dosages of Adjunct Therapies

	F	β	*p*
Number of days in treatment	6.44*		
Dosage acupuncture		.24	.00
Dosage brainwave		.28	.00
Dosage anticraving medication		.16	.02
Number of neurobehavioral sessions attended	7.51*		
Dosage acupuncture		.27	.00
Dosage brainwave		.28	.00
Dosage anticraving medication		.23	.00

*$p \leq 0.0001$.

pants received, the longer they stayed in treatment. These effects were independent of gender, age, education, and baseline motivation for treatment.

The second research question was whether retention affected treatment outcomes. Table 5 shows results of *t* tests for improvements in psychosocial functioning and drug use for the overall sample between intake and follow-up. Table 5 indicates that levels of psychological functioning rose significantly ($p < 0.001$), that levels of social functioning rose significantly ($p < 0.01$), and that self-reported crack cocaine use in the last 30 days ($p < 0.001$) and the last 6 months ($p < 0.001$) decreased significantly in the overall sample.

Table 6 shows that none of the analyses for effects of days in treatment on drug use outcomes produced significant overall *F* statistics. Although the *t* scores hint at an effect of days in treatment on self-reported 30-day abstinence from crack cocaine, general urinalysis results, and urinalysis results for cocaine, the absence of a significant overall *F* means these results should be treated with caution. Table 6 also shows the results for analyses of number of neurobehavioral counseling sessions. Marginally significant main effects were found for urinalysis results for cocaine metabolites ($F = 2.22$, $p \leq 0.05$). *T* scores were also significant ($p < 0.01$), confirming the contribution of number of neurobehavioral counseling sessions attended to urine screen results. Thus, neurobehavioral counseling sessions appear to be effective in facilitating abstinence from cocaine as measured by cocaine urine screens. There is a hint of an effect of counseling sessions on both self-reported abstinence from crack, and on general urinalysis results, as indicated by the significance of the *t* scores in the analyses ($p < 0.05$), but as the *F* statistics are not significant, the results are inconclusive and must be treated with caution.

The third research question was whether adjunct therapies directly improved treatment outcomes, beyond the effects of time in treatment. The results of statistical regressions testing effects of adjunct therapy dosage on drug use outcomes beyond the effects of retention are given in Table 7. As indicated by the *F* statistic, no significant overall effects were found in this analysis. Retention in the program, as measured by the number of neurobehavioral therapy sessions received, was therefore the primary predictor of drug use outcomes as measured by urinalysis results. The significant effects of adjunct therapy were limited to its positive association with retention in treatment.

DISCUSSION

This study was limited by some of the factors associated with randomized field experiments. There was a low participation rate in the experimental conditions, which reduced the number of participants who received full dosages of the adjunct therapies. Urine sample results were secured on an even smaller sample than those for whom follow-up surveys were available. However, the analyses reported above reduced concerns that individuals lost to follow-up or not having urine samples differed significantly from individuals for whom complete data were available.

Generalizability of these results is limited due to the ethnic homogeneity of the sample (92.5% African-American). However as noted, while ethnic homogeneity is not unusual in studies of drug treatment, which tend to focus on samples of middle-class whites, data on the effectiveness of cocaine treatment for African-American drug users inhabiting low-income urban neighborhoods are rare. Thus, the limited generalizability of the results may be offset by their contribution to knowledge regarding a population of clients hitherto underserved by drug treatment and evaluation.

TABLE 5
T Tests for Overall Change

Variable	Intake Score	9 Month Score	Change	*t* Value	*p*
Psychological functioning	2.22	2.42	0.20	6.32	.000
Social functioning	2.19	2.26	0.08	2.92	.004
Crack use in last 30 days	2.64	0.92	−1.72	−7.76	.000
Crack use in last 6 months	4.68	1.79	−2.89	−12.31	.000

TABLE 6
Effects of Days in Treatment and Neurobehavioral Sessions Attended

	F	β	*p*
Effects on change in self-reported crack cocaine use—9 months			
Change in crack use			
Days in treatment	.77	−.12	.13
Sessions attended	.88	−.13	.09
Effects on change in self-reported crack cocaine abstinence—9 months			
Abstinence from crack use			
Days in treatment	1.56	−.21	.01
Sessions attended	1.37	−.19	.01
Effects on general urine drug screen			
General urinalysis			
Days in treatment	1.81	−1.7	.03
Sessions attended	2.15	−.20	.01
Effects on cocaine-specific urine drug screen			
Cocaine urinalysis			
Days in treatment	1.85	−.29	.00
Sessions attended	2.22*	−.31	.00

*$p \leq .05$.

Finally, like any randomized field study, this study is limited by the possibility of self-selection. Subjects who were more determined to overcome crack cocaine addiction may have remained in treatment longer, attended more neurobehavioral sessions, *and* attended more adjunct therapy sessions. To reduce the intervening effects of self-selection, motivation for treatment was included as a control variable in all regression equations. The inclusion of motivation for treatment may be partially responsible for the weak effects of time in treatment on urine screen results. However, the effects of adjunct therapy were moderately strong even after controlling for motivation for treatment. These moderately strong effects, found despite the inclusion of motivation for treatment, suggest that self-selection is not likely to be responsible for the effects of adjunct therapies reported here.

Despite these limitations, this study provides valuable information on the effectiveness of three adjunct therapies in treating crack cocaine addiction among a particularly vulnerable population. The results of tests for the first research question indicate that adjunct therapy significantly improved retention in intensive outpatient neurobehavioral treatment for crack cocaine addiction independently of motivation for treatment at intake. For those patients who made use of the adjunct therapies, these effects extended beyond the first 30 days of treatment. The results of tests for the second research question indicate that retention in intensive outpatient neurobehavioral treatment significantly improved drug use outcomes at 9 months as measured by cocaine-specific urinalysis results. Finally, the results of tests for the third research question indicate that adjunct therapies did not *directly* improve drug use outcomes beyond improvement attributable to retention in intensive outpatient neurobehavioral treatment.

Both population focus and research design contribute to the importance of this study to the treatment of crack cocaine addiction. First, the inclusion of a comparison group receiving a widely accepted nonchemical clinical addiction therapy modality contrasts with earlier studies, which either included no comparison group, compared adjunct therapies to 12-step groups alone, or compared adjunct therapies to psychotherapy alone. Second, it is one of the first studies to test adjunct therapies on chronic crack cocaine users. Third, it is one of the first studies to focus on a sample of largely indigent drug users in a neighborhood with a pronounced crack cocaine problem.

The results of this study support Gawin and Kleber's (1986b) findings regarding the effects of pharmacological intervention on program retention. They

TABLE 7
Effects of Adjunct Therapies on Urine Drug Screen Results Beyond Those of Retention Alone

	F	β	*p*
Effects on general urine drug screen of adjunct therapy beyond retention	1.89		
Neurobehavioral sessions attended		−.19	.02
Dosage acupuncture		.09	.24
Dosage anticraving medicine		−.11	.15
Dosage brainwave		−.03	.67
Effects on cocaine-specific urine drug screen of adjunct therapy beyond retention	1.76		
Neurobehavioral sessions attended		−.32	.00
Dosage acupuncture		.07	.46
Dosage anticraving medicine		−.14	.15
Dosage brainwave		.00	.99

also support the effectiveness of acupuncture and brainwave therapies in producing similar results. Specifically, this study contributes to the existing knowledge base by showing that adjunct therapy improves retention in cognitive-behavioral (neurobehavioral) crack cocaine treatment. However, it is the neurobehavioral treatment itself and not adjunct therapies *per se*, that is directly responsible for the drug use outcome effects reported here. The overall high rate of abstinence from cocaine self-reported at follow-up, along with the percentage of the sample with urines negative for any drug (52.2%) and for cocaine (59.1%), suggests that the failure of adjunct therapies to produce measurable direct effects on drug use outcomes may be a testimony to the potency of the neurobehavioral therapy received by participants in all modalities. However, the data also indicate that adjunct therapies probably influenced drug users to stay in treatment. Participants who received larger doses of adjunct therapy attended a greater number of neurobehavioral counseling sessions, and thus were exposed to a larger dose of neurobehavioral treatment. Larger doses of adjunct therapy were also associated with a greater number of days in treatment. However, because it was the number of neurobehavioral sessions attended that predicted urine screen outcomes, adjunct therapies, by improving attendance rates, contributed *indirectly* to treatment success.

Because this was not a clinical trial, still less a double-blinded study, placebo effects cannot be ruled out. In fact, the absence of any significant differences in effects between the three adjunct therapies suggests that the knowledge of participants that they were receiving an adjunct therapy may be the most reasonable explanation for the differences in retention that were found. It is possible that the special attention focused on individuals in adjunct therapy groups would have encouraged them to stay in the program regardless of the specific adjunct therapy they received. Gestures presented to clients as techniques for managing cocaine craving may have had exceptional power in such a context. Thus, these results cannot be characterized as support for the physiological mechanisms theoretically underlying any one of the adjunct therapies studied, but they do support the notion that the addition of particular adjunct therapies to outpatient neurobehavioral cocaine treatment does improve retention rates among precisely the type of drug users who are at increased risk for attrition from outpatient treatment programs (Agosti et al., 1991; Kleinman et al., 1992).

It is suggested that future studies focus on the potency of anticraving medication as compared to nonpharmaceutical adjunct therapies, on psychological versus physiological effects of adjunct therapies, and on intervening psychosocial variables mediating the relationships between adjunct therapies, client retention, drug use outcomes, and measures of short-term psychological and/or cognitive changes theoretically linked to adjunct therapies. Studies of the latter sort could be particularly instructive in indicating the change processes that are stimulated by the addition of therapies like acupuncture, biofeedback, and pharmaceutical intervention to existing cocaine treatment regimens. Finally, more treatment research and evaluation is needed that focuses on the effect of various treatments on the urban, indigent populations for whom the consequences of the crack cocaine epidemic have been particularly immediate and painful.

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