

CONTINGENT REINFORCEMENT OF ABSTINENCE WITH INDIVIDUALS ABUSING COCAINE AND MARIJUANA

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Two males diagnosed with cocaine dependence received a behavioral intervention comprised of contingency management and the community reinforcement approach. During the initial phase of treatment, reinforcement was delivered contingent on submitting cocaine-free urine specimens. The community reinforcement approach involved two behavior therapy sessions each week. Almost complete cocaine abstinence was achieved, but regular marijuana use continued. During a second phase, reinforcement magnitude was reduced, but remained contingent on submitting cocaine-free specimens. Behavior therapy was reduced to once per week. Cocaine abstinence and regular marijuana use continued. Next, reinforcement was delivered contingent on submitting cocaine- and marijuana-free specimens. This modified contingency resulted in an abrupt increase in marijuana abstinence and maintenance of cocaine abstinence. One- and 5-month follow-ups indicated that cocaine abstinence continued, but marijuana smoking resumed. These results indicate that the behavioral intervention was efficacious in achieving abstinence from cocaine and marijuana; maintenance, however, was achieved for cocaine only.

DESCRIPTORS: drug abuse treatment, cocaine, marijuana, contingency management, social reinforcement

Approximately 1 to 2 million persons in the United States are currently dependent on cocaine (Committee on the Judiciary, United States Senate, 1990; National Institute on Drug Abuse [NIDA], 1989). Not surprisingly, many of these individuals seek treatment for their problem (NIDA, 1987). Unfortunately, no consensus exists about how to treat cocaine dependence effectively (Gawin & Kleber, 1987). This is particularly alarming given the serious public health problems associated with cocaine use and dependence, including AIDS (Chaisson et al., 1989), sudden death (Cregler & Mark, 1986), and maternal and fetal adverse effects (Chasnoff, Burns, Schnoll, & Burns, 1985).

An estimated 40% to 50% of persons seeking treatment for cocaine dependence also meet diagnostic criteria for cannabis dependence (N. Miller et al., 1990; Schnoll, Daghestani, Karrigan, Kitchen, & Hansen, 1985). Common reasons given for the use of cannabis by persons presenting for cocaine

treatment are (a) to counteract cocaine-induced anxiety, (b) to relieve cocaine-induced depression, (c) to substitute when cocaine is scarce, and (d) to use as a primary drug of choice (N. Miller et al., 1990). The effect of marijuana use on success in treatment of cocaine dependence is unknown, although some evidence suggests that continued use is a poor prognostic indicator (Rawson, Obert, McCann, & Mann, 1986). Currently, there are no empirically based guidelines for the treatment of cocaine-dependent individuals who also regularly use marijuana. A common position is that persons seeking treatment for cocaine dependence must simultaneously cease all use of other drugs of abuse to succeed in treatment (e.g., N. Miller et al., 1990; Washton, 1990), but there have been no controlled studies to support this position.

Although no consensus exists about how to treat cocaine or marijuana dependence (Gawin & Kleber, 1987; Roffman, Stephens, & Simpson, 1989), results obtained using behavioral treatments for cocaine and other types of drug dependence appear promising. Two behavioral interventions with demonstrated efficacy for drug and alcohol abuse treatment are contingency-management procedures (e.g., Bigelow, Stitzer, & Liebson, 1984; Higgins, Stitzer,

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Bigelow, & Liebson, 1986) and the community reinforcement approach (Hunt & Azrin, 1973; Sisson & Azrin, 1989).

Contingency-management procedures are designed to decrease drug use by systematically arranging appropriate environmental consequences for drug use or abstinence. In general, reinforcement is presented contingent on evidence of drug abstinence and is withheld when drugs are used. Aversive contingencies are used less frequently for ethical reasons, and because they may lead to greater treatment dropout than positive reinforcement interventions (Stitzer, Bickel, Bigelow, & Liebson, 1986). Contingency-management procedures have been found to be effective in reducing alcohol consumption (Bigelow, Griffiths, & Liebson, 1975; Griffiths, Bigelow, & Liebson, 1978; P. Miller, 1975; P. Miller, Hersen, Eisler, & Watt, 1974) and illicit opiate and benzodiazepine use by individuals in methadone treatment for opiate dependence (Hall, Cooper, Burmaster, & Polk, 1977; Stitzer, Bigelow, & Liebson, 1979, 1980). Anker and Crowley (1982) demonstrated the efficacy of aversive contingencies in reducing cocaine use in a self-selected sample of cocaine-dependent individuals.

The community reinforcement approach (CRA) focuses on developing community-based sources of reinforcement (e.g., employment, new recreational and social activities, improved quality of living, and enhancement of marital relationship) that can compete with the reinforcing effects of alcohol and other drugs. In a series of controlled studies, Azrin and his colleagues demonstrated the efficacy of CRA in achieving abstinence with alcohol-dependent individuals; the intervention also increased employment and reduced the amount of time individuals were institutionalized (Azrin, 1976; Azrin, Sisson, Meyers, & Godley, 1982; Hunt & Azrin, 1973).

Recently Higgins *et al.* (1991) compared a behavioral treatment for cocaine dependence that combined contingency-management procedures and CRA with standard outpatient drug counseling. The behavioral intervention was superior in reducing cocaine use and retaining patients in treatment.

The present study employed a multiple baseline design to assess the efficacy of a treatment that

combined contingency management with CRA to increase abstinence from cocaine and marijuana use.

METHOD

Subjects

Two males seeking treatment for cocaine dependence participated in this study. Both subjects met DSM-III-R criteria for cocaine dependence (American Psychiatric Association, 1987). Phil was 28 years old, white, unemployed, and divorced, with 11 years of education. He reported using cocaine regularly for the past 3 years, using 8 g of cocaine the week prior to intake, and using cocaine on 3 of the prior 30 days. His preferred route of administration was smoking. Phil also met criteria for marijuana dependence. He reported smoking marijuana regularly for the past 17 years, using approximately 14 g per week, and smoking marijuana on 27 of the prior 30 days. Phil sought treatment because of the negative impact of cocaine use on his family (daughter and ex-wife), and he recently had been put on probation for possession of cocaine and ordered to obtain treatment. He did not express interest in treatment for his marijuana use. He reported receiving no other prior treatment for substance abuse. He had sought outpatient treatment at another clinic in the community prior to attending our clinic. He was referred by that clinic to an inpatient facility, but did not follow through.

Mike was 35 years old, white, employed part-time, and single, with 14 years of education. He reported working 18 of the prior 30 days and reported income of \$600.00 per month. He reported using cocaine regularly for the past 10 years, using 7 g per week, and using it on 29 of the prior 30 days. His preferred route of administration was intranasal. Mike also met criteria for marijuana abuse. He reported smoking marijuana regularly for the past 15 years, smoking approximately 4 g per week, and smoking it on 10 of the prior 30 days. Mike reported that he was seeking treatment because he "wanted to stop using cocaine" and because our research clinic offered an "opportunity

for free treatment." He did not express interest in treatment for marijuana use. To our knowledge, Mike had no involvement with the legal system. He reported receiving no other prior treatment for substance abuse.

Subjects did not know each other, and to our knowledge had no contact with each other during treatment. Both subjects provided written informed consent to participate in a research protocol for treatment of cocaine dependence, and later for treatment of both cocaine and marijuana abuse or dependence.

Data Collection

Urinalysis monitoring. Urine specimens were collected under staff observation and were immediately analyzed using an onsite enzyme multiplied immunoassay technique system (EMIT; Syva Corp.). The approximate cost of the reagent used to test for each drug metabolite was \$2.00 per test. Results were available 2 to 5 min after specimen collection. Sensitivity levels for the detection of benzoylecgonine and 11-nor-delta-9-THC-9-carboxylic acid (hereafter referred to as cannabinoid), the primary metabolites of cocaine and marijuana, were set at 300 ng/mL and 100 ng/mL, respectively, which are the cutoffs recommended by the manufacturer. These levels maximize the detection of use during the past 72 hr and minimize the detection of more distant use. Restricting detection to relatively recent use provides the necessary flexibility to detect and differentially reinforce brief periods of abstinence.

Reliability of the EMIT results was checked by retesting 10 randomly selected specimens per subject via an independent laboratory using a fluorescence polarization immunoassay technology (TDx; Abbot Corp.). Sensitivity levels were set at the same ng/mL for benzoylecgonine and cannabinoids as those employed in the EMIT analyses. Agreement was 100% for the cocaine analyses. Agreement was also 100% for cannabinoid-negative specimens (eight of eight tests were confirmed); however, only 33% (four of 12 tests) of cannabinoid-positive specimens were confirmed. The eight specimens for which disagreement occurred were then submitted

to a more definitive analysis using gas chromatography and mass spectrometry. Those analyses confirmed that seven of the eight specimens were cannabinoid positive. Thus, our urinalysis testing may have resulted in one false positive, although no positive results were challenged by either subject.

Corroboration of subject self-reports. Significant others were interviewed to obtain independent corroboration of subject self-reports of cocaine and marijuana use and employment status at each phase of treatment and follow-up. Phil's roommate and Mike's girlfriend participated. Significant others indicated whether they agreed with the subject self-reports and rated their level of confidence (0 to 100) in their confirmations (Sobell et al., 1980).

Procedures

Experimental design. Initially, subjects received CRA and contingent reinforcement for cocaine abstinence only; this is referred to as the cocaine-abstinence phase of treatment. Phil and Mike entered this treatment phase during the same week. After 12 weeks, each subject entered the cocaine-maintenance phase, during which reinforcement for cocaine abstinence was reduced in magnitude and frequency. It was during this second phase that subjects were given notice that, in a third phase of treatment (cocaine-marijuana-abstinence phase), the contingency would be modified to require both cocaine and marijuana abstinence. This sequence of interventions created an opportunity to assess the efficacy of the treatment package of contingency management and CRA by observing effects first on cocaine use and then on marijuana use. In addition, by staggering the time of implementation of the contingency in the cocaine-marijuana-abstinence phase, a multiple baseline design across persons was created to provide a relatively stringent test of the treatment package. Follow-up interviews were conducted 1 month and 5 months after treatment termination.

Cocaine-abstinence phase. The cocaine-abstinence phase lasted for 12 weeks, and involved CRA and contingency-management procedures. CRA consisted of two behavior therapy sessions each week. A master's level therapist with 3 months

experience in treatments for substance abuse and dependence conducted the therapy sessions with both subjects. For both Phil and Mike, the sessions involved functional analysis of cocaine use, stimulus-control training, employment and career counseling, assertiveness training, AIDS education, relaxation training, and counseling targeting increased participation in non-drug-related recreational and social activities. Six of Mike's sessions involved reciprocal relationship counseling with his girlfriend (Azrin, Naster, & Jones, 1973). During this phase, Mike's girlfriend was telephoned immediately following each urinalysis test and was informed of the results. If the specimen was negative for cocaine, she performed an agreed-upon positive activity with Mike. If the specimen was positive, she refrained from the agreed-upon activity.

The contingency-management procedures focused on urinalysis results. Urine specimens were collected four times a week (Mondays, Wednesdays, Fridays, and Saturdays). Urine was always analyzed for benzoylecgonine (cocaine metabolite). At least once each week, random specimens were also analyzed for cannabinoids, opiates, barbiturates, amphetamines, and benzodiazepines. For each benzoylecgonine-negative specimen, the subject earned points and immediately received vouchers indicating the number of points earned. The first negative urine specimen earned 10 points, and each consecutive negative specimen thereafter earned 5 points more than the previous one. For example, the second consecutive specimen earned 15 points, the third earned 20 points, and so on. Each point was worth \$0.15. In addition, four consecutive negative specimens earned bonus points equivalent to \$10.00 to reinforce periods of continuous abstinence.

In the event of a benzoylecgonine-positive specimen, no points were earned and the number of points that could be earned for the next negative specimen was reset to 10; consecutive negative specimens, thereafter, increased by 5 points as described above. Once earned, points could not be taken away. If a scheduled specimen was not provided, it was treated as a positive specimen.

If the subject remained abstinent for the entire

12-week period, he earned the equivalent of \$12.36 per day. Points could be exchanged for various prosocial goods or services such as movie tickets, sporting goods, ski-lift tickets, dinner certificates, and so forth. The purpose of this system was to support the goals of CRA by increasing involvement in prosocial activities and developing a reinforcing drug-free life-style to compete with the reinforcing effects of drugs. Exchanges could be made on short notice, but at least a few hours notice was necessary so that the voucher purchases could be approved by the therapist and arranged by clinic staff. No money ever exchanged hands; clinic staff made all purchases. Each subject was encouraged to use the points as they were earned.

Cocaine-maintenance phase. During this phase, subjects provided urine specimens twice per week (Tuesdays and Fridays), and one \$1.00 Vermont state lottery ticket was provided for each benzoylecgonine-negative specimen. Behavior therapy was reduced to a 30-min session once per week. For both subjects, therapy sessions focused on maintaining behavior changes made in the initial phase and developing strategies for initiating marijuana abstinence. The duration of the cocaine-maintenance phase was 3.5 weeks for Phil and 7.5 weeks for Mike.

Cocaine-marijuana-abstinence phase. This final phase of treatment was implemented due to marijuana use throughout the first two phases. As a step toward implementation of this phase, both subjects were invited to participate in a new contingency-management procedure that targeted marijuana and cocaine use. The only change was that reinforcement (i.e., vouchers) would be provided contingent on submitting specimens negative for *both* cocaine and marijuana. Subjects were told that they would be given a 2-week notice prior to implementation of the new contingency. The notice was designed to allow time for marijuana to clear the subject's system prior to implementation of the contingencies. Cannabinoids may take from 2 to 4 weeks to clear the body of a regular marijuana user (Hawks & Chiang, 1986). Phil received notice at the end of Week 1 and Mike received notice at the end of Week 5 of the cocaine-maintenance phase.

This phase of treatment lasted for 12 weeks, and urine specimens continued to be collected twice per week on Tuesdays and Fridays. The EMIT cutoffs for benzoylecgonine and cannabinoids were the same as in the prior phases. Urine specimens were analyzed immediately for cocaine and marijuana, and vouchers were received immediately after testing. The total value of the vouchers that could be earned in this phase was equal to that in the cocaine-abstinence phase. Subjects attended 30-min individual behavior therapy sessions on a weekly or biweekly schedule. Therapy sessions focused on maintaining the behavior changes made during the previous phases of treatment.

Follow-up. At 1 and 5 months after treatment termination, each subject returned to the clinic for an interview and to provide a urine specimen. No other clinic contact or any type of treatment occurred during this period.

RESULTS

Baseline

Only one baseline specimen was collected from each subject prior to the intervention. Phil provided a benzoylecgonine-negative specimen, whereas Mike provided a benzoylecgonine-positive specimen. Of the 29 specimens collected from Phil prior to treatment for marijuana use, 21% were cannabinoid negative, whereas 9% of Mike's 34 baseline specimens were cannabinoid negative (Figure 1).

Cocaine-Abstinence Phase

During the 12 weeks of this phase in which cocaine abstinence was reinforced, Phil provided 90% and Mike provided 96% benzoylecgonine-negative specimens. Both subjects regularly tested positive for cannabinoids during this phase. They tested negative for all other drugs monitored during this period (opiates, barbiturates, amphetamines, and benzodiazepines) with the exception of one benzodiazepine-positive test at Week 1 for Mike. Phil reported working 28 of the final 30 days of this phase, and Mike reported working 22 of the final 30 days.

Cocaine-Maintenance Phase

During this brief period, Phil and Mike provided 100% benzoylecgonine-negative specimens, indicating complete abstinence from cocaine use. Both subjects continued to use marijuana regularly and tested negative for all other drugs monitored.

Cocaine-Marijuana-Abstinence Phase

During the 12 weeks of this phase in which cocaine and marijuana abstinence was reinforced, little or no use of either drug was detected. Phil provided 96% and Mike provided 100% benzoylecgonine-negative specimens, and Phil provided 92% and Mike provided 100% cannabinoid-negative specimens. As in the previous phase, both subjects tested negative for all other drugs monitored. Both subjects reported working 24 of the final 30 days of this phase.

Follow-Up

One month after treatment termination, Phil provided a benzoylecgonine-negative and a cannabinoid-positive specimen. He reported no use of cocaine during the prior 30 days, smoking marijuana 3 of the prior 30 days, and working 20 of the prior 30 days. Five months after treatment termination, Phil provided a benzoylecgonine-negative and a cannabinoid-positive specimen. He reported no use of cocaine during the prior 30 days, smoking marijuana 6 of the prior 30 days, and working 24 of the prior 30 days.

Mike also provided a benzoylecgonine-negative and a cannabinoid-positive specimen at the 1-month follow-up. He reported no use of cocaine during the prior 30 days, smoking marijuana 15 of the prior 30 days, and working 18 of the prior 30 days. Mike again provided a benzoylecgonine-negative and a cannabinoid-positive specimen at the 5-month follow-up. He reported no use of cocaine during the prior 30 days, smoking marijuana 15 of the prior 30 days, and working 20 of the prior 30 days.

Reports from Significant Others

Phil's significant other confirmed his self-reports of cocaine and marijuana use at all points in treat-

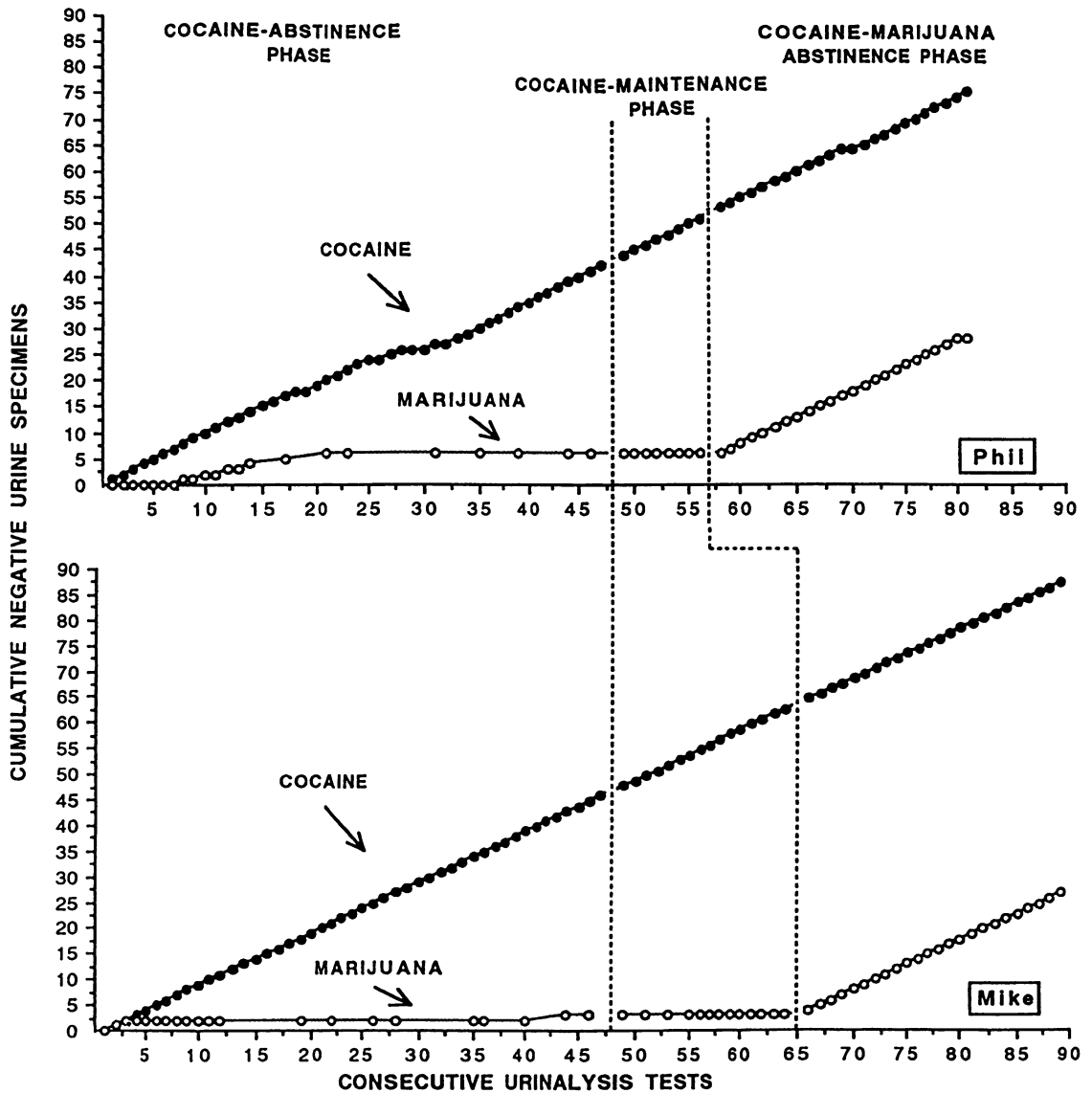


Figure 1. The cumulative number of negative cocaine and marijuana urinalysis results obtained with Phil and Mike during three phases of treatment as a function of consecutive tests conducted throughout treatment. Cocaine and marijuana results are represented by closed and open symbols, respectively.

ment and follow-up. All confirmations were made with 80% or greater confidence. She confirmed Phil's employment reports with 100% confidence with the exception of his employment report at the 5-month follow-up (30% confidence). Mike's roommate confirmed his self-reports of cocaine use and marijuana use with 100% confidence at all points in treatment and follow-up. She also confirmed his employment reports with 100% confidence at all points with the exception that she

believed he was working less than reported at intake (50% confidence).

DISCUSSION

Results of the present study demonstrate the efficacy of a treatment package that included contingency management and CRA for increasing cocaine and marijuana abstinence with 2 persons seeking treatment for cocaine dependence. At intake,

both subjects reported using approximately 30 g of cocaine during the prior month, and those reports were confirmed by significant others. During the initial phase of treatment, incentives were provided for cocaine-free urine specimens and CRA was implemented. Cocaine abstinence was achieved with both subjects, but marijuana use continued at a steady and regular level. This pattern of cocaine abstinence and regular marijuana use was maintained during the second treatment phase, until notice was given concerning the modified contingency requiring cocaine and marijuana abstinence. Implementation of this modified contingency resulted in almost complete abstinence from marijuana and cocaine with both subjects, with the initiation of abstinence from marijuana corresponding with the initiation of the modified contingency for each subject. In our opinion, this sequence of changes in cocaine and marijuana urinalysis results supports the inference that the treatment package was effective in engendering drug abstinence in these subjects.

The findings of the present study support previous findings of the efficacy of contingent reinforcement in reducing drug use (Hall et al., 1977; Higgins et al., 1986, 1991; Stitzer et al., 1979, 1980). The extension of the efficacy of contingency-management procedures to cocaine dependence is important given the high prevalence of cocaine dependence and the dearth of controlled treatment research data providing a clear demonstration of an effective treatment for cocaine use (Gawin & Kleber, 1987). It is important to note, however, that despite the use of a multiple baseline design in the present study, it is difficult to tell whether the contingency-management procedure, the CRA, or the combination of both procedures was responsible for increased abstinence.

One- and 5-month follow-up data revealed that cocaine abstinence was maintained, but that marijuana use was reinitiated at a reduced rate for 1 subject and at a rate similar to that exhibited prior to treatment for the other subject. Maintenance of cocaine abstinence for approximately 1 year is encouraging, considering the many difficulties often encountered in treating cocaine dependence (Gawin & Kleber, 1987). The failure to maintain marijuana

abstinence in this study raises questions about the utility of intervening on other drug use when the user has not requested such help. These results suggest that doing so may result in only short-term changes, and may not be a necessary step in achieving abstinence from the drug for which help was requested.

On the other hand, the continued use of other drugs of abuse during treatment for cocaine dependence is typically viewed as increasing the risk for relapse. From an operant perspective, use of other psychoactive substances may bring the user into contact with discriminative stimuli for use of the primary drug. These discriminative stimuli may be in the form of persons and other environmental stimuli previously paired with cocaine availability, the interoceptive stimulus effects of the secondary drug, or some combination of the two (see Bickel & Kelly, 1988, for a review). In research with nonhumans, for example, reinitiation of cocaine-reinforced responding during extinction can be "primed" by drugs other than cocaine (de Wit & Stewart, 1981). Furthermore, the use of other drugs of abuse may impair the ability to learn or apply skills important to maintaining long-term abstinence or to developing new prosocial behaviors that can provide alternative sources of reinforcement. In light of these considerations, and the fact that the majority of persons who seek treatment for cocaine dependence also abuse or are dependent on other drugs (Higgins et al., 1991; N. Miller et al., 1990; Schnoll et al., 1985), more research is needed to determine (a) when it is necessary to intervene on other drug use and (b) the most effective intervention method for doing so.

The efficacy of a "sequential" approach using contingency management and CRA for treating multiple-drug users demonstrated in the present study provides an alternative to traditional approaches to drug abuse treatment (e.g., the 12-step approach) that emphasize (and usually mandate) immediate cessation from all drugs of abuse and treat all drugs, including alcohol, similarly (Cook, 1988; Washton, 1990). Such demands can sometimes result in early treatment dropouts (Higgins et al., 1991). Not demanding concurrent cessation of all drugs, by contrast, may retain the user in

treatment, thereby facilitating the active treatment of the more "serious" drug use, and perhaps increase the probability of compliance with the treatment of secondary drug use at a later time. Of course, it is possible that we may have been able to achieve abstinence from both drugs by implementing the contingency requiring abstinence from both drugs during the initial phase, or that a longer period of marijuana abstinence prior to treatment termination may have resulted in better maintenance of marijuana abstinence. These are empirical questions to be pursued in future studies.

Finally, the cost of providing the treatment described in this study may be a concern. For example, the incentives derived from the contingency-management procedure cost a maximum of \$12.36 per day during each 12-week phase. However, it is important to note that such costs are minimal when compared to the costs of inpatient hospitalization or the costs of medical care for cocaine-associated diseases such as AIDS. Nevertheless, it is doubtful that this treatment procedure can be adopted for widespread use in the near future. The primary importance of these findings is the demonstration that environmental conditions can be arranged to compete effectively with the reinforcing effects of cocaine and marijuana use. The means by which those conditions are arranged may vary considerably. For example, contingent incentives could be donated by community businesses and organizations (Boudin *et al.*, 1977), or the magnitude of incentives could be reduced, perhaps without changing their efficacy. Future studies investigating use of different classes, magnitudes, and schedules of reinforcement will be necessary to identify the range of options available in developing effective behavioral interventions for cocaine and other forms of drug dependence.

REFERENCES

- American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed. rev.). Washington, DC: Author.
- Anker, A. A., & Crowley, T. J. (1982). Use of contingency contracts in specialty clinics for cocaine abuse. In L. S. Harris (Ed.), *Problems of drug dependence* (NIDA Research Monograph 41, pp. 452-459). Washington, DC: U.S. Government Printing Office.
- Azrin, N. H. (1976). Improvements in the community reinforcement approach to alcoholism. *Behaviour Research and Therapy*, **14**, 339-348.
- Azrin, N. H., Naster, B. J., & Jones, R. (1973). Reciprocity counseling: A rapid learning-based procedure for marital counseling. *Behaviour Research and Therapy*, **11**, 365-382.
- Azrin, N. H., Sisson, W., Meyers, R., & Godley, M. (1982). Alcoholism treatment by disulfiram and community reinforcement therapy. *Journal of Behavior Therapy & Experimental Psychiatry*, **13**, 105-112.
- Bickel, W. K., & Kelly, T. H. (1988). The relationship of stimulus control to the treatment of substance abuse. In B. A. Ray (Ed.), *Learning factors in substance abuse* (NIDA Research Monograph 84, pp. 122-140). Washington, DC: U.S. Government Printing Office.
- Bigelow, G., Griffiths, R. R., & Liebson, I. A. (1975). Experimental models for the modification of human drug self-administration: Methodological developments in the study of ethanol self-administration by alcoholics. *Federation Proceedings*, **34**, 1785-1792.
- Bigelow, G., Stitzer, M. L., & Liebson, I. A. (1984). The role of behavioral contingency management in drug abuse treatment. In J. Grabowski, M. L. Stitzer, & J. E. Henningfield (Eds.), *Behavioral intervention techniques in drug abuse treatment* (NIDA Research Monograph 46, pp. 36-52). Washington, DC: U.S. Government Printing Office.
- Boudin, H. M., Valentine, V. E., Inghram, R. D., Brantley, J. M., Ruiz, M. R., Smith, G. G., Catlin, R. P., & Regan, E. J. (1977). Contingency contracting with drug abusers in the natural environment. *International Journal of the Addictions*, **12**, 1-16.
- Chaisson, R. E., Bacchetti, P., Osmond, D., Brodie, B., Sande, M. A., & Moss, A. R. (1989). Cocaine use and HIV infection in intravenous drug users in San Francisco. *Journal of the American Medical Association*, **261**, 561-565.
- Chasnoff, I. J., Burns, W. J., Schnoll, S. H., & Burns, K. A. (1985). Cocaine use in pregnancy. *New England Journal of Medicine*, **313**, 666-669.
- Committee on the Judiciary, United States Senate. (1990). *Hard-core cocaine addicts: Measuring and fighting the epidemic* (Publication No. 552-070-08156-9). Washington, DC: U.S. Government Printing Office.
- Cook, C. C. H. (1988). The Minnesota Model in the management of drug and alcohol dependency: Miracle, method or myth? Part I. The philosophy and the programme. *British Journal of Addiction*, **83**, 625-634.
- Cregler, L. L., & Mark, H. (1986). Medical complications of cocaine abuse. *New England Journal of Medicine*, **315**, 1495-1500.
- de Wit, H., & Stewart, J. (1981). Reinstatement of cocaine-responding in the rat. *Psychopharmacology*, **75**, 134-143.
- Gawin, F. H., & Kleber, H. (1987). Issues in cocaine abuse treatment research. In S. Fisher, A. Raskin, & E. H. Uhlenhuth (Eds.), *Cocaine: Clinical and biobehav-*

- ioral aspects* (pp. 174–192). New York: Oxford University Press.
- Griffiths, R. R., Bigelow, G., & Liebson, I. (1978). Relationship of social factors to ethanol self-administration in alcoholics. In P. E. Nathan, M. A. Marlatt, & T. Loberg (Eds.), *Alcoholism: New directions in behavioral research and treatment* (pp. 351–379). New York: Plenum Press.
- Hall, S. M., Cooper, J. L., Burmaster, S., & Polk, A. (1977). Contingency contracting as a therapeutic tool with methadone maintenance clients: Six single subject studies. *Behaviour Research and Therapy*, **15**, 438–441.
- Hawks, R. L., & Chiang, C. N. (1986). Examples of specific drugs. In R. L. Hawks & C. N. Chiang (Eds.), *Urine testing for drugs of abuse* (NIDA Research Monograph 73, pp. 84–112). Washington, DC: U.S. Government Printing Office.
- Higgins, S. T., Delaney, D. D., Budney, A. J., Bickel, W. K., Hughes, J. R., Foerg, F., & Fenwick, J. W. (1991). A behavioral approach to achieving initial cocaine abstinence. *American Journal of Psychiatry*, **148**, 1218–1224.
- Higgins, S. T., Stitzer, M. L., Bigelow, G., & Liebson, I. A. (1986). Contingent methadone delivery: Effects on illicit opiate use. *Drug and Alcohol Dependence*, **17**, 311–322.
- Hunt, G. M., & Azrin, N. H. (1973). A community-reinforcement approach to alcoholism. *Behaviour Research and Therapy*, **14**, 339–348.
- Miller, N. S., Klahr, A. L., Gold, M. S., Sweeney, K., Cores, J. A., & Sweeney, D. R. (1990). Cannabis diagnosis of patients receiving treatment for cocaine dependence. *Journal of Substance Abuse*, **2**, 107–111.
- Miller, P. M. (1975). A behavioral intervention program for chronic public drunkenness offenders. *Archives of General Psychiatry*, **32**, 915–918.
- Miller, P. M., Hersen, M., Eisler, R. M., & Watt, J. G. (1974). Contingent reinforcement of lowered blood/alcohol levels in an outpatient chronic alcoholic. *Behaviour Research and Therapy*, **12**, 261–263.
- National Institute on Drug Abuse. (1987). *Cocaine client admissions 1976–1985* (DHHS Publication No. ADM 87-1528). Washington, DC: U.S. Government Printing Office.
- National Institute on Drug Abuse. (1989). Household survey. In National Institute on Drug Abuse (Ed.), *NIDA notes* (vol. 4, pp. 42–43) (DHHS Publication No. ADM 89-1488). Washington, DC: U.S. Government Printing Office.
- Rawson, R. A., Obert, J. L., McCann, M. J., & Mann, A. J. (1986). Cocaine treatment outcome: Cocaine use following inpatient, outpatient, and no treatment. In L. S. Harris (Ed.), *Problems of drug dependence* (NIDA Research Monograph 67, pp. 271–277). Washington, DC: U.S. Government Printing Office.
- Roffman, R. A., Stephens, R. S., & Simpson, E. E. (1989). Relapse prevention with adult chronic marijuana smokers. *Journal of Chemical Dependency Treatment*, **2**, 241–257.
- Schnoll, S. H., Daghestani, A. N., Karrigan, J., Kitchen, S. B., & Hansen, T. (1985). Characteristics of cocaine users in treatment. In L. S. Harris (Ed.), *Problems of drug dependence* (NIDA Research Monograph 67, p. 397). Washington, DC: U.S. Government Printing Office.
- Sisson, R., & Azrin, N. (1989). The community reinforcement approach. In R. K. Hester & W. R. Miller (Eds.), *Handbook of alcoholism treatment approaches: Effective alternatives* (pp. 242–257). New York: Pergamon Press.
- Sobell, M. A., Maisto, S. A., Sobell, L. C., Cooper, A. M., Cooper, T. C., & Sanders, B. (1980). Developing a prototype for evaluating alcohol treatment effectiveness. In L. C. Sobell, M. B. Sobell, & E. Ward (Eds.), *Evaluating alcohol and drug abuse treatment effectiveness: Recent advances* (pp. 129–150). New York: Pergamon Press.
- Stitzer, M., Bickel, W. K., Bigelow, G., & Liebson, I. (1986). Effects of methadone dose contingencies on urinalysis test results of poly-abusing methadone-maintenance patients. *Drug and Alcohol Dependence*, **18**, 341–348.
- Stitzer, M., Bigelow, G., & Liebson, I. (1979). Reducing drug use among methadone maintenance clients: Contingent reinforcement for morphine-free urines. *Addictive Behaviors*, **5**, 333–340.
- Stitzer, M., Bigelow, G., & Liebson, I. (1980). Reducing benzodiazepine self-administration with contingent reinforcement. *Addictive Behaviors*, **4**, 245–252.
- Washton, A. M. (1990). Structured outpatient treatment of alcohol vs. drug dependencies. In M. Galanter (Ed.), *Recent developments in alcoholism* (vol. 8, pp. 285–304). New York: Plenum Press.

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