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CONTINGENT REINFORCEMENT FOR BENZODIAZEPINE-FREE URINES: EVALUATION OF A DRUG ABUSE TREATMENT INTERVENTION

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This study evaluated contingent reinforcement for benzodiazepine-free urines as a therapeutic intervention for promoting reduced use of supplemental benzodiazepine drugs among methadone maintenance outpatients. Ten methadone maintenance patients were selected for participation on the basis of positive urinalysis results. During a 12-week intervention period these patients were offered clinic privileges, including monetary payments or methadone take-home doses, contingent on benzodiazepine negative urinalysis test results. Eight of ten participants responded to the intervention with at least 2.5 weeks of consecutive clean urines. An increase in benzodiazepine-negative tests during the contingent reinforcement period was significant for the group as a whole. The results suggest that more widespread application of contingent reinforcement procedures may be warranted in drug abuse treatment clinics.

DESCRIPTORS: behavior modification, behavioral treatment, contingency management, reinforcement, drug abuse treatment

Supplemental drug use is common among methadone maintenance patients, and although reduced supplemental drug use is invariably seen as an important goal of treatment programs, there has been little systematic evaluation of specific interventions for promoting reduced drug use among methadone maintenance patients (Stitzer, Bigelow, & Liebson, 1979*a*). One type of treatment intervention which has shown promise for reducing supplemental drug use is contingent reinforcement for abstinence, when abstinence is monitored via urinalysis testing. Several reports are available in which contingent reinforcement for morphine-free urines resulted in reduced opiate use in patients who were habitual users of supplemental opiates. Hall, Cooper, Burmaster, and Polk (1977) reported a controlled case study in which the proportion of morphine-free urines of one methadone maintenance patient increased dramatically during periods of time when various program privileges and other reinforcers were delivered contingent upon drug-free urine samples. Stitzer, Bigelow, and Liebson (1980) studied seven methadone maintenance patients who were chronic heroin abusers. These subjects were offered monetary payment and program privileges during randomly selected weeks for morphine-free urine samples. Reductions in opiate use were achieved in five of seven study participants during the contingent reinforcement intervention, compared to pre-study baseline rates of urine positives. Finally, Hall, Bass, Hargreaves, and Loeb (1979) studied the effects of monetary payment contingent on morphine-free urines in patients enrolled in 16-day methadone detoxification treatment. Opiate-positive

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urine test rates were significantly reduced in the group of patients randomly assigned to the contingent payment procedure.

Besides opiates, benzodiazepine tranquilizers such as diazepam (Valium®) are probably the drugs most frequently used by methadone maintenance patients. Woody, Mintz, O'Hare, O'Brien, Greenstein, and Hargrove (1975) designated 40% of their methadone maintenance patients as "diazepam users" on the basis of self-reports of liking for the drug and/or recent use of street-purchased drug. A similar incidence of benzodiazepine use was noted by Bigelow, Stitzer, Lawrence, Krasnegor, D'Lugoff, and Hawthorne (1980) when judgment was based on persistent drug-positive urinalysis tests and Stitzer, Griffiths, McLellan, Grabowski, and Hawthorne (1981) found an even higher prevalence of benzodiazepine-positive tests among methadone maintenance patients. Kleber and Gold (1978), although they do not provide quantitative estimates of benzodiazepine use, have also observed that the predominant nonopiate drugs of abuse among their methadone maintenance patients were benzodiazepine tranquilizers. The purpose of the present study was to extend the analysis of contingent reinforcement for drug abstinence to the population of methadone maintenance patients who use benzodiazepine tranquilizers and to test further the efficacy of these contingent reinforcement procedures in promoting reduced supplemental drug use.

The study was conducted with a group of chronic benzodiazepine supplementers concurrently enrolled in methadone maintenance treatment. An A-B-A design was used to evaluate the impact on supplemental benzodiazepine use of reinforcement for clean urines within the context of a methadone maintenance treatment clinic. Standard drug abuse clinical urinalysis testing procedures provided an objective index of recent benzodiazepine use, a target for the contingent reinforcement intervention, and a means to evaluate the impact of contingent reinforcement procedures on drug use. During the contingent reinforcement intervention, subjects were offered program privileges and monetary payments for providing objective urinalysis evidence of abstinence from benzodiazepine drugs.

METHODS

Participants

Ten male patients currently enrolled in methadone maintenance treatment participated. Characteristics of these participants are presented in Table 1. All had lengthy histories of opiate addiction and all but one had histories of methadone maintenance treatment in other clinics prior to enrollment in the present clinic. Participants were selected on the basis of extensive clinical and urinalysis histories of benzodiazepine abuse from the patients enrolled in a small (30-40 patient) treatment and research clinic located at Baltimore City Hospitals. Those who had been enrolled at the clinic prior to the start of eligibility screening for the present study showed benzodiazepine positive urinalysis results (thin layer chromatography analysis) on 50% or more of the urine samples collected during their enrollment at the clinic (Table 1) while all study participants showed 80% or more positive samples (thin layer chromatography) during the 3-mo period prior to the start of their intervention (see Table 2).

Procedures

A within-subject A-B-A design was used to assess the impact of contingent reinforcement for clean urine samples on benzodiazepine urinalysis levels of study participants. Participants were approached at different points in their clinic enrollment (see Table 1) and did not all participant simultaneously in this experiment. During preintervention baseline assessment, study participants attended the clinic daily to ingest methadone delivered in a cherry syrup vehicle (Methadose®) under nursing supervision, gave twice weekly (Monday and Friday) urine samples and attended counseling sessions, as required by the clinic. These patients were not told that they were being evaluated for the

Table 1

Characteristics of Study Participants

Participant	Age (yr)	Race	Methadone Dose (mg)	Years of Narcotics Addiction[1]	Prior Meth. Maint.[2]	Prestudy Treatment Duration[3] (mo)	Percent Urine Samples Positive for Benzodiazepines[4]	Education (yr)	Employment[5]	Marital Status[6]
BD	33	W	50	11	Yes	0	—	9	U	M
MJ	28	W	30[a]	11	Yes	16	92.2	12	E	D
AS	29	B	30	12	No	14	55.0	12	U	S
MK	31	W	70	10	Yes	0	—	12	E	S
MC	29	W	70	7	Yes	30	48.5	12	U	D
PT	25	W	50	10	Yes	23	90.0	9	U	S
NC	24	W	50	10	Yes	0	—	10	U	S
BH	30	W	80	11	Yes	0	—	12	PT	S
SD	27	W	50[b]	13	Yes	4	100.0	9	U	D
BB	26	W	70 90[c]	5	Yes	0	—	8	E	S

[1]Estimated from reported year of first continuous use.
[2]Other treatment clinics.
[3]Present treatment clinic.
[4]TLC analysis.
[5]U = Unemployed; E = Employed; PT = Part-time.
[6]M = Married; S = Single; D = Separated or divorced.
[a]On day 36 of postintervention baseline, dose increased to 45 mg during a "self-regulated detox"; dose fluctuated between 35 and 45 mg throughout the remainder of this baseline period.
[b]Disciplinary detox started day 12 of postintervention baseline. Dose restored on day 30.
[c]Dose increase occurred 15 days prior to end of contingent intervention period.

present study. Once eligibility was established, study participants received a notice during the week prior to the planned start of the contingent reinforcement intervention which informed them of the upcoming opportunity to earn clinic privileges and cash payments for benzodiazepine-free urines. It was explained to study participants that the decision to give up drugs was entirely up to them and that their treatment status would not be influenced by their drug use. It was explained that benzodiazepine drugs can be detected in urine for 2-3 wk after a single ingestion. Therefore, they might earn some privileges by giving up benzodiazepine drugs intermittently, but if they wanted to obtain the maximum number of reinforcers available they would have to give up benzodiazepine drugs entirely.

During the contingent intervention period, reinforcers were available twice weekly, on Monday and Friday. Delivery of reinforcers during the study was based on results of a benzodiazepine urinalysis test conducted on site at the clinic using an EMIT (Enzyme Multiplied Immunoassay Technique; Syva Corp.) system. The reading obtained from the participants' urine sample had to be below or no more than 25 points above the calibrator value which indicated the cutoff between a positive and a negative test sample. If these conditions were met, the participant could choose one item from the following reinforcer menu: (a) receive two methadone take-home doses; (b) receive $15 cash; (c) receive two single-day opportunities to self-regulate their methadone dose by as much as ±20 mg. All reinforcers were delivered immediately after the urinalysis test was completed. If the take-home privilege was selected, the participant drank his usual daily dose at the clinic and received two sealed bottles each containing his usual dose of methadone. These participants did not report to the clinic for the next two days and were instructed to ingest one dose each day at the time of day that they generally reported to the clinic. Earned reinforcers were appropriately delivered or withheld on 98% of occasions. In two instances (SD, PT) reinforcers were delivered that should

not have been delivered, as urinalysis values exceeded the 25 point-above-calibrator cutoff, while in three instances (one for MJ, two for BH) scheduled reinforcers were not delivered.

EMIT urinalysis data are generally reported for 12 wk (24 tests) prior to and during the contingent reinforcement period. For BD, MK, and PT contingent reinforcement conditions remained in effect for 13 wk (26 urine tests). Duration of postintervention assessment was 12 wk for the six participants who remained available for that duration; 0.5 wk for BH, who transferred out of the clinic; 2 wk for MC, who enrolled in another research project; 6.5 wk for BB, and 10.5 wk for NC.

Urinalysis testing. Urines were analyzed for benzodiazepines by two commercially available tests commonly used in drug abuse urinalysis screening. An EMIT test for benzodiazepines was conducted on twice weekly samples delivered during the study. The EMIT yields an optical density reading which reflects the urine concentration of benzodiazepine drugs and/or their metabolic products. Benzodiazepine drugs reliably detected by EMIT include chlordiazepoxide, clorazepate, diazepam, lorazepam, prazepam and oxazepam, but not flurazepam. The participants' optical density reading is compared to a reading obtained that same day for the low calibrator sample (0.5 μg/ml oxazepam) provided by the Syva Corp. Values reported in this paper are the difference between the subject urine value and the low calibrator value. In usual clinical practice, sample readings above the low calibrator are judged to be drug-positive, while sample readings below the low calibrator are judged to be benzodiazepine-free or clean samples. The low calibrator cutoff was used in this fashion in the present study to provide a dichotomous measure of clean vs. dirty urines. EMIT benzodiazepine test results were also used in a semiquantitative fashion to track the disappearance of benzodiazepine drugs from the body. Sequential sample values were obtained previously in our clinic from patients participating in other studies who claimed to have stopped benzodiazepine use. These sample values showed a downward trend over 1-2 wk following cessation of use and were likely to be below the low calibration within a few days of a reading which was within 25 points of the low calibrator cutoff. A 25 point-above-calibrator cutoff was adopted for initiating contingent reinforcement for clean urines, and provided an additional criterion for assessing urinary benzodiazepine levels before, during, and after the contingent reinforcement intervention.

Urine samples were also routinely sent to an outside laboratory where they were tested by thin layer chromatography (TLC) analysis once weekly (Monday sample) for benzodiazepines and twice weekly for a variety of other drugs. All benzodiazepine drugs are reliably detected by TLC. Other drugs detected by TLC were opiates, including methadone, heroin, morphine, codeine, meperidine, and hydromorphone; barbiturate and nonbarbiturate sedatives, including phenobarbital, unspecified barbiturates, meprobamate, methaqualone, glutethimide, and ethchlorvynol; and a variety of other drugs, including stimulants (cocaine, amphetamine, methamphetamine, phenmetrazine), phenothiazines, phenytoin, propoxyphene, and phencyclidine. Results from TLC analysis dichotomized samples into benzodiazepine positive and negative categories, and these results were used in data analysis as an independent check for the presence or absence of benzodiazepine drugs, and as a reliability check for EMIT results. However, the benzodiazepine metabolite concentration reliably detected by the TLC method is somewhat lower than the concentration detected as positive by EMIT (Budd & Walkin, 1980; Poklis, 1981). Because of the differences in sensitivity between the two tests, the relationship between test results depends in large part on patterns of benzodiazepine ingestion. Thus, intermittent use of benzodiazepines might result in sporadic negative test results on EMIT but continuous positive results on TLC. Furthermore, if benzodiazepine use were to stop completely, negative results would be

expected to appear on the EMIT test sooner than on the TLC test. TLC analysis therefore provides a more stringent criterion for long-term abstinence from benzodiazepine use and provides a reliability check for EMIT results only in the case of long-term abstinence.

Data analysis. To determine the statistical significance of treatment effects on detection of benzodiazepine-positive urine samples, three benzodiazepine urinalysis indices were subjected to statistical analysis; all were qualitative indices which were analyzed as the percentage of urine samples meeting the criterion: (a) percent samples benzodiazepine-free by TLC analysis; (b) percent samples benzodiazepine-free by EMIT analysis (below the low calibrator cutoff); and (c) percent EMIT sample values within the reinforcement range (below the 25 point-above-calibrator cutoff). Percentage of urines meeting each criterion was calculated for each individual during each treatment condition. An arcsine transformation was then performed since this is the recommended method of normalizing percentage data prior to statistical analysis (Cohen & Cohen, 1975). A repeated measures analysis of variance was conducted with data from 8 participants × 3 treatment conditions to assess the statistical significance of changes in urine positive tests for the group as a whole. The epsilon adjustment procedure (with df = 1,7) was used in tests of statistical significance (Geisser & Greenhouse, 1958). Neither MC nor BH was included in this analysis due to their early dropout during the postintervention period. Inclusion of available data for MC and BH would have strengthened the statistical results reported; omission of their limited data is therefore a conservative decision.

RESULTS

Rates of benzodiazepine-free urinalysis results were significantly increased during the 3-mo contingent reinforcement treatment period. Table 2 summarizes the percentage of benzodiazepine-free urine samples observed on the EMIT and TLC tests during each phase of the study for individual study participants. Although the percentage of clean samples varied somewhat depending on the cutoff criteria used to define a benzodiazepine-free sample, results are similar across all three cutoff criteria. Percentage of clean urines for the group of study participants was low (3.6-23.4% depending on the cutoff criteria) during the initial baseline assessment period, increased above baseline levels during the contingent reinforcement treat-

Table 2

Percentage of benzodiazepine urinalysis tests meeting cutoff criteria for drug-free sample.

	EMIT Test: 25 points-above-calibrator cutoff			*EMIT Test: Low calibrator cutoff*			*TLC Test*		
Participant	*Pre*	*Treatment*	*Post*	*Pre*	*Treatment*	*Post*	*Pre*	*Treatment*	*Post*
BD	30.4	96.0	4.5	4.3	92.0	0.0	0.0	84.6	0.0
MJ	70.8	100.0	33.3	37.5	100.0	19.0	16.7	75.0	16.7
AS	17.4	83.3	41.7	0.0	75.0	8.7	0.0	75.0	8.3
MK	30.4	80.8	28.6	8.7	53.8	14.3	8.3	30.8	9.1
MC	22.2	29.2	0.0	11.1	20.8	0.0	0.0	16.7	0.0
PT	12.5	88.5	12.5	4.2	84.6	0.0	0.0	76.9	0.0
NC	20.8	45.8	47.6	4.2	33.3	33.3	0.0	8.3	20.0
BH	8.3	62.5	—	8.3	50.0	—	0.0	58.3	—
SD	16.7	37.5	37.5	16.7	20.8	29.2	11.1	8.3	16.7
BB	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	23.4	62.4	22.9	9.5	53.0	11.6	3.6	43.4	7.9
SEM	(5.6)	(9.9)	(5.9)	(3.3)	(10.2)	(4.1)	(1.8)	(10.1)	(2.6)

ment period, and returned to low preintervention levels during the final baseline period when the contingent reinforcement intervention was withdrawn. Repeated measures analysis of variance (using the conservative Geisser-Greenhouse procedure) revealed significant treatment effects for all three cutoff criteria: EMIT test, low calibrator cutoff ($F = 10.03, p < .05$); EMIT test, 25 point-above-calibrator cutoff ($F = 9.64, p < .05$) and TLC test ($F = 7.5, p < .05$). Examination of results for individuals revealed that 6 of 10 study participants (BD, MJ, AS, MK, PT, BH) showed clear increases in their overall percentage of benzodiazepine-negative tests during the contingent reinforcement intervention period compared to their pre- and postintervention baseline negative urine test rate. A seventh patient (NC) increased benzodiazepine-free urines during both contingent reinforcement and postintervention baseline periods compared to his preintervention baseline rate. Three patients (MC, SD, BB) showed no clear changes in overall rates of benzodiazepine-negative tests during different portions of the study.

Figure 1 shows in greater detail results for sequential urinalysis tests for each study participant. For 5 of the 10 patients (BD, MJ, AS, MK, PT) urine levels of benzodiazepines became negative during the early portion of the contingent reinforcement period and remained negative for the remainder of the intervention period. Participants MC, NC, and BH had longer runs of consecutive benzodiazepine-free urines during the contingent reinforcement period than during baseline portions of the study, but these three patients all relapsed to benzodiazepine use during the contingent reinforcement portion of the study. SD had a cyclic pattern of benzodiazepine test results which did not differ across different portions of the study, whereas BB remained steadily benzodiazepine-positive throughout the study.

Agreement was obtained between EMIT and TLC benzodiazepine test results on 90.4% of 324 tests conducted. All but two disagreements were cases in which EMIT showed a negative result while TLC analysis was drug-positive. These discrepancies may occur because of the greater sensitivity of the TLC analysis, as previously described. Because of this difference in sensitivity of the two tests, abstinence from benzodiazepine drugs should be detected sooner by EMIT than by TLC testing. Comparison of results from EMIT and TLC testing in Figure 1 indicates that this was almost always the case, and that in fact the TLC test detected only relatively lengthy periods of abstinence from benzodiazepine drugs.

As shown in the urinalysis data of Table 3, participants in the present study supplemented their methadone with an assortment of psychoactive drugs in addition to benzodiazepines. Urinalysis data were examined for evidence of compensatory changes in use of nonbenzodiazepine drugs during the contingent reinforcement treatment portion of the study. In general, there were no consistent changes in other drug use during the time that benzodiazepine use was reduced. Table 3 reveals four instances (BH, sedative; MJ, MC, PT other drugs) of an apparent increase in some other drug class during the time of reduced benzodiazepine use, while in two instances (AS, opiate; MK, sedatives) other supplemental drug use decreased when benzodiazepine use decreased. Fluctuations in other drug use by SD and BB would not appear to be relevant since they never reduced their benzodiazepine-positive rates to any significant extent. In the four instances of apparent drug substitution, a detailed examination of temporal patterns in the urinalysis data indicated only one instance (PT) in which the appearance of positives from another drug class coincided with disappearance of benzodiazepines from the urine. For BH, sedative positives were observed during the contingent reinforcement phase both when his urines were positive and when his urines were negative for benzodiazepines, while for MC an increase in other drug positives clearly coincided with his return to benzodiazepine use during the contingent reinforcement study phase. For MJ, the small increase in urine

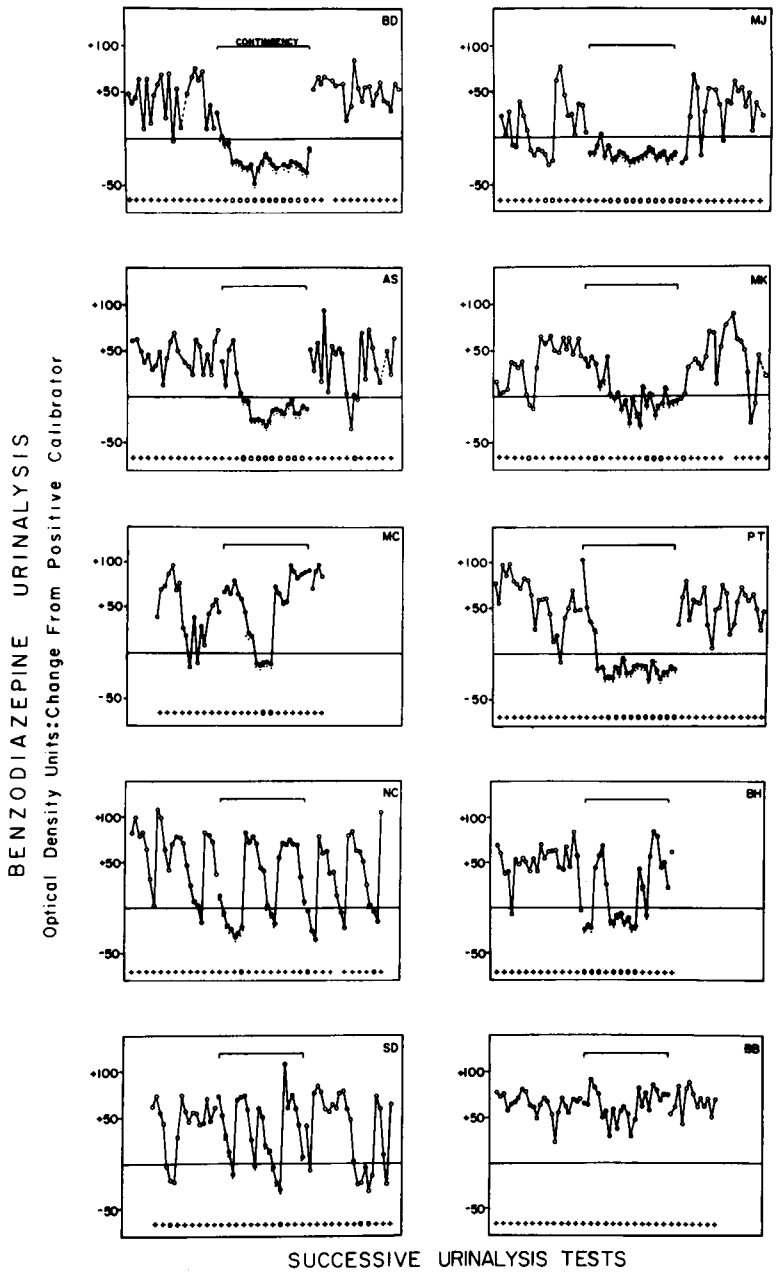

Fig. 1. Results of twice weekly benzodiazepine urinalysis tests in 10 individual methadone maintenance patients. Shown on the ordinate are readings obtained on an EMIT urinalysis test system, expressed as deviations from the low calibrator cutoff value. Optical density readings obtained for the benzodiazepine drug positive calibrator have been subtracted from readings obtained for the patient sample. Positive scores fall above the horizontal line and represent benzodiazepine positive samples; negative scores fall below the line and represent benzodiazepine-free samples. Open data points represent samples collected during baseline portions of the study, when no consequences were attached to urine results. Filled data points represent samples collected during contingent treatment portions of the study, when patients could obtain reinforcers for evidence of abstinence from benzodiazepine use. Periods of contingent treatment are also indicated by a bracket above. Small dots adjacent to data points indicate delivery of a reinforcer. Along the bottom of each graph are shown benzodiazepine positive (+) and negative (0) urine results obtained for these same urine samples by thin layer chromatography analysis at an independent laboratory.

Table 3

Percent of Drug-Positive Urinalysis Test Results[1]

Participant	Opiates[2]			Sedatives[3]			Other[4]		
	Pre	Treatment	Post	Pre	Treatment	Post	Pre	Treatment	Post
BD	13.0	3.8	8.7	0.0	0.0	0.0	4.3	0.0	4.3
MJ	8.3	8.3	66.7	12.5	8.7	4.2	4.2	20.8	29.2
AS	37.5	0.0	16.7	0.0	0.0	0.0	0.0	0.0	70.8
MK	13.6	15.4	0.0	13.0	0.0	39.1	4.3	0.0	0.0
MC	0.0	0.0	0.0	22.2	16.7	25.0	11.1	25.0	100.0
PT	4.2	0.0	0.0	20.8	15.4	30.4	4.2	53.8	25.0
NC	4.2	0.0	0.0	4.2	4.2	5.0	25.0	0.0	9.5
BH	0.0	4.2	—	25.0	58.3	—	8.3	0.0	—
SD	0.0	4.2	4.2	27.8	41.7	50.0	11.1	0.0	8.3
BB	8.3	25.0	23.1	0.0	25.0	0.0	79.2	12.5	0.0

[1]Thin Layer chromatography analysis.
[2]Morphine, quinine, codeine, demerol.
[3]Ethchlorvynol, barbiturates, meprobamate, methaqualone.
[4]Phenothiazines, propoxyphene, phencyclidine, amitriptyline.

positives in the other category was due to a cluster of dirty urines observed during the second month of his 3-mo abstinence from benzodiazepines. Thus, drug substitution was rare, and reductions in other drug use appeared to be equally as likely as increases.

Table 3 reveals several instances in which the use of drugs from other classes appeared to increase during the postintervention baseline period, coinciding with a return to benzodiazepine use by study participants. This pattern was noted for patient MJ (opiates and other drugs), Patients AS and MC (other drugs), and patients MK and PT (sedatives). In these cases, percentage of drug-positive urines during the post-intervention baseline period was higher than that observed during the preintervention baseline period.

Study participants selected the methadone take-home privilege on 37% of 154 occasions when contingent reinforcers were earned. Monetary payment was selected on 63% of occasions, and dosage self-regulation was never selected.

DISCUSSION

Using a within-subject A-B-A design, the present study evaluated benzodiazepine urinalysis test results during baseline periods of standard methadone maintenance clinic treatment (medication and counseling) and during a period that included contingent reinforcers for benzodiazepine-free urinalysis test results. The study showed that benzodiazepine use among methadone maintenance patients can be reduced by providing reinforcers contingent on drug-free urinalysis test results. Eight of ten study participants achieved benzodiazepine-free urines during portions of the contingent reinforcement study phase for periods of time ranging from 2.5 wk (MC) to 12 wk (MJ) of consecutive clean urines; five participants produced clean urines for virtually the entire contingent reinforcement phase of the study (Figure 1) and three relapsed to benzodiazepine use during the time that the contingent reinforcement intervention was in effect. Although the contingent reinforcement procedure was not uniformly effective for all study participants, there was a statistically significant effect of the treatment on urinalysis results for the group as a whole. These results support the efficacy of contingent reinforcement procedures for promoting reduced supplemental drug use among methadone maintenance patients, as previously reported for opiate drugs (Hall et al., 1977, 1979; Stitzer et al., 1980) and extend the application of contingent

reinforcement procedures to the reduction of benzodiazepine use.

The present study demonstrated efficacy for a treatment intervention that included contingent reinforcement for benzodiazepine-free urines. However, the study did not specifically evaluate the contingent reinforcement component of the procedure in comparison to instructional and feedback elements of intervention. An experimentally more rigorous test of the contingent reinforcement procedure might have been made, for example, by dispensing noncontingent privileges and payment to participants during baseline portions of the study or by comparing the contingent reinforcement procedure to an active attention control procedure. Although standard clinic treatment would appear to be a suitable and clinically meaningful comparison for evaluating the efficacy of new therapeutic interventions, further studies would be necessary to evaluate the specific efficacy of the contingent payment component of the intervention. It should be noted, however, that the weight of clinical experience in the treatment of drug abuse does not suggest that feedback or instructions have marked efficacy.

The present study sought to measure and influence the ingestion of a long-acting class of drugs whose use occurred unobserved in the natural environment. Clearly, a valid objective measure of recent drug use was required to make such a project feasible. The on-site EMIT urinalysis system provided a convenient objective indicator of recent benzodiazepine use and allowed for rapid implementation of reinforcement procedures based on urinalysis test results. Validity of EMIT urinalysis results, specifically those indicating prolonged periods of abstinence, was generally supported by thin layer chromatography testing conducted by an outside laboratory. Focus on a class of drugs with a prolonged presence of detectable metabolites following ingestion meant that reinforcement could be offered only for evidence of prolonged total abstinence rather than for short-term reductions in frequency or quantity of use. This is in contrast to the situation with opiate drugs whose by-products dissipate within days of ingestion. The present study thus shows that therapeutic interventions that include reinforcement for abstinence can be effective even with drugs where abstinence can be verified only after a fairly lengthy delay.

Implementation of contingent reinforcement procedures designed to influence drug use depends on the availability of alternative reinforcers that can compete with the powerful reinforcing properties of drugs of abuse. Reinforcer choices in the present study were consistent with previous studies which found that both monetary payment and methadone take-home privileges can be effective reinforcers for behavior change among drug abusers enrolled in methadone maintenance treatment (Stitzer et al., 1977, 1979*b*, 1980) while the dosage self-regulation option may have lesser desirability and efficacy as a reinforcer (Stitzer & Bigelow, 1978; Stitzer et al., 1979*b*). Although the relative reinforcing efficacy of specific options may clearly depend on parameters of the option offered as well as characteristics of the setting and the study participants, both methadone take-home privileges and monetary payments appear to be effective reinforcers for use in procedures designed to reduce supplemental drug use among methadone maintenance patients.

Contingent reinforcement for drug-free urines may represent a viable and practical alternative to commonly used methods for dealing with the ubiquitous problem of supplemental drug use among methadone maintenance patients. At present, the primary intervention used is verbal encouragement to discontinue supplemental drug use. If this method is ineffective, the offending patient may be threatened with termination from treatment and ultimately discharged if satisfactory improvement is not forthcoming. It is paradoxical that drug abuse patients are routinely dismissed from treatment for exhibiting the behavior that brought them into treatment in the first place. Procedures that include contingent reinforcement for clean urines would

appear to be one type of therapeutic intervention with efficacy in promoting reductions of drug abuse in this population. Although monetary payment was the reinforcer selected most often in a previous study (Stitzer et al., 1980), contingent reinforcement procedures could be practically implemented in drug abuse treatment clinics without additional cost. Take-home medication and many other program privileges are potential reinforcers available at the methadone treatment clinic for delivery in contingent arrangements (Stitzer & Bigelow, 1978). Clinics might also obtain security deposits from patients which would be returned contingent on evidence of desirable behavioral change. To the extent that contingent reinforcement techniques are effective, they allow the opportunity to provide additional, more comprehensive therapy to drug abuse patients during a time that they are exercising some degree of control over their drug use. Implementation of more comprehensive therapies may be necessary with this difficult population to achieve more pronounced and long lasting therapeutic benefits.

Overall, there do not appear to be any serious therapeutic drawbacks or side effects of contingent reinforcement procedures that would militate against their application in treatment clinics. For example, the analysis of other drug use in the present study (Table 3) suggested that reductions in the use of one class of drugs were not generally associated with increases in the use of drugs from other classes, and may actually have had a beneficial influence on other drug use. The failure to observe widespread increases in other drug use during contingently reinforced abstinence from benzodiazepine drugs is consistent with findings of a previous study which provided reinforcement for opiate-free urines (Stitzer et al., 1980). At present, the one practical drawback to implementation of urinalysis incentive procedures appears to be the requirement for a convenient and objective measure of recent drug use. This limits the range of drugs that can be the target of contingent interventions since there are many specific drugs commonly used by methadone maintenance patients which cannot be detected on the EMIT system. This is a relevant problem since many patients use drugs from multiple drug classes and could possibly benefit from interventions that focus simultaneously on a variety of drugs. Several instances were also noted in the present study (Table 3) where increases in the use of additional drugs appeared to be precipitated when drug abuse patients returned to the use of benzodiazepine drugs after a period of abstinence. This possibility should be recognized by clinicians interested in applying these procedures, and suitable precautions taken.

Contingency management procedures have demonstrated therapeutic efficacy in a variety of behavioral disorders (Leitenberg, 1976), as well as specific utility in promoting abstinence from alcohol and tobacco use (Stitzer et al., 1979*a*). The efficacy of contingent reinforcement therapies in promoting reduced use of specific supplemental drugs among methadone maintenance patients, which has been demonstrated in this and other studies, suggests that these procedures may warrant more widespread and systematic application in drug abuse treatment programs.

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