

Effects of Lower-Cost Incentives on Stimulant Abstinence in Methadone Maintenance Treatment

A National Drug Abuse Treatment Clinical Trials Network Study

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Background: Contingency management interventions that provide tangible incentives based on objective indicators of drug abstinence have improved treatment outcomes of substance abusers, but have not been widely implemented in community drug abuse treatment settings.

Objective: To compare outcomes achieved when a lower-cost prize-based contingency management treatment is added to usual care in community methadone hydrochloride maintenance treatment settings.

Design: Random assignment to usual care with (n=198) or without (n=190) abstinence incentives during a 12-week trial.

Setting: Six community-based methadone maintenance drug abuse treatment clinics in locations across the United States.

Participants: Three hundred eighty-eight stimulant-abusing patients enrolled in methadone maintenance programs for at least 1 month and no more than 3 years.

Intervention: Participants submitting stimulant- and alcohol-negative samples earned draws for a chance to

win prizes; the number of draws earned increased with continuous abstinence time.

Main Outcome Measures: Total number of stimulant- and alcohol-negative samples provided, percentage of stimulant- and alcohol-negative samples provided, longest duration of abstinence, retention, and counseling attendance.

Results: Submission of stimulant- and alcohol-negative samples was twice as likely for incentive as for usual care group participants (odds ratio, 1.98; 95% confidence interval, 1.42-2.77). Achieving 4 or more, 8 or more, and 12 weeks of continuous abstinence was approximately 3, 9, and 11 times more likely, respectively, for incentive vs usual care participants. Groups did not differ on study retention or counseling attendance. The average cost of prizes was \$120 per participant.

Conclusion: An abstinence incentive approach that paid \$120 in prizes per participant effectively increased stimulant abstinence in community-based methadone maintenance treatment clinics.

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CONTINGENCY MANAGEMENT (CM) interventions for drug use attempt to increase desired behavior by offering valuable reinforcers contingent on behavior change. Early work^{1,2} demonstrating efficacy for CM in methadone hydrochloride maintenance treatment settings used take-home privileges to reinforce drug abstinence. In outpatient psychosocial treatment, vouchers for retail goods offered for cocaine-negative urine samples were successful in promoting cocaine abstinence.³ This approach was adopted to address the cocaine abuse that can be problematic among methadone maintenance patients.^{4,5} By using voucher reinforcers, a seminal study⁶ found that

about 50% of methadone-maintained cocaine-abusing participants were able to remain abstinent for substantial periods during a 12-week intervention, while this was true for none of the participants who received noncontingent vouchers. Reductions in nontargeted opioid use have also been observed when reinforcers are available for cocaine abstinence.^{6,7}

Interest in testing the effectiveness of CM within the new National Drug Abuse Treatment Clinical Trials Network (CTN) was based on the substantial work demonstrating efficacy of these procedures.⁸ They have not been widely implemented in part because of high costs⁹ and in part because of negative attitudes about providing tangible reinforcers to patients undergoing treatment.¹⁰

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Table 1. Characteristics of Participating Treatment Clinic Study Samples

Clinic	Study Sample Size	Demographics*			Drug Negative at Intake*		Methadone Hydrochloride Dose, mg†
		Female	Minority‡	High School Graduate	Opioid	Stimulant	
A	92	52.2	83.7	79.4	53.3	25.0	67.9 (23.9)
B	88	58.0	95.4	65.9	51.7	21.8	82.3 (16.2)
C	64	39.1	59.0	62.7	47.0	27.0	79.0 (17.3)
D	54	31.5	64.8	57.4	50.9	30.2	99.4 (23.7)
E	45	31.1	64.4	66.7	60.0	26.7	100.9 (23.7)
F	45	35.6	53.3	46.7	62.8	15.6	108.0 (33.1)

*Data are given as percentage of participants at each clinic.

†Data are given as mean (SD).

‡Minority participants were primarily African American and Hispanic (see Table 2).

In previous research,^{6,11} study participants could earn more than \$1000 worth of vouchers during a course of treatment, with average earnings being around \$500. To address cost, a CM procedure that uses intermittent rather than continuous reinforcement was developed.¹² In this procedure, drug-negative urine samples earn participants the chance to draw from an urn and win prizes valued from \$1 to \$100. Average expected maximal earnings in the prize drawing procedures are \$250 to \$400, less than half that of most voucher studies. In one study¹³ of cocaine-dependent methadone maintenance patients, this intermittent reinforcement procedure increased the duration of cocaine and opioid abstinence relative to standard treatment.

The present study assessed the effectiveness of the intermittent reinforcement approach to CM by conducting a multisite study in community-based methadone maintenance clinics within the CTN. Usual care psychosocial treatment and methadone prescribing practices were purposely not altered in the design, and were expected to vary across sites.¹⁴ A primary purpose of a multisite study is to evaluate whether an intervention will have effects robust enough to supercede the effects of usual care treatment in a wide variety of clinics and populations. Thus, a strength of this study is the potential for generalizability of its findings.

Stimulant abuse was targeted in this study because it remains one of the most treatment-resistant problems in the methadone-maintained population.^{15,16} Furthermore, because there is a well-established association between stimulant and alcohol use,¹⁷ alcohol abstinence was simultaneously targeted for reinforcement. To further encourage abstinence from multiple substances, additional reinforcement was provided when participants demonstrated abstinence from opioids.¹⁸

The primary hypotheses were that participants in the abstinence incentive condition would submit more stimulant- and alcohol-negative samples and sustain longer durations of abstinence from these drugs than usual care participants. Secondary hypotheses were that participants in the incentive condition would attend more counseling sessions and submit more opioid-negative urine samples than participants in the usual care condition. Differences in retention were not anticipated, because usual care retention rates are generally high for methadone maintenance patients who are stabilized and receiving an adequate dose.

METHODS

STUDY PARTICIPANTS

Effect sizes of overall drug use outcomes in previous single-site studies¹⁹⁻²¹ using lower-cost incentive procedures were used to estimate a necessary sample size of 200 per group. Participants were 388 outpatients recruited from 6 methadone maintenance community treatment programs that were members of the CTN. All were located in urban areas in the northeast, east, or southwest. They had an average static patient census of 490 (range, 270-870), and all reported a substantial problem with stimulant abuse in their patient population. **Table 1** shows characteristics of participants enrolled from each site.

To be eligible for the study, patients had to (1) be enrolled in methadone treatment for a minimum of 30 days and no longer than 3 years (1095 days), (2) have submitted a stimulant-positive clinic urine sample within 2 weeks of study entry (verified from clinic records), (3) state that they were not in recovery from a gambling problem (because of the potential similarity between gambling and the prize draw incentive procedure), and (4) demonstrate understanding of study procedures by passing a simple informed consent quiz at 80% or better. The study was approved by institutional review boards local to the clinics, and was overseen by the CTN Data Safety Monitoring Board, which reviewed all adverse events. None were found to be study related.

All participants were enrolled into the study between April 30, 2001, and February 28, 2003. Potential participants were referred by counselors or responded to information available at the clinic. As a result, little information is available about participants who were ineligible or uninterested. Overall, 402 participants signed informed consent forms and were randomized to a study treatment (**Figure 1**). Fourteen participants were randomized but were found later not to meet study inclusion criteria (primarily because prior treatment duration exceeded criteria cutoff), for a final study sample of 388 participants: 190 in the usual care condition and 198 in the abstinence incentive condition.

STUDY PROCEDURES

Intake Assessment

Participants completed a 1.5-hour intake assessment during which information was obtained about demographics, psychosocial problems, and lifetime and current drug use, including DSM-IV diagnoses (M.L.C., J.M.P., N.M.P., K.K., R.L., F.S., J.B., A.C., Mark Cowell, BA, John Hamilton, MFT, Leroy Lucero, BA, J.K., Rob-

ert Sterling, PhD, Therese Killeen, PhD, and M.L.S., unpublished data, September 2004). As compensation for completing the assessment, participants chose 1 item from a selection valued at about \$20 each (eg, gift certificates to local stores or portable compact disc players). These items also served to ensure exposure of all participants to the types of prizes that would be available should they be assigned to the incentive condition.

Randomization

On completion of the assessment, participants gave their first study urine sample, which was tested on-site. Results of this urine sample were used by research assistants to stratify and randomize participants to study groups according to 2 variables: (1) presence or absence of a stimulant drug (cocaine, amphetamine, or methamphetamine) and (2) presence or absence of opioids. Participants were randomized to either the usual care or the abstinence incentive condition. Stratification and random assignment were conducted independently at each site and accomplished by a computer program using a dynamic balanced randomization procedure.²² Research staff did not know the randomization sequence, but were aware of individual group assignment.

Study Time Line

From the day of randomization, the study protocol extended 12 weeks. Participants were considered terminated from the study 84 days after randomization, on discharge from the clinical program, or if 30 days elapsed between study visits with research staff. Follow-ups were conducted at 1, 3, and 6 months after study intake. Data collection rates were 87%, 81%, and 74%, respectively, with no group differences in collection rates.

Urinalysis Procedures

During the study, all participants were expected to provide a urine sample at twice-weekly visits scheduled on nonconsecutive days (eg, Monday and Thursday or Monday and Wednesday) throughout the 12-week study, for a total of 24 urine samples. The intake specimen constituted the first of these 24 samples. Urine sample collections were typically observed by a same-sex individual to ensure validity. Additional validity checks included the use of an external temperature strip and an adulterant test that detected abnormal levels of pH, creatinine, glutaraldehyde, and nitrite (AdultaCheck 4 or Intect 7; Roche Diagnostics, Indianapolis, Ind). Urine samples that failed any of these validity checks were discarded, and participants were asked to provide another sample. All urine samples were tested immediately using a testing system (OnTrak TesTcup 5 system; Roche Diagnostics) that detects amphetamine, methamphetamine, cocaine, tetrahydrocannabinol, and morphine. (The term *opioids* is used to refer to all drugs that test positive in the morphine assay; this does not include methadone.) In addition, all participants provided a breath sample at each study visit that was tested for alcohol using a desktop or handheld breathalyzer. Samples reading 0.01 g/dL or higher were considered positive for alcohol. Although clinic staff typically had access to study results, no clinical consequences resulted.

Usual Care

Study procedures were an adjunct to usual care services and did not affect these services. Participants could continue in usual care if they declined or discontinued study participation. All participants were expected to ingest a methadone dose daily and to at-

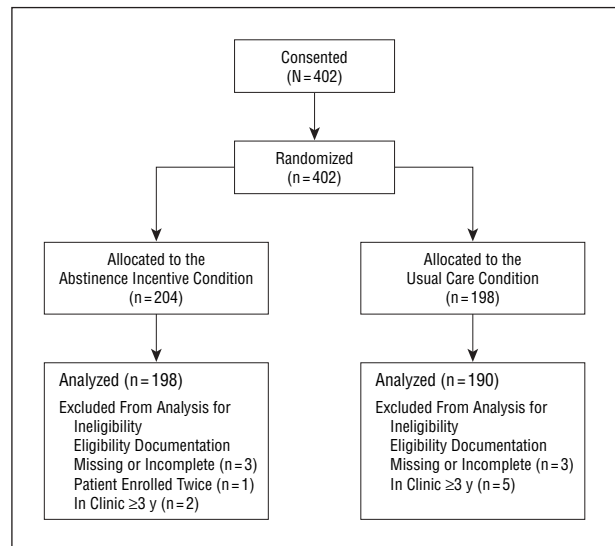


Figure 1. Flow diagram of study participation.

tend individual and group counseling as required by the clinic, which ranged from 3 times per week to once per month. In addition, usual care participants were asked to provide urine and breath samples twice weekly as part of the study and were given immediate feedback on their results. Research staff congratulated participants when they tested negative for drugs and alcohol and encouraged them to stop using when they tested positive for drugs and alcohol. If participants had clinical issues, research staff encouraged them to discuss these issues with their counselor.

Abstinence Incentive Procedures

Participants assigned to this condition could draw for prizes each time they tested negative for cocaine, amphetamine, methamphetamine, and alcohol (these were termed the *primary target drugs*). Plastic chips marked with an incentive value were drawn from an opaque container containing 500 chips: 250 (50.0%) were marked "Good Job," 209 (41.8%) were marked "Small," 40 (8.0%) were marked "Large," and 1 (0.2%) was marked "Jumbo." Good Job chips meant no tangible incentive was earned, while Small, Large, and Jumbo chips indicated prize value categories. Small prizes were worth approximately \$1; popular items included toiletries, snacks, bus tokens, and gift certificates to fast food restaurants. Items available as Large prizes were worth approximately \$20; popular items included kitchenware (pots, dishes, and silverware), cordless telephones, portable compact disc players, and gift certificates to retail stores. Jumbo prizes were worth \$80 to \$100; televisions, stereos, and digital video disc players were popular selections. Prizes were kept on-site in locked cabinets and were replenished regularly by research staff. Each clinic selected its own array of prizes within the retail value guidelines and was encouraged to stock prizes that would be desirable to participants.

The number of draws earned at a research visit was based on drug test results. Specifically, the number of draws increased by 1 for each week in which all submitted samples tested negative for the primary target drugs. The number of draws earned reset to a single draw after an unexcused absence or submission of a sample positive for one of the primary target drugs. This escalating reinforcement schedule with reset contingency has been used effectively in prior work.^{8,13} Participants who notified staff of an expected missed visit could be excused, in which case draws continued to escalate if the partici-

pant had tested negative for drugs at his or her most recent visit. However, at least one sample per week was required to be eligible for increased draws.

To offset the low rate of reinforcement early in the study when number of draws was low, a large prize was awarded when a participant first achieved 2 consecutive weeks of abstinence (ie, 4 consecutive samples negative for the primary target drugs). At each visit, a participant testing negative for all primary target drugs could earn 2 bonus draws if his or her urine sample was also negative for opioids. Samples negative for opioids but positive for stimulants earned no draws. The number of bonus draws did not escalate. Urine samples were tested for tetrahydrocannabinol, but no consequences were attached to the result.

Participants who provided all scheduled urine and breath samples throughout the 12-week study and who had negative results for all primary and bonus drugs earned 204 draws, resulting in a maximum of approximately \$400 in prizes, plus one guaranteed \$20 prize.

OUTCOME MEASURES

Retention, Study Participation, and Treatment Participation

Study retention was defined as the number of days that elapsed between the first and last study urine sample submitted.

Study participation was assessed using the percentage of participants submitting at least one study urine sample during each study week. The participation variable was defined in this way because patients could and often did attend 1 rather than 2 study visits in a given week while continuing to remain active in the study.

Treatment participation was assessed by examining the total number of counseling sessions attended during the 12-week study period. Individual, group, and family counseling sessions were collapsed for this variable.

Use of Primary Target Drugs

Because of the number of missing urine samples, drug use during treatment was examined in several ways. Variables examined were as follows: (1) percentage of samples submitted testing negative for primary target drugs (stimulants and alcohol) at each of 24 study visits, (2) overall percentage of submitted samples testing positive for each drug (stimulants, alcohol, opioids, and marijuana), (3) total number of samples submitted by each participant testing negative for stimulants and alcohol, and (4) longest duration of sustained abstinence, defined as the most consecutive twice-weekly samples testing negative for stimulants and alcohol. The follow-up urine sample result was used to assess drug use at follow-up.

Data Imputation

Because the protocol allowed for a single excused absence within a week without penalty, missing visits were coded as negative when both of the proximal samples collected in the week before and after the missing value were negative for stimulants and alcohol. This procedure was followed for all analyses of drug use outcomes. The negative sample imputation was made for 2.1% and 2.6% of incentive and usual care data, respectively. Urinalysis results from all other missing visits were coded as missing or positive, depending on the purpose of the analysis.

DATA ANALYSIS

Group comparisons for demographic measures were made using *t* tests for continuous variables and χ^2 tests for dichoto-

mous variables. Study retention was compared across groups using a Cox proportional hazards model.²³ An event was considered to have occurred when a subject dropped out of the study; therefore, it was defined as the last submitted urine sample if it occurred before week 12. Data were censored at study day 84 if a urine sample was submitted in the last week of the study. Results are reported using hazard ratios and 95% confidence intervals (CIs). For binary variables that repeated over time (eg, whether submitted samples tested negative for target drugs), the analysis was conducted using generalized estimating equations.²⁴ Results are reported as odds ratios (ORs) with 95% CIs, indicating the likelihood that incentive participants had different outcomes than usual care participants. Because results did not differ for sample sizes of 402 (total randomized) and 388 (full sample minus those ineligible), only data from the smaller sample are presented.

We analyzed individual abstinence outcomes in 3 ways. First, the mean longest duration of sustained abstinence achieved by individual participants was compared across groups using *t* tests. Second, participants' longest durations of sustained abstinence were categorized as follows: 4 weeks or longer, 8 weeks or longer, and 12 weeks. The percentage of participants meeting vs not meeting each of these durations was compared across groups using χ^2 tests; ORs and 95% CIs represent the magnitude of difference. Because these duration categories are not independent (eg, participants with ≥ 8 weeks of abstinence also have ≥ 4 weeks), each category was tested independently.

In the third approach, participants were classified into categories by the total number of stimulant- and alcohol-negative samples submitted, whether consecutive or nonconsecutive. Categories were 0, 1 to 6, 7 to 12, 13 to 18, and 19 to 24 negative samples submitted during the 12-week study, with positive and missing urine samples considered positive for stimulants and alcohol. Group differences in distribution were examined with the χ^2 test. Subsequently, the number of incentive vs usual care participants within each category was compared with the number not falling into that category using a χ^2 test. All data analyses were conducted using SAS statistical software, version 9.0 for Windows (SAS Institute Inc, Cary, NC).

RESULTS

BASELINE CHARACTERISTICS

Table 2 shows the baseline characteristics of participants randomized to the 2 treatment conditions. Overall, 74.9% of participants had cocaine abuse or dependence. An additional 3.6% had methamphetamine or amphetamine abuse or dependence, and 3.9% had an abuse or dependence diagnosis for both drugs. Neither demographic characteristics nor substance use variables differed significantly between groups.

STUDY RETENTION AND PARTICIPATION: GROUP EFFECTS

Figure 2A shows study retention across the 12-week intervention period. The decline in study retention over time was virtually identical for the 2 groups (relative hazard ratio, 1.1; 95% CI, 0.8-1.5). By the end of 12 weeks, 67.1% of incentive participants and 64.8% of usual care participants were retained in the study (although more may have stayed in treatment).

Figure 2B shows study participation defined as the percentage of participants submitting at least 1 urine sample

Table 2. Demographic and Drug Use Characteristics*

Characteristic	Incentive Group (n = 198)	Usual Care Group (n = 190)	P Value†
Sex			.10
Male	60.1	51.6	
Female	39.9	48.4	
Race			.94
African American	49.5	51.3	
White	25.8	26.5	
Hispanic	17.7	15.3	
Other	7.1	6.9	
Age, y‡	42.4 (8.9)	41.6 (8.3)	.33
Education, y‡	11.6 (1.9)	11.8 (2.1)	.55
Marital status			.29
Married or cohabitating	13.6	13.7	
Separated, divorced, or widowed	38.9	31.6	
Never married	47.5	54.7	
Current employment status			.54
Full time	16.8	14.0	
Part time	14.7	18.3	
Unemployed	68.5	67.7	
Currently on probation or parole	15.7	16.3	.86
Legal referral to treatment	3.5	7.9	.06
Current drug abuse or dependence§			
Stimulant	84.3	80.5	.32
Alcohol	16.7	17.4	.85
Cannabis	7.9	8.7	.80
Opioid	80.0	79.9	.98
Drug-negative sample at intake			
Stimulant	24.7	23.9	.85
Alcohol	99.0	98.9	.96
Cannabis	86.9	88.3	.67
Opioid	53.0	53.7	.89
Time in treatment, d‡	269 (282)	274 (290)	.87
Methadone hydrochloride dose, mg‡	86.6 (26.1)	85.1 (27.2)	.57

*Data are given as percentage of each group unless otherwise indicated. Percentages may not total 100 because of rounding.
 †Based on the *t* test for continuous variables and the χ^2 test for dichotomous variables.
 ‡Data are given as mean (SD).
 §Diagnosis based on the *DSM-IV* checklist; the time frame for current abuse or dependence is past 90 days.
 ||Cocaine, amphetamine, and methamphetamine.

during a given study week. The function is similar to that for study retention, except that the percentage of participants submitting urine samples during any given study week is lower than the percentage considered retained. Overall, participants in the incentive and usual care groups submitted a mean (SD) of 15.5 (6.7) and 14.1 (6.4) urine samples, respectively, throughout the 12-week study. Although the usual care participants were somewhat less likely to submit urine samples, the between-group difference was not statistically significant (generalized estimating equation; OR, 1.2; 95% CI, 0.9-1.6).

Participants in the incentive condition attended a mean (SD) of 8.6 (8.0) counseling sessions during the 12-week period, which was not significantly different from the mean (SD) of 10.3 (11.9) sessions for participants in the usual care condition ($t_{326} = -1.56, P = .12$). Approximately half of these were individual and half were group counseling sessions.

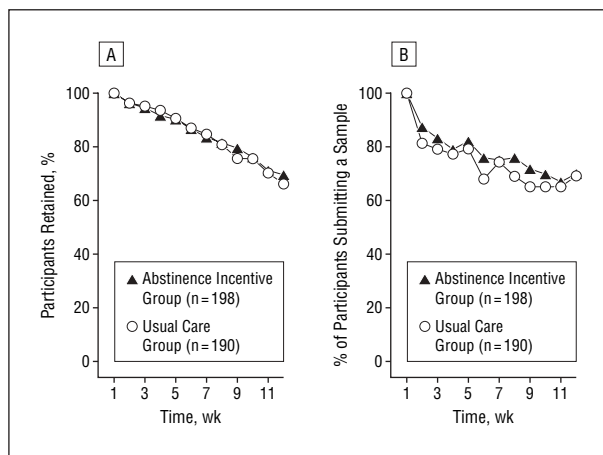


Figure 2. Study retention (A) and participation (B). In A, retention in a 12-week study of abstinence incentives is shown for abstinence incentive and usual care participants. In B, the percentage of participants in each study condition submitting at least 1 urine sample during the indicated study week is shown.

DRUG USE: GROUP EFFECTS

Figure 3 shows the percentage of submitted samples testing negative for stimulant drugs and alcohol during the 12-week protocol. In both groups, about 25% of samples tested negative for the primary target drugs at the first study visit. This percentage increased for both groups over the next 2 study visits and continued to increase for the incentive group through visit 6 (week 3). Overall, incentive participants were significantly more likely to submit stimulant- and alcohol-negative samples than were usual care participants (OR, 1.98; 95% CI, 1.42-2.77; missing samples coded as missing). Groups remained significantly different when all missing samples were coded as positive (OR, 1.99; 95% CI, 1.47-2.69) or negative (OR, 1.43; 95% CI, 1.12-1.81) for stimulants and alcohol, and results were virtually identical when site was added as a covariate in the model. At the 6-month follow-up, there were no group differences in percentage of submitted samples negative for stimulants and alcohol (37.5% incentive group [n=152] vs 35.9% usual care group [n=142]; $\chi^2 = 0.08, P = .78$).

Table 3 shows the effect of incentives on stimulant- and alcohol-negative samples within participating clinics. Although within-clinic tests were underpowered to detect statistically significant differences, substantial incentive vs usual care group differences were seen in 4 of 6 sites. In 5 of 6 clinics, usual care participants demonstrated an increase in the number of stimulant- and alcohol-negative samples following study intake.

Table 4 shows the overall percentage of submitted samples negative for each drug tested. It is clear that the significant between-group difference in samples negative for primary target drugs was entirely because of stimulant use. Only about 1% of breath test results were positive for alcohol, and this rate did not differ significantly across the 2 groups. Table 4 also shows that the likelihood of providing an opioid-negative urine sample was significantly higher in the incentive than usual care group. Tetrahydrocannabinol was detected in only about 9% of urine samples, with similar rates detected in the 2 groups.

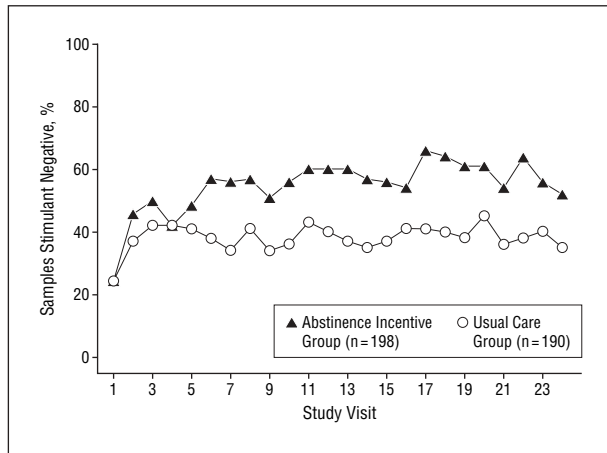


Figure 3. Target drug use. The mean percentage of submitted samples testing negative for target drugs (stimulants and alcohol) is shown for abstinent incentive and usual care participants at each of 24 study visits.

Table 3. Site Differences in Percentage of Samples Submitted During Treatment Testing Stimulant and Alcohol Negative

Site	Usual Care Intake	Usual Care During Treatment	Incentive During Treatment	OR (95% CI)*
A	25	35	61	2.9 (1.4-5.8)
B	22	41	56	1.9 (0.9-3.8)
C	22	27	46	2.3 (1.0-5.1)
D	27	57	65	1.4 (0.6-2.9)
E	33	22	49	3.5 (1.1-11.3)
F	16	43	46	1.1 (0.5-2.6)

Abbreviations: CI, confidence interval; OR, odds ratio.
*A generalized estimating equation was used to obtain ORs; the reference is the usual care group.

DRUG USE: INDIVIDUAL DIFFERENCES

Longest Duration of Abstinence

The escalating draw feature of the incentive procedure was designed to reinforce long durations of abstinence. Mean (SD) consecutive visits with detected abstinence were 5.5 (7.9) for incentive participants vs 2.3 (3.8) for usual care participants ($t_{288}=5.16, P<.001$). This represents approximately 1 vs 3 weeks of consecutive abstinence for usual care vs incentive participants. These results were nearly identical when site was added as a covariate in an analysis of covariance; the adjusted mean was 5.4 for incentive participants and 2.1 for usual care participants. As shown in **Table 5**, the odds of participants achieving 4 or more weeks (8 visits), 8 or more weeks (16 visits), and 12 weeks of documented sustained abstinence were approximately 3, 9, and 11 times greater, respectively, for incentive than for usual care participants.

Number of Negative Urine Samples Submitted

Figure 4 shows that the distribution of participants submitting different numbers of stimulant- and alcohol-negative samples differed between groups ($\chi^2=15.9, P<.01$). The proportion of individuals with poor outcomes (ie, 0-6

Table 4. Samples Submitted That Tested Negative for Drug

Drug	Incentive Group (n = 198)*	Usual Care Group (n = 190)*	OR (95% CI)†
Primary target			
Stimulants only	54.4	38.7	1.89 (1.35-2.63)
Alcohol only	99.1	98.7	1.43 (0.58-3.45)
Secondary			
Opioids	71.4	62.4	1.49 (1.09-2.08)
Marijuana	91.8	90.0	1.25 (0.73-2.17)

Abbreviations: See Table 3.

*Data are given as percentage of each group.

†A generalized estimating equation was used to obtain ORs; the reference is the usual care group.

Table 5. Participants With Specified Weeks of Continuous Stimulant- and Alcohol-Negative Samples

Time, wk	Incentive Group (n = 198)*	Usual Care Group (n = 190)*	OR (95% CI)†
≥4	23.7	9.0	3.1 (1.7-5.7)
≥8	16.7	2.1	9.3 (3.2-26.7)
12	5.6	0.5	11.1 (1.4-86.5)

Abbreviations: See Table 3.

*Data are given as percentage of each group.

†Each analysis was conducted separately; the reference is the usual care group.

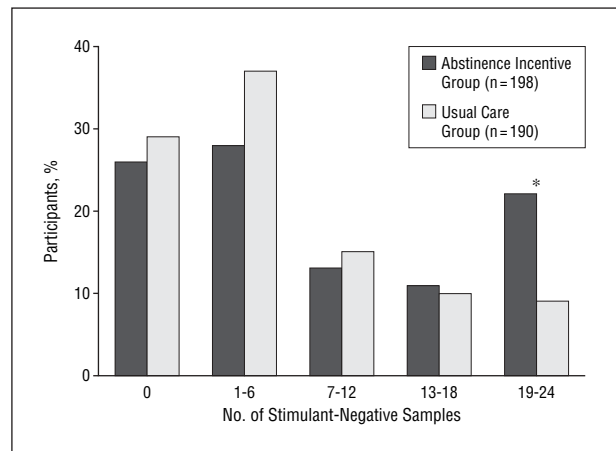


Figure 4. Distribution of individual participant outcomes. Data are shown for abstinent incentive and usual care study participants. Individuals were classified into 1 of 5 categories based on the total number of samples (of 24 possible) submitted during the 12-week study that were negative for stimulants and alcohol.

negative samples submitted) was high in both groups. In contrast, good outcomes (ie, 19-24 negative samples) were more than twice as likely in the incentive as in the usual care group (21.2% vs 8.0%; $\chi^2=13.6, P<.001$).

INCENTIVES EARNED

Participants assigned to the incentive condition earned an average of 43 draws for abstinence. These draws re-

sulted in a mean (SD) of 21 (29) Good Job chips, 19 (25) Small prizes, 4 (6) Large prizes, and 0.2 (0.5) Jumbo prizes per participant. The average total cost of the incentive procedure, including the bonus Large prize earned for achieving 2 or more weeks of continuous abstinence, was \$120 per participant, or \$1.42 per participant per day during the 12-week intervention.

COMMENT

The results of this National Drug Abuse Treatment CTN study clearly demonstrate the effectiveness of motivational incentives targeted to drug abstinence when implemented in community methadone maintenance treatment programs. Specifically, the relatively low-cost tangible incentives offered in this study doubled the likelihood that participants would provide stimulant- and alcohol-negative samples at any given visit. The intervention also increased by more than 2-fold the percentage of participants submitting negative samples during 10 to 12 weeks of the study and increased by 3-fold or more the percentage of participants who achieved 4 weeks or more of stimulant abstinence. This effect was primarily due to reductions in stimulant use. Thus, drug use outcomes were improved in the total number of drug-free samples provided and in a longer duration of continuous abstinence.

The significant effects of abstinence reinforcement seen in this large multisite study are consistent with effects seen in previous small studies^{13,25} using the intermittent reinforcement procedure with methadone maintenance patients. Thus, the present study confirms the effectiveness of the intervention under conditions in which usual care treatment was allowed to vary. It is also remarkable that robust between-group differences were found despite substantial increases in stimulant-negative urine samples submitted by the usual care group. To our knowledge, the latter effect, presumably due to the attention and urine test result feedback provided as part of the study, has not been reported previously.¹³ Anecdotal reports indicate that many usual care participants looked forward to receiving the test results and social reinforcement when results were drug negative. An alternative explanation is that participants may have volunteered for the study because they were already motivated to make changes in their stimulant use.

Incentives also improved outcomes for opioid use, even though opioid abstinence was reinforced on a substantially leaner schedule than stimulant abstinence. These results are likely because opioids were specifically targeted as a bonus drug. Alternatively, reductions in opioid use may reflect a cessation of combined opioid and cocaine use (eg, "speedball") or the generalized effects on nontargeted drug use that have been observed in other studies in which cocaine was the primary target drug.⁷ Although participants had been in treatment for at least 30 days, more than 40% of study participants submitted a urine sample positive for opioids at entry into the study, indicating a need for increased therapeutic attention to opioid abstinence in this population.

Although approximately 17% of the sample met the criteria for current alcohol abuse or dependence, few participants overall submitted alcohol-positive breath samples,

which precluded the possibility of detecting reductions in alcohol use in either group. Breath alcohol was used for this study because it is commonly used in clinics, but there are more sensitive methods of monitoring alcohol use (eg, urinary 5-hydroxytryptophol).²⁶ Future studies should consider using such measures to provide a better test of CM to reduce drinking, because alcohol abuse has a negative effect on outcomes for stimulant abusers.¹⁸

This study, like others^{6,13} evaluating CM interventions in methadone maintenance populations, did not find an effect of incentives on treatment participation, whether measured as study retention or counseling attendance, or on long-term outcomes after withdrawal of the intervention. Methadone maintenance is designed to be a long-term treatment, and even patients receiving minimal care usually remain in treatment for extended periods.¹¹ In other non-methadone maintenance populations, however, CM interventions produce improved treatment retention.⁸ Furthermore, it is unlikely that counseling attendance would be affected by incentives unless attendance was specifically targeted, a strategy that has been successful in other contexts.^{25,27} The similarity of study retention and urine sample collection rates across the 2 study groups strengthens conclusions that can be drawn about stimulant abstinence from urine test results, because these results are not differentially influenced by between-group differences in data collection or study dropout rates. With regard to poststudy follow-up, relapse after termination of drug abuse treatment interventions is common and does not detract from the importance of during-treatment effects.²⁸ The benefits of tangible incentives may be extended into the postintervention period when incentives are combined with other effective psychosocial or low-cost treatments, such as community reinforcement or methadone take-home privileges.^{29,30} Alternatively, clinics may benefit from incorporating abstinence incentives into standard ongoing care, either as an intensive time-limited intervention or throughout treatment.

The generalizability of study findings is greatly strengthened by a large sample size and the good regional and population diversity found in nonresearch community-based methadone maintenance clinics. In contrast, all previous studies^{6,13} of abstinence incentives have been conducted in single clinics, many of which were accustomed to research. Thus, this study demonstrates the effectiveness of incentives across heterogeneous populations in diverse community treatment settings. Generalizability may be somewhat limited by the voluntary nature of study participation and the relatively few patients enrolled at each site, but this limitation is far outweighed by the benefits of a multisite community-based clinical trial. Limitations associated with missing data were addressed with specific analytic methods, including multiple analyses using different assumptions about missing data, all of which yielded similar results.

This study confirms and extends support for a lower-cost approach to reinforcing abstinence. For an approximate direct cost of \$1.42 per day, plus urine test costs, the incentive procedure doubled the odds that participants would submit stimulant-negative urine samples and tripled the odds that participants would attain at least 4 weeks of sustained stimulant abstinence. It is unlikely that this cost can be further lowered substantially while retaining beneficial effects on abstinence,³¹ although

higher incentive values may increase the effectiveness or extend benefits to more participants.³² Cost-benefit analyses would be useful. Further adoption of these methods is facilitated by published reports³³ that provide detailed suggestions for how to implement lower-cost CM approaches in the community. Results from the present study support more widespread adoption of incentive procedures and suggest that directing resources toward abstinence incentive interventions could improve treatment outcomes in community methadone maintenance programs.

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REFERENCES

- Kidorf M, Stitzer ML, Brooner RK. Characteristics of methadone patients responding to take-home incentive. *Behav Ther.* 1994;25:109-121.
- Stitzer ML, Iguchi MY, Felch LJ. Contingent take-home incentive: effects on drug use of methadone maintenance patients. *J Consult Clin Psychol.* 1992;60:927-934.
- Higgins ST, Budney AJ, Bickel WK, Foerg FE, Donham R, Badger GJ. Incentives improve outcome in outpatient behavioral treatment of cocaine dependence. *Arch Gen Psychiatry.* 1994;51:568-576.
- Grella CE, Anglin MD, Wugalter SE. Patterns and predictors of cocaine and crack use by clients in standard and enhanced methadone maintenance treatment. *Am J Drug Alcohol Abuse.* 1997;23:15-42.
- Saxon AJ, Wells EA, Fleming C, Jackson TR, Calsyn DA. Pre-treatment characteristics, program philosophy and level of ancillary services as predictors of methadone maintenance treatment outcome. *Addiction.* 1996;91:1197-1209.
- Silverman K, Higgins ST, Brooner RK, Montoya ID, Cone EJ, Schuster CR, Preston KL. Sustained cocaine abstinence in methadone maintenance patients through voucher-based reinforcement therapy. *Arch Gen Psychiatry.* 1996;53:409-415.
- Silverman K, Wong CJ, Umbricht-Schneiter A, Montoya ID, Schuster CR, Preston KL. Broad beneficial effects of cocaine abstinence reinforcement among methadone patients. *J Consult Clin Psychol.* 1998;66:811-824.
- Higgins ST, Silverman K. *Motivating Behavior Change Among Illicit-Drug Abusers: Research on Contingency Management Interventions.* Washington, DC: American Psychological Association; 1999.
- Petry NM. A comprehensive guide to the application of contingency management procedures in general clinic settings. *Drug Alcohol Depend.* 2000;58:9-25.
- Kellogg SH, Burns M, Coleman P, Stitzer M, Wale JB, Kreek MJ. Something of value: the introduction of contingency management interventions into the New York City Health and Hospital Addiction Treatment Service. *J Subst Abuse Treat.* 2005;28:57-65.
- Rawson RA, Huber A, McCann M, Shoptaw S, Farabee D, Reiber C, Ling W. A comparison of contingency management and cognitive-behavioral approaches during methadone maintenance treatment for cocaine dependence. *Arch Gen Psychiatry.* 2002;59:817-824.
- Petry NM, Martin B, Cooney Petry NM, Martin B, Cooney JL, Kranzler HR. Give them prizes, and they will come. *J Consult Clin Psychol.* 2000;68:250-257.
- Petry NM, Martin B. Low-cost contingency management for treating cocaine- and opioid-abusing methadone patients. *J Consult Clin Psychol.* 2002;70:398-405.
- Prendergast ML, Podus D, Chang E. Program factors and treatment outcomes in drug dependence treatment. *Subst Use Misuse.* 2000;35:1931-1965.
- Kosten TR, Gawin FH, Rounsaville BJ, Kleber HD. Cocaine abuse among opioid addicts. *Am J Drug Alcohol Abuse.* 1986;12:1-16.
- Leri F, Bruneau J, Stewart J. Understanding polydrug use: review of heroin and cocaine co-use. *Addiction.* 2003;98:7-22.
- Brady KT, Sonne S, Randall CL, Adinoff B, Malcolm R. Features of cocaine dependence with concurrent alcohol abuse. *Drug Alcohol Depend.* 1995;39:69-71.
- Bovasso G, Cacciola J. The long-term outcomes of drug use by methadone maintenance patients. *J Behav Health Serv Res.* 2003;30:290-303.
- Downey KK, Helmus TC, Schuster CR. Treatment of heroin-dependent polydrug abusers with contingency management and buprenorphine maintenance. *Exp Clin Psychopharmacol.* 2000;8:176-184.
- Piotrowski NA, Tusel DJ, Sees KL, Reilly PM, Banys P, Meek P, Hall SM. Contingency contracting with monetary reinforcers for abstinence from multiple drugs in a methadone program. *Exp Clin Psychopharmacol.* 1999;7:399-411.
- Preston KL, Umbricht A, Epstein DH. Methadone dose increase and abstinence reinforcement for treatment of continued heroin use during methadone maintenance. *Arch Gen Psychiatry.* 2000;57:395-404.
- Signorini DF, Leung O, Simes RJ, Beller E, Gebiski VJ, Callaghan T. Dynamic balanced randomization for clinical trials. *Stat Med.* 1993;12:2343-2350.
- Cox JR. Regression model and life table. *J R Stat Soc Ser A.* 1972;34:187.
- Zeger SL, Liang K-Y, Albert P. Models for longitudinal data: a generalized estimating equation approach. *Biometrics.* 1988;44:1049-1060.
- Petry NM, Martin B, Simic F. Prize reinforcement contingency management for cocaine dependence. *J Consult Clin Psychol.* 2005;73:354-359.
- Helander A, von Wachenfeldt J, Hiltunen A, Beck O, Liljeberg P, Borg S. Comparison of urinary 5-hydroxytryptophol, breath ethanol, and self-report for detection of recent alcohol use during outpatient treatment: a study on methadone patients. *Drug Alcohol Depend.* 1999;56:33-38.
- Brooner RK, Kidorf MS, King VL, Stoller KB, Peirce JM, Bigelow GE, Kolodner K. Behavioral contingencies improve counseling attendance in an adaptive treatment model. *J Subst Abuse Treat.* 2004;27:223-232.
- Bigelow GE, Brooner RK, Silverman K. Competing motivations: drug reinforcement vs non-drug reinforcement. *J Psychopharmacol.* 1998;12:8-14.
- Higgins ST, Sigmon SC, Wong CJ, Heil SH, Badger GJ, Donham R, Dantona RL, Anthony S. Community reinforcement therapy for cocaine-dependent outpatients. *Arch Gen Psychiatry.* 2003;60:1043-1052.
- Silverman K, Robles E, Mudric T, Bigelow GE, Stitzer ML. A randomized trial of long-term reinforcement of cocaine abstinence in methadone-maintained patients who inject drugs. *J Consult Clin Psychol.* 2004;72:839-854.
- Petry NM, Tedford J, Austin M, Nich C, Carroll KM, Rounsaville BJ. Prize reinforcement contingency management for treating cocaine users: how low can we go, and with whom? *Addiction.* 2004;99:349-360.
- Dallery J, Silverman K, Chutuape MA, Bigelow GE, Stitzer ML. Voucher-based reinforcement of opiate plus cocaine abstinence in treatment-resistant methadone patients. *Exp Clin Psychopharmacol.* 2001;9:317-325.
- Petry NM, Simic F Jr. Recent advances in the dissemination of contingency management techniques. *J Subst Abuse Treat.* 2002;23:81-86.