

Effect of Prize-Based Incentives on Outcomes in Stimulant Abusers in Outpatient Psychosocial Treatment Programs

A National Drug Abuse Treatment Clinical Trials Network Study

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Context: Contingency management interventions that provide tangible incentives based on objective indicators of drug abstinence are efficacious in improving outcomes in substance abusers, but these treatments have rarely been implemented in community-based settings.

Objective: To evaluate the efficacy of an abstinence-based contingency management intervention as an addition to usual care in community treatment settings.

Design: Random assignment to usual care or usual care plus abstinence-based incentives for 12 weeks.

Setting: Eight community-based outpatient psychosocial drug abuse treatment programs.

Participants: A total of 415 cocaine or methamphetamine users beginning outpatient substance abuse treatment.

Intervention: All participants received standard care, and those assigned to the abstinence-based incentive condition also earned chances to win prizes for submitting substance-free urine samples; the chances of winning prizes increased with continuous time abstinent.

Main Outcome Measures: Retention, counseling attendance, total number of substance-free samples provided, percentage of stimulant- and alcohol-free samples submitted, and longest duration of confirmed stimulant abstinence.

Results: Participants assigned to the abstinence-based incentive condition remained in treatment for a mean \pm SD of 8.0 ± 4.2 weeks and attended a mean \pm SD of 19.2 ± 16.8 counseling sessions compared with 6.9 ± 4.4 weeks and 15.7 ± 14.4 sessions for those assigned to the usual care condition ($P < .02$ for all). Participants in the abstinence-based incentive condition also submitted significantly more stimulant- and alcohol-free samples ($P < .001$). The abstinence-based incentive group was significantly more likely to achieve 4, 8, and 12 weeks of continuous abstinence than the control group, with odds ratios of 2.5, 2.7, and 4.5, respectively. However, the percentage of positive samples submitted was low overall and did not differ between conditions.

Conclusion: The abstinence-based incentive procedure, which provided a mean of \$203 in prizes per participant, was efficacious in improving retention and associated abstinence outcomes.

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THE NATIONAL INSTITUTE ON Drug Abuse Clinical Trials Network (CTN) is a collaborative effort between drug abuse treatment researchers and providers. Given the gap between research and treatment,¹ the primary goals of this initiative are to implement, in community-based clinics, interventions found to be efficacious in research settings and to assess the effectiveness of these approaches in substance-abusing patients in clinical settings throughout the country.

Contingency management (CM) treatments were selected as among the first interventions tested in the CTN. These interventions are based on behavioral research indicating that when a behavior is reinforced, it increases in frequency. The efficacy of CM has been demonstrated in opioid-,²⁻⁵ marijuana-,⁶ alcohol-,⁷ and cocaine-dependent patients.⁸

In treating cocaine dependence, many CM studies provided vouchers, exchangeable for retail goods and services, on submission of cocaine-free urine specimens.

Table 1. Characteristics of the 415 Study Participants by Clinic

Clinic	Participants, No.	Age, Mean, y	Female, %	Minority, %*	Employed, %†	Criminal Justice Referral, %	Stimulant Free at Intake, %
1	67	35.8	100.0	73.1	14.9	17.9	82.1
2	48	33.7	31.3	54.2	31.3	62.5	91.7
3	27	38.0	44.4	70.4	33.3	37.0	85.2
4	32	30.8	65.6	31.3	43.8	21.9	75.0
5	55	41.8	43.6	98.2	20.0	3.6	43.6
6	88	31.2	48.9	42.1	55.7	37.5	68.2
7	59	38.2	54.2	78.0	23.7	61.0	91.5
8	39	38.9	41.0	64.1	59.0	20.5	59.0

*Minority representation in the overall sample was 36% African American and 12% Hispanic (see Table 2).

†Full or part time.

For example, Higgins et al⁸ found that 55% of cocaine-dependent outpatients who received behavioral therapy plus contingent vouchers achieved at least 2 months of continuous cocaine abstinence vs 15% of patients who received behavioral therapy alone. Voucher CM interventions also enhance retention in treatment, a critical issue in treating cocaine-dependent outpatients.⁹⁻¹² In the study by Higgins et al,⁸ 90% of patients who received vouchers remained in treatment for at least 3 months vs 65% who received behavioral therapy alone. To demonstrate that beneficial effects were related to contingent reinforcement rather than to voucher availability, Higgins et al¹³ randomly assigned patients to conditions in which they received vouchers contingent on abstinence or regardless of sample results. More than 30% of the patients in the contingent condition maintained 3 months or more of continuous abstinence vs approximately 10% of patients who received noncontingent vouchers.

Despite the efficacy of voucher CM procedures in research trials,¹⁴ some issues have hindered their implementation in community-based programs.¹⁵ One issue is cost. In previous research,^{8,13} participants could earn more than \$1000 in vouchers. Recent studies¹⁶⁻¹⁸ have applied an intermittent reinforcement CM approach in which patients earn a chance to draw chips from a container and win prizes of varying magnitudes; average maximal earnings were arranged to be \$250 to \$400.^{5,8,13,19} This prize-based CM procedure, similar to voucher CM, enhances retention and increases durations of objectively confirmed abstinence relative to standard treatment.^{16-18,20}

The purpose of this study is to assess the efficacy of prize-based CM in improving outcomes in community-based substance abuse treatment clinics. Insofar as community-based clinics have rarely participated in intervention research,¹ this study provides a unique opportunity to evaluate promising interventions in the context of usual care. Because this was a multisite study, standard therapy content, intensity, and outcomes were expected to vary across clinics.²¹ This diversity of usual care was accommodated in the study design by viewing CM as an add-on to usual care. Indeed, the point of a multisite study is to determine whether an intervention is sufficiently robust to have discernible effects when administered across clinics with differences in patients and diversity of usual care practices.

Stimulant abusers were selected for the study sample because this population is one of the largest seeking substance abuse treatment. Because of the well-established connection between cocaine and alcohol use,²²⁻²⁵ stimulant abusers were required to provide negative breath alcohol samples in addition to stimulant-free urine samples to receive reinforcement. Additional incentives were provided for abstinence from marijuana and opioids, which are also commonly abused by stimulant-dependent patients.²⁶⁻²⁸

Primary hypotheses were that participants in the incentive condition would remain in the study longer, submit more stimulant- and alcohol-free samples, provide a higher percentage of stimulant- and alcohol-free samples, and sustain longer durations of abstinence from these drugs. Secondary hypotheses were that participants in the incentive condition would attend more counseling sessions and submit a higher proportion of samples free of opioids and marijuana than participants receiving usual care.

METHODS

STUDY PARTICIPANTS

Using effect sizes from studies with lower-cost incentive procedures^{18,29-31} and adjusting for higher variability expected in a multisite study, sample sizes were estimated to be approximately 200 per group. The 415 participants were outpatients at 8 community clinics that were members of the CTN and major providers in their regions. All the clinics provide psychosocial counseling without administering methadone or other opioid agonists. Six clinics were located in east, southeast, or southwest urban settings, 1 was in the suburban southeast, and another was in the rural southwest. Annual clinic population counts ranged from 130 to 3000, with only 1 clinic treating less than 200 patients per year. **Table 1** provides characteristics of the participants from each clinic.

Patients presenting for treatment learned about the study at intake to the clinic. Only patients who disclosed stimulant use (cocaine, methamphetamine, or amphetamine) during their initial evaluation or who submitted a stimulant-positive urine sample were invited to participate. Patients were unaware of study eligibility requirements, and only a small proportion of clinic patients were enrolled in the study. Eligibility criteria were as follows: (1) reported stimulant use within 2 weeks of study entry (n=305; 73.5%), (2) exited a controlled environment (de-

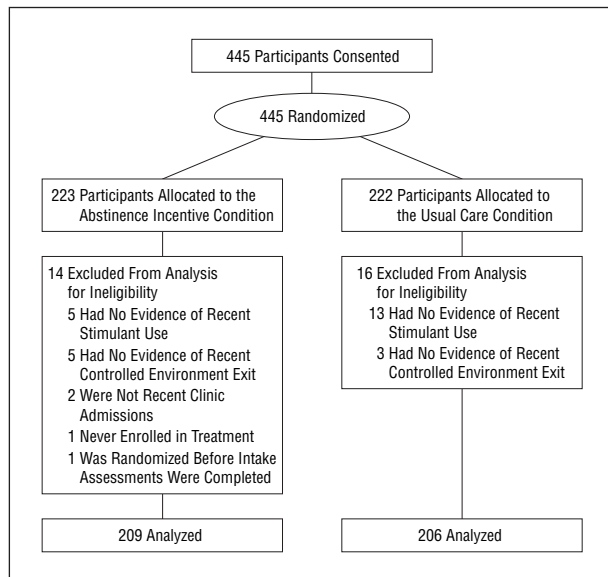


Figure 1. Flow diagram of the participant intake process.

toxication unit, hospital, or correctional facility) within 2 weeks of study entry and reported stimulant use within 2 weeks of entering the controlled environment ($n=97$; 23.4%), or (3) submitted a stimulant-positive urine sample at treatment entry without self-reporting stimulant use ($n=13$; 3.1%). Because few community clinics use formal diagnostic procedures in practice, diagnosis of a stimulant use disorder was not required for study participation. Nevertheless, 79.3% of participants met the criteria for stimulant dependence, and an additional 5.1% met the abuse criteria only.

Participants provided written informed consent, approved by local institutional review boards, and were excluded if they did not obtain a score of 80% or greater on a consent quiz. Participants recovering from a gambling problem were also excluded because of the potential similarity between gambling and the incentive procedure. No potential participants were excluded for either reason.

Participants were enrolled between April 30, 2001, and February 28, 2003. Screening information was not systematically collected, and data are unavailable for patients who did not qualify for or who refused participation. In total, 445 participants were randomized. Based on reviews of medical records that were blinded to treatment condition, 30 randomized participants were determined before data analysis to not fully meet the study inclusion criteria. Exclusion of such patients from analyses is legitimate as long as uniform scrutiny for ineligibility is applied across treatment groups.³² Exclusions were similar between conditions (**Figure 1**). The final sample size was 415. Participants were considered terminated from the study 84 days after randomization, on discharge from the clinic, or when 30 days elapsed between study visits with research staff.

STUDY PROCEDURES

Intake Assessment and Randomization

Participants completed a 1.5-hour interview (M.C., J.M.P., N.M.P., K.K., Frank Satterfield, J.B., A.C., M.C., J.H., Leroy Lucero, Joe Krasnansky, CSW, R.S., M.L.S., unpublished data, September 2004) before randomization, with information gathered on demographics, psychosocial problems, and lifetime and current drug use, including *DSM-IV* substance use diagnoses. As compensa-

tion, participants chose from items valued at \$20 (gift certificates, watches, etc). The item also provided exposure to the types of prizes available for those assigned to the incentive condition.

On completing the intake assessment, participants provided their first study urine sample, which was tested on site using procedures described later herein. The results of this sample were used to stratify participants on 2 variables before randomization: (1) the presence or absence of a stimulant (cocaine, amphetamine, or methamphetamine) and (2) the presence or absence of marijuana or opioids. Participants were randomized to 1 of 2 study conditions: usual care or usual care plus abstinence-based incentives for 12 weeks. Random assignment was conducted at each site independently using a computer program and a dynamic balanced randomization procedure.³³ The randomization sequence was unknown to research staff, but group assignment was not masked after randomization.

Urinalysis Procedures

Participants were asked to provide 2 urine samples per week on nonconsecutive days, for a total of 24 samples, with the intake sample being the first. Schedules were individualized to coincide with clinic attendance. In most cases, collections were observed by a same-sex observer. Additional validity checks included temperature and adulterant strips that detected pH, creatinine, glutaraldehyde, and nitrite (AdultaCheck 4 or Intect 7; Roche Diagnostics, Indianapolis, Ind). Samples failing any validity checks were discarded, and participants were asked to provide another. Urine samples were tested using OnTrak TesTcup 5 (Roche Diagnostics), which detects cocaine, methamphetamine, amphetamine, tetrahydrocannabinol, and morphine. Participants also provided a breath sample at each visit that was tested for alcohol using a desktop or handheld breathalyzer. Although such devices can detect only very recent alcohol use, samples reading greater than 0.01 g/dL were considered positive.

Usual Care

Usual care consisted primarily of group and possibly some individual and family counseling. Participants in the study also received immediate feedback on urinalysis results. Research staff congratulated participants when they tested negative and encouraged them to stop using substances when they tested positive. If participants reported personal problems or clinical issues, research staff provided empathy and encouraged them to discuss their concerns with their counselor. Study participation did not affect standard care. Participants could continue receiving standard treatment without continuing in the study and after study completion.

Abstinence Incentives

Participants assigned to this condition earned chances to win prizes when their test results were negative for cocaine, amphetamine, methamphetamine, and alcohol (the primary target drugs). Participants with negative test results for all the primary target drugs were invited to draw 1 to 12 chips from an opaque container that contained 500 chips. Each chip was marked with a reward value: 250 chips (50.0%) stated "Good Job," 209 (41.8%) stated "Small," 40 (8.0%) stated "Large," and 1 (0.2%) stated "Jumbo." No tangible reward was earned for drawing a Good Job. Prizes associated with Small chips were worth approximately \$1. When such a chip was drawn, participants selected from a variety of \$1 prizes; popular items included toiletries, snacks, bus tokens, and fast-food gift certificates. Large prizes were worth approximately \$20 and included

items such as kitchen objects (pots and dishes), telephones, compact disc players, and retail store gift certificates. Jumbo prizes were worth \$80 to \$100; popular items were televisions, stereos, and DVD players. Prizes were stored in locked cabinets and were replenished regularly. The clinics chose items they thought would be desirable.

The number of draws earned was determined on a schedule that was responsive to test outcomes. Specifically, draws increased by 1 for each week in which all the submitted samples were free of the primary target drugs. The number of draws reset to 1 after an unexcused absence or submission of a sample positive for a primary target drug. Participants who notified staff in advance of an expected missed visit could receive an excused absence, in which case the number of draws continued to escalate, provided that they had negative test results at their most recent visit. However, at least 1 sample per week had to be submitted to be eligible for increased draws.

To offset low rates of reinforcement early in the study, when the number of draws was low, a single large prize was awarded when a participant first achieved 2 consecutive weeks of abstinence. At each study visit, participants could also earn 2 bonus draws if their sample was also free of opioids and marijuana. Bonus draws, available to all the participants in this condition, depended on total abstinence (from primary and secondary target drugs) and did not escalate across time. Participants who provided all the scheduled urine and breath samples and who were free of all primary and secondary target drugs earned 204 draws, resulting in an average of approximately \$400 in prizes, plus a \$20 prize after the first 2 weeks of abstinence.

OUTCOME MEASURES

Retention in the study was defined as the number of days that elapsed between when the first and last study urine samples were submitted. Study compliance was the percentage of participants who submitted at least 1 sample per week during the study. This definition was used because participants could and often did sustain a schedule of once- rather than twice-weekly contact. Treatment participation referred to the number of counseling sessions attended during the 12-week study, including individual, group, and family counseling sessions.

To account for missing and incomplete data, substance use outcomes were evaluated in several ways: (1) overall percentage of submitted samples that were free of each target drug (stimulants, alcohol, opioids, and marijuana), (2) percentage of samples submitted that were free of stimulants and alcohol at each of the 24 study visits, (3) total number of stimulant- and alcohol-free samples submitted by each participant, and (4) longest duration of abstinence (LDA) from the primary target drugs for each participant. The LDA was defined as the number of consecutive samples obtained under the twice-weekly schedule that indicated abstinence from the primary target drugs (with each sample representing 2-5 days of abstinence).

Consistent with the protocol, allowing for 1 excused absence per week without penalty, we coded missing visits as negative if the most proximal samples before and after the missing value had negative results. For the primary target drugs, this imputation was made for 4.1% and 4.3% of incentive and usual care data, respectively.

DATA ANALYSIS

Between-group comparisons on baseline measures were conducted using *t* tests for continuous variables and χ^2 tests for dichotomous variables. Study retention was compared between groups using the Cox proportional hazards model.³⁴ An "event" was defined on the day of the last submitted sample,

with data censored at day 84 if a sample was provided in week 12. Results are reported using hazard ratios and 95% confidence intervals (CIs). Binary variables that repeated across time (whether participants submitted samples each week and whether submitted samples tested negative or positive for the primary target drugs by week) were analyzed using generalized estimating equations.³⁵ Results are reported as odds ratios (ORs) (with 95% CIs), indicating the likelihood that participants in the incentive condition had different outcomes than participants in the usual care condition.

Data analyses were conducted using 2 different samples: all randomized participants (*n* = 445) and all randomized participants minus those noted retrospectively not to have met all the eligibility criteria (*n* = 415). Because all the results were almost identical for the 2 samples, only data from the sample with verified eligibility are reported.³²

Individual differences in outcomes (LDA and number of negative samples) were analyzed in 3 ways. First, mean LDA was compared between groups using *t* tests and Mann-Whitney tests; results were similar, and *t* test results are reported. Second, participants were classified according to maximum LDA: 4 weeks or longer, 8 weeks or longer, and 12 weeks. Percentages of participants meeting vs not meeting each LDA criterion were compared between groups using χ^2 tests. To further express the magnitude of differences between groups, ORs and 95% CIs are presented. Because LDA categories are not independent (those with ≥ 8 weeks of abstinence also have ≥ 4 weeks of abstinence), separate tests were conducted in each category.

A final perspective on treatment-related abstinence was obtained by classifying participants into 5 categories according to the number of stimulant- and alcohol-free samples submitted, whether they were consecutive or not: 0, 1 to 6, 7 to 12, 13 to 18, and 19 to 24 substance-free samples. We used χ^2 tests to determine whether the overall distribution differed between groups and whether groups differed within each category. Data analyses were conducted using a statistical software program (SAS 9.0 for Windows; SAS Institute Inc, Cary, NC).

RESULTS

BASELINE CHARACTERISTICS

In general, neither demographics nor substance use variables differed between conditions except that participants in the usual care condition were more likely to be married than those in the incentive condition (**Table 2**).

STUDY RETENTION AND PARTICIPATION

Figure 2A shows study retention. There was an initial decline of approximately 10% in the curves, indicating that some individuals came to the first study visit but were not seen again. After visit 2, the retention curves began to diverge. Participants assigned to the incentive condition were significantly more likely to be retained than those assigned to usual care (unadjusted hazard ratio, 1.45; 95% CI, 1.13-1.87). By the end of 12 weeks, 49% of the incentive participants were still retained vs 35% of the usual care participants. Results were similar when site was added as a covariate in the model (adjusted relative hazard ratio, 1.60; 95% CI, 1.23-2.07), with incentive participants more likely to remain in treatment.

Figure 2B shows the percentage of participants submitting at least 1 urine sample each week. The func-

Table 2. Demographic and Drug Use Characteristics of the 415 Study Participants by Condition

Characteristic	Incentive Condition (n = 209)	Usual Care Condition (n = 206)	P Value
Sex, %			
M	44.5	44.7	.97
F	55.5	55.3	
Race, %			
African American	31.6	40.3	.31
White	45.0	39.3	
Hispanic	12.9	12.1	
Other	10.5	8.3	
Age, mean (SD), y	35.9 (9.1)	35.7 (8.3)	.80
Education, mean (SD), y	11.7 (1.9)	11.9 (2.0)	.37
Marital status, %			
Married or cohabitating	18.7	28.6	.05
Separated/divorced/widowed	34.0	31.1	
Never married	47.3	40.3	
Current employment status, %			
Full time	18.2	20.9	.70
Part time	14.8	16.0	
Unemployed	67.0	63.1	
Currently on probation or parole, %	35.9	34.5	.76
Legal referral to treatment, %	32.5	34.0	.75
Current drug abuse or dependence, %*			
Stimulants†	83.7	84.9	.73
Alcohol	44.5	39.8	.33
Marijuana	21.6	20.4	.76
Opiates	8.2	10.7	.39
Negative sample at intake, %			
Stimulants†	74.6	73.2	.73
Alcohol	99.0	99.5	.57
Marijuana	88.0	90.2	.47
Opiates	96.6	97.1	.81

*Based on *DSM-IV* diagnoses; the time frame for current abuse or dependence was the past 90 days.

†Includes cocaine and methamphetamine.

tion is similar to that for study retention, except that the percentage submitting samples during any given week is lower than the percentage considered retained in the study. Incentive participants were more likely to submit samples than usual care participants (OR, 1.56; 95% CI, 1.19-2.05). Individuals in the incentive and usual care conditions submitted a mean ± SD of 12.9 ± 8.0 and 9.9 ± 7.1 samples, respectively ($t_{412}=4.04$; $P<.001$).

Effects noted for the entire sample were generally replicated within sites, although the small sample sizes (and subsequent reduced power) prevented the detection of statistically significant effects within most sites.

Table 3 shows trends in the expected direction at all sites for mean number of urine samples submitted, with statistically significant effects at 3 of 8 sites. Effects were also in the expected direction for mean number of weeks retained, but they reached statistical significance at only 2 sites.

COUNSELING USE

Participants in the incentive condition attended a mean ± SD of 19.2 ± 16.8 counseling sessions during the 12-week study compared with 15.7 ± 14.4 sessions for par-

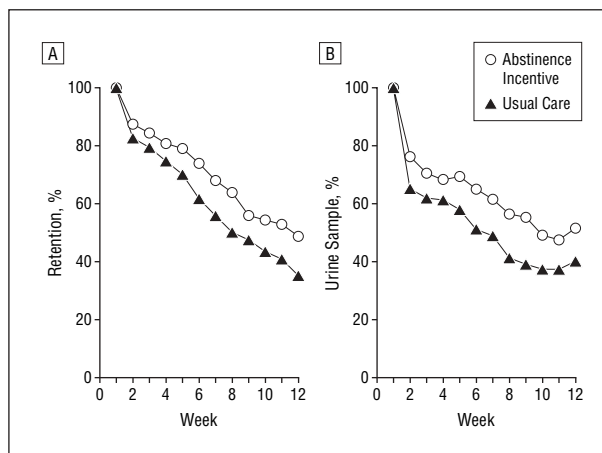


Figure 2. Retention and urine sample submission data in a 12-week study of abstinence incentives for incentive (n=209) and usual care (n=206) participants. A, Percentage of participants who remained in the study each week. Study dropout was defined when 30 days had elapsed since the most recent study visit. An "event" was counted for any sample submitted before the last study week; data were censored at day 84 if a submitted sample was provided in the last study week. B, Percentage of participants who submitted at least 1 urine sample during the indicated study week.

ticipants in the usual care condition ($t_{210}=2.30$; $P<.02$). Approximately 80% of the sessions were group therapy as opposed to individual or family sessions; adjustment for site did not alter this result.

DRUG USE

Percentages of submitted samples that were free of the primary and secondary target drugs are given in **Table 4**. Using the primary analyses that assumed that missing samples were negative if they were preceded and followed by negative samples (4.1% and 4.3% of incentive and usual care data, respectively), generalized estimating equation analysis revealed nonsignificant differences between conditions (OR, 1.25; 95% CI, 0.85-1.85), and most samples collected were stimulant free in both conditions. When missing samples were coded as missing, generalized estimating equation analysis likewise revealed no between-group differences in stimulant-free samples (OR, 1.29; 95% CI, 0.87-1.89). If missing samples were coded as positive (the most conservative approach), a significantly higher proportion of stimulant-free samples was evident in the incentive condition (OR, 1.69; 95% CI, 1.30-2.19). Table 4 indicates that rates of alcohol-negative breath samples were extremely high. Similarly, 96% to 98% of samples were free of opiates and marijuana. Rates did not differ by condition, except when missing samples were treated as positive.

The LDA is a relevant outcome measure because the escalating draw feature of the incentive condition was designed specifically to reinforce long durations of abstinence from the primary target drugs. The mean ± SD number of consecutive visits with confirmed abstinence was 5.2 ± 6.9 for usual care participants vs 8.6 ± 9.2 for incentive participants ($t_{386}=4.24$; $P<.001$), translating to approximately 2.6 and 4.4 weeks, respectively, of consecutive abstinence. Consistent with the protocol, missing samples were treated as negative in these analyses as long

Table 3. Study Results From Individual Sites

Site No.	Participants, No.	Incentive Condition	Usual Care Condition	<i>t</i> Test (<i>df</i>)	<i>P</i> Value
Urine Samples Provided, Mean (SD), No.					
1	67	15.7 (8.7)	9.9 (6.3)	3.10 (65)	.003*
2	48	14.0 (9.0)	10.3 (8.1)	1.50 (46)	.14
3	27	12.0 (7.3)	5.9 (5.7)	2.35 (25)	.03*
4	32	12.3 (7.7)	6.5 (5.6)	2.42 (30)	.02*
5	55	9.0 (8.1)	7.2 (7.7)	0.81 (53)	.42
6	88	14.1 (8.4)	12.1 (7.6)	1.19 (85)	.20
7	59	12.3 (5.3)	10.9 (6.3)	0.93 (57)	.36
8	39	12.7 (7.5)	10.8 (6.0)	0.88 (37)	.38
Total	415	12.9 (8.0)	9.9 (7.1)	4.04 (412)	<.001*
Retained in Study, Mean (SD), wk					
1	67	9.2 (3.7)	6.9 (3.8)	2.50 (65)	.01*
2	48	7.7 (5.0)	6.8 (4.8)	0.64 (46)	.52
3	27	7.1 (3.9)	3.6 (3.8)	2.37 (25)	.03*
4	32	7.9 (4.5)	5.6 (4.7)	1.38 (30)	.18
5	55	6.3 (4.8)	4.8 (4.6)	1.20 (53)	.23
6	88	8.5 (4.1)	7.9 (4.1)	0.62 (86)	.53
7	59	8.9 (3.3)	8.3 (4.3)	0.54 (57)	.59
8	39	7.9 (4.3)	8.0 (4.0)	-0.12 (37)	.91
Total	415	8.0 (4.2)	6.9 (4.4)	2.60 (413)	<.001*
Longest Duration of Confirmed Stimulant and Alcohol Abstinence, Mean (SD), No. of Consecutive Visits					
1	67	13.5 (10.2)	5.5 (6.8)	3.80 (58)	.001*
2	48	11.9 (10.0)	7.1 (8.2)	1.80 (46)	.08
3	27	6.5 (7.4)	3.2 (5.2)	1.34 (25)	.19
4	32	7.1 (8.4)	2.9 (5.0)	1.66 (30)	.11
5	55	4.0 (7.8)	3.0 (6.6)	0.54 (53)	.59
6	88	8.6 (9.1)	6.4 (7.9)	1.18 (85)	.24
7	59	6.4 (7.3)	4.8 (5.9)	0.92 (57)	.36
8	39	9.6 (9.2)	5.6 (6.7)	1.54 (37)	.13
Total	415	8.6 (9.2)	5.2 (6.9)	4.24 (386)	<.001*

*Statistically significant differences between groups.

Table 4. Submitted Samples That Were Free of the Primary and Secondary Target Drugs

	Drug-Free Samples, %		OR (95% CI)*
	Incentive Condition (n = 209)	Usual Care Condition (n = 206)	
Missing Samples Considered Negative†			
Primary target drugs			
Stimulants	90.7	88.6	1.25 (0.85-1.85)
Alcohol	99.7	99.7	0.94 (0.37-2.38)
Secondary target drugs			
Marijuana	97.1	96.4	1.25 (0.65-2.44)
Opioids	98.2	98.2	0.96 (0.38-2.38)
Missing Samples Considered Missing			
Primary target drugs			
Stimulants	89.7	87.2	1.29 (0.87-1.89)
Alcohol	99.7	99.7	0.95 (0.37-2.43)
Secondary target drugs			
Marijuana	96.9	96.0	1.30 (0.68-2.50)
Opioids	98.0	98.0	0.99 (0.40-2.48)
Missing Samples Considered Positive			
Primary target drugs			
Stimulants	48.2	35.6	1.69 (1.30-2.19)
Alcohol	74.5	66.6	1.47 (1.07-2.02)
Secondary target drugs			
Marijuana	52.1	39.3	1.68 (1.31-2.16)
Opioids	52.7	40.1	1.66 (1.30-2.13)

Abbreviations: CI, confidence interval; OR, odds ratio.

*Generalized estimating equation analysis was used to obtain ORs; the reference group is the usual care condition.

†Missing samples were considered negative only if the samples preceding and following the missing sample were also negative.

Table 5. Various Durations of Continuous Documented Abstinence From the Primary Target Drugs by Condition

Continuous Abstinence, wk	Incentive Condition, % (n = 209)	Usual Care Condition, % (n = 206)	OR (95% CI)
≥4	39.7	21.0	2.48 (1.61-3.84)
≥8	26.3	11.7	2.69 (1.59-4.56)
12	18.7	4.9	4.48 (2.17-9.23)

Abbreviations: CI, confidence interval; OR, odds ratio.

as at least 1 sample per week was provided and the samples before and after the missing one were negative. Results were nearly identical when site was added as an independent covariate in the analyses; the adjusted mean was 8.4 for incentive participants and 4.8 for usual care participants ($P < .001$). Differences in LDA were in the expected direction at all sites, but they generally did not reach significance within sites (Table 3).

The incentive condition had approximately twice as many participants with at least 4 weeks (8 visits; OR, 2.48) and at least 8 weeks (16 visits; OR, 2.69) of documented sustained abstinence (Table 5). Percentage of participants with 12 weeks of documented abstinence was nearly 4 times greater for the incentive condition than for the usual care condition (OR, 4.48).

NUMBER OF NEGATIVE SAMPLES SUBMITTED

Individual participant data were also examined for the number of stimulant- and alcohol-free samples submitted, regardless of whether they were provided in consecutive weeks. The distribution differed significantly between conditions ($\chi^2_4 = 18.0$; $P < .001$) (Figure 3). The proportion of participants with very good outcomes (19-24 negative samples), was significantly higher in the incentive condition than in the usual care condition ($\chi^2_1 = 13.4$; $P < .001$); conversely, the proportion with relatively poor outcome (1-6 negative samples) was lower in the incentive condition than in the usual care condition ($\chi^2_1 = 8.8$; $P = .003$).

INCENTIVES EARNED

Participants assigned to the incentive condition earned a mean of 76.5 draws. These draws resulted in a mean of 36.8 Good Job chips, 32.1 Small prizes, 7.4 Large prizes, and 0.2 Jumbo prizes per participant. The average total cost of the incentive procedure, including the bonus prize for participants who achieved 2 or more weeks of continuous abstinence, was \$203 per participant, or \$2.42 per participant per day.

COMMENT

This National Drug Abuse Treatment CTN study showed that retention in psychosocial treatment programs was significantly lengthened when tangible incentives, in the form of drawings for prizes of varying magnitudes, were

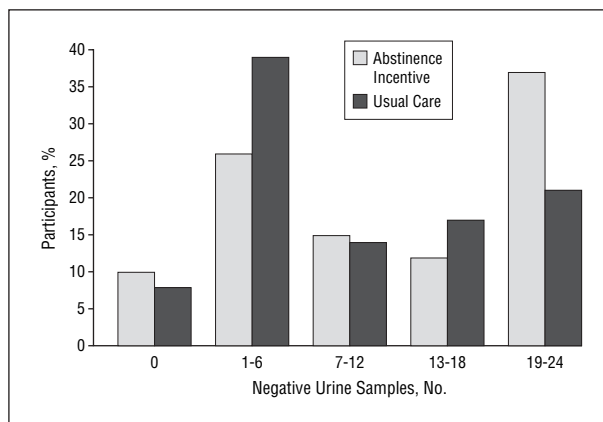


Figure 3. Distribution of individual participant outcomes for the incentive (n=209) and usual care (n=206) study participants. Individuals were classified into 1 of 5 categories based on the total number of samples (of 24 possible samples) submitted during the 12-week study that were free of stimulants and alcohol. Participants with 1 to 6 negative samples had relatively poor treatment outcomes, and those with 19 to 24 negative samples had relatively good outcomes.

provided contingent on submission of drug-free samples. Retention increased whether it was defined as the number of days between study intake and the last study visit, the proportion of participants who submitted samples each week, or the number of counseling sessions attended. These results replicate those of studies regarding the efficacy of CM treatments in general^{8,13,19} and the prize-based system in particular.^{16,18} This study extends these effects to a heterogeneous patient population. With the exception that women were overrepresented in this sample, the demographic characteristics of the participants were consistent with those of stimulant abusers initiating treatment throughout the country.^{11,36,37} Furthermore, this is the first known study of CM interventions conducted in clinics throughout the United States.

The incentive condition also improved drug use outcomes related to treatment retention. Participants in the incentive condition provided a higher overall number of negative samples, and they achieved a longer duration of documented continuous abstinence compared with participants in the usual care condition. Ability to detect an increase in the percentage of negative samples submitted was hampered by the high rate of negative samples submitted in both study conditions (Table 4), effects similar to those described by Petry et al.^{16,18} These data suggest that patients who remained engaged in psychosocial treatment programs generally refrained from substance use. These conclusions are paralleled in drug abuse outcomes monitoring projects that also show that time in treatment is associated with decreases in drug use.^{11,12,38} However, effects on retention and drug use cannot be separated in many of these studies, including the present one, because drug use was not measured systematically in participants once they stopped receiving treatment.

In a parallel CTN study of this prize-based incentive procedure in cocaine-abusing patients undergoing methadone maintenance treatment, the intervention significantly increased the proportion of drug-free samples submitted (J.M.P., N.M.P., M.L.S., J.B., Scott Kellogg, PhD, Frank Satterfield, Marion Schwartz, MSW, Joe Krasnan-

sky, CSW, Eileen Pencer, MSW, Lolita Silva-Vazquez, MA, K.C.K., C.R.-M., J.M.R., A.C., M.C., K.K., R.L., unpublished data, October 2004). In that study, along with others in patients receiving methadone maintenance treatment,^{17,20} ability to improve drug abuse outcomes was not hampered by a ceiling effect on the proportion of negative samples. Furthermore, retention rates are high in patients undergoing methadone maintenance treatment, even in non-CM conditions, thereby not obscuring the relationship between retention and outcomes.^{17,20}

No treatment effects on alcohol use were noted in this study, primarily because almost all the breath alcohol readings were negative. In part, these rates may reflect the short interval in which alcohol use can be detected and the low sensitivity of breath alcohol readings. Rates of opioid- and marijuana-free samples were similarly high during the study. Low rates of marijuana and alcohol use may be partly related to the overrepresentation of women in this study because women generally have lower rates of alcohol and marijuana dependence than men.³⁹

In light of the low rates of drug use during this study, one may question whether participants were really drug abusers. However, 84% met *DSM-IV* criteria for stimulant dependence or abuse, and between-group differences in the number of negative urine samples provided remained significant in a secondary data analysis that included only those meeting *DSM-IV* criteria ($t_{1,339} = 3.94$). Furthermore, only a few patients who attended the clinics were referred to the study, reserving study slots for individuals most likely to have clinically significant stimulant abuse problems.

The low rates of detected drug use call into question whether incentives based on drug abstinence are necessary to improve outcomes or whether incentives based directly on attendance may be equally beneficial in these types of clinics. Attendance-based CM procedures have generally increased attendance but have resulted in mixed effects in reducing drug use.⁴⁰⁻⁴⁴ However, studies that did not find benefits in drug use outcomes were short-term,⁴⁴ were applied with opioid-dependent patients with much higher levels of baseline drug use,⁴² and provided low magnitudes of vouchers.⁴⁰ If attendance-based incentive procedures using this prize reinforcement approach are efficacious in improving outcomes among stimulant abusers attending psychosocial treatment programs, a potential advantage would be that attendance-based incentives may encourage patients who have a relapse to return to treatment rather than assuming that they are unwelcome in the clinic if they have used drugs. If effective, other benefits would be that urinalysis frequency could be reduced, with consequent cost savings, and incentive programs could be better tailored to attendance expectations of clinics. Future research on incentives in outpatient psychosocial treatment should focus on this important question of identifying optimal target behaviors for improving outcomes.

Differences in outcomes are common across clinics in multisite studies. In this study, clinics that seemed to benefit least from the CM intervention were those with the highest rates of retention among usual care participants (sites 6, 7, and 8). This observation may suggest that incentive procedures may be best suited for clinics with relatively low

rates of retention. Nevertheless, the consistency of benefits across clinics underscores the generality of positive effects that can be obtained using the CM procedure.

Strengths of this study include the large sample size, reliance on objective indicators of outcomes, and the inclusion of 8 community-based clinics. Limitations include the use of a single set of incentive parameters and relatively high rates of missing data. Although many clinics participated in this study, CTN clinics were not randomly chosen. The generality of these effects to other clinics remains a question, although these CTN clinics seem to be similar to those participating in outcomes monitoring projects.^{11,12,37}

Another question that remains, but that cannot be answered by the present data, is whether the short-term benefits produced by abstinence incentives translate into longer-term improvements in outcomes. Although longer-term follow-up visits were planned for this study, completion rates were too low to draw meaningful conclusions. Some studies^{13,19,45} in outpatient psychosocial treatment settings show that beneficial effects of CM persist throughout a 1- to 2-year period, but not all CM studies find long-term benefits.⁴ The LDA achieved during treatment is among the best predictors of improved outcomes at follow-up.^{20,45} However, additional research is needed to address the long-term efficacy of this CM intervention, especially as applied in community-based settings.

The mean direct cost of the prizes awarded in this study was \$203 per participant. Other studies demonstrate beneficial effects of this prize reinforcement system with similar and even slightly less dense reinforcement schedules,^{16-18,20} but if the magnitude of prizes available is substantially reduced (ie, to <\$80 per participant), efficacy is diminished.¹⁸ In some financing structures for substance abuse treatments, the cost of the prizes may be recouped, at least in part, by increased state or insurer reimbursement for the number of counseling sessions attended. This cost may also be offset by reductions in societal costs associated with drug abuse. Although challenges remain for implementing this prize-based CM system in community settings, this study is an important step in testing and adapting empirically validated interventions, with the ultimate goal of improving treatment of substance abusers throughout the country.

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