Published in final edited form as:

J Subst Abuse Treat. 2017 January ; 72: 134–139. doi:10.1016/j.jsat.2015.08.010.

Contingency management abstinence incentives: Cost and implications for treatment tailoring

Colin Cunningham, Ph.D.¹, Maxine Stitzer, Ph.D.^{1,*}, Aimee N. C. Campbell, Ph.D.², Martina Pavlicova, Ph.D.³, Mei-Chen Hu, Ph.D.², and Edward V. Nunes, M.D.²

¹Johns Hopkins University School of Medicine, Department of Psychiatry

²Columbia University Department of Psychiatry and New York State Psychiatric Institute

³Columbia University Mailman School of Public Health Department of Biostatistics

Abstract

Objective—To examine prize-earning costs of contingency management (CM) incentives in relation to participants' pre-study enrollment drug use status (baseline (BL) positive vs BL negative) and relate these to previously reported patterns of intervention effectiveness.

Methods—Participants were 255 substance users entering outpatient treatment who received the Therapeutic Educational System (TES), in addition to usual care counseling. TES included a CM component such that participants could earn up to \$600 in prizes on average for providing drug negative urines and completing web-based cognitive behavior therapy modules. We examined distribution of prize draws and value of prizes earned for subgroups that were abstinent (BL negative; N = 136) or not (BL positive; N = 119) at study entry based on urine toxicology and breath alcohol screen.

Results—Distribution of draws earned (median = 119 vs 17; $p < .0001$) and prizes redeemed (median = 54 vs 9; $p < .001$) for drug abstinence differed significantly for BL negative compared to BL positive participants. BL negative earned on average twice as much in prizes as BL positive participants (\$245 vs \$125). Median value of prizes earned was 5.4 times greater for BL negative compared to BL positives participants (\$237 vs \$44; $p < .001$).

Conclusions—Two-thirds of expenditures in an abstinence incentive program were paid to BL negative participants. These individuals had high rates of drug abstinence during treatment and did not show improved abstinence outcomes with TES versus usual care (Campbell et al., 2014). Effectiveness of the abstinence-focused CM intervention included in TES may be enhanced by tailoring delivery based on patients' drug use status at treatment entry.

Keywords

contingency management; incentive costs; baseline drug use; treatment tailoring

*Indicates Corresponding author Maxine Stitzer Ph.D., Johns Hopkins Bayview Medical Campus, 5510 Nathan Shock Drive, Baltimore, MD 21224., mstitzer@jhmi.edu, Phone: 1-410-550-0042.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1. Introduction

Contingency management (CM) is a highly efficacious intervention (Benishek et al., 2014; Lussier et al., 2006; Stitzer et al., 2006 for review) to promote abstinence in drug users but it is not widely implemented in usual care (McGovern et al., 2004; Willenbring et al., 2004; Benishek et al., 2010). One of the main concerns cited by practitioners is cost of the intervention. An interesting feature of CM is that cost is directly related to outcome. Specifically, in the case of a drug abstinence target based on submission of drug negative urine specimens, the more negative specimens submitted during treatment, the more money that will be earned by the patient and the higher the cost of CM to the clinic. This raises the question of whether the cost of CM could be reduced by targeting treatment on those who are most likely to benefit.

CM does not generally have differential efficacy in participant subgroups. For example, it has been shown to be efficacious among drug users with a variety of use profiles including outpatient substance users with primary cocaine (Higgins et al., 1991, 1994), alcohol (Petry et al., 2000), cannabis (Budney et al., 1991), and opioid-dependence (Robles et al., 2002; Silverman et al., 1996), as well as cigarette smokers (Shoptaw et al., 1996). CM has also been shown to be effective in drug users with a broad range of demographic and psychosocial characteristics including race (Barry et al., 2009), income level (Rash et al., 2009; Secades-Villa et al., 2012), psychiatric severity (Weinstock et al., 2007) and presence or absence of legal problems (Petry et al., 2011). However, efficacy may differ based on drug use severity (Stitzer et al., 1992; Kidorf et al., 1994; Silverman et al., 1998) as determined by self-report and behavioral characteristics that are apparent prior to CM implementation. In particular, the presence versus absence of active on-going drug use, as indicated by a drug positive (BL positive) versus negative (BL negative) urine test at treatment entry. In addition to being highly prognostic of overall treatment success (e.g. Alterman et al 1997; Ehrman et al., 2001), abstinence at treatment entry is a factor that may interact with abstinence incentive treatments.

Several studies have examined CM interventions in stimulant abusers testing positive versus negative for cocaine prior to the start of CM delivered in psychosocial outpatient treatment (Campbell et al., 2014; Higgins et al., 1994; Petry et al., 2004; Stitzer et al, 2007). While findings have been somewhat mixed across these studies, two large and well conducted studies (Campbell et al., 2014; Petry et al., 2004) found dramatic and significant effects of prize-draw CM on drug use only among individuals with evidence of on-going cocaine use at baseline (i.e. submitting drug positive urine samples) while participants who tested negative at baseline indicating abstinence from drug use, had good outcomes throughout that were not further improved by exposure to CM. In the recent large sample (n = 507) multi-site study, conducted within NIDA's National Drug Abuse Treatment Clinical Trials Network (CTN), beneficial effects of a web-based treatment (Therapeutic Education System; Bickel et al., 2008) that incorporates an abstinence incentive intervention were confined to participants with evidence of active drug use at study entry (i.e., BL positive for one or more drugs). Those with active drug use at study entry had more than twice the odds of abstinence at end of treatment compared with those receiving treatment as usual (Odds Ratio: 2.18, p =

003). In contrast, those who were drug negative at study entry had relatively high rates of drug abstinence throughout the study and showed no effect of TES compared with treatment as usual (Odds Ratio: 1.17, $p = .489$).

The large sample CTN study provided a unique opportunity to contrast the prize draw and prize win patterns, as well as costs associated with a CM intervention in drug users who begin treatment with and without biological evidence of active substance use (BL positive vs negative). Although increased voucher earnings naturally follow improved abstinence outcomes, the findings from this secondary analysis bring a unique perspective to the CM literature by quantifying and categorizing costs in relation to effects of the intervention on clinical outcomes. This is different from previous cost-effectiveness studies (Olmstead et al., 2007; Olmstead et al., 2009) that have documented the incremental cost of producing additional drug-negative urines during treatment with prize and voucher-based CM intervention, but related this only to the abstract question of how much society is willing to pay for the additional improvement in treatment outcome produced by a monetary-based CM intervention. Findings of the present analysis of cost versus clinical benefit have important implications for understanding optimal strategies for CM effectiveness and cost-benefit through tailored delivery of CM interventions based on initial drug use status of patients entering outpatient psychosocial counseling treatment.

2. Methods

Methods for the parent multi-site study, conducted at 10 community psychosocial counseling substance abuse treatment programs, have been previously described in detail (Campbell et al., 2012; 2014). Highlights are reiterated below.

2.1. Participants

The sample of treatment seeking substance users ($N = 507$) were age 18 or older; indicated by self-report that they had used any illicit substances including stimulants, opioids and marijuana in the 30 days before study entry (or within 60 days for those exiting a controlled environment); had entered the treatment episode within the past 30 days (randomization occurred on average 9.5 days [$SD=7.4$] after treatment entry); were planning to remain in the area and in the treatment program for at least 3 months; and were proficient in English. Excluded were those being treated with opioid replacement therapy (e.g., buprenorphine, methadone) or unable to provide informed consent. Participants could be polysubstance users but following administration of a self report TimeLine Follow-Back (TLFB; Sobell and Sobell, 1992) during baseline assessment, each was asked which substance they considered their biggest problem and/or the one for which they were seeking treatment. Primary drug of abuse was designated as alcohol, stimulants, marijuana or opioids (Campbell et al., 2013; Cochran et al., 2015)). Participants were also classified at baseline as to their current drug use status at study entry on the basis of urine toxicology and alcohol breath tests (active use = any drug positive; versus abstinent = no drug positive).

The sample used in the current analysis consisted of 255 participants who were randomized to receive the Therapeutic Education System (TES) as part of their outpatient treatment since only this treatment contained a CM component.

2.2 Study Design

The parent study used a 2-group randomized design in which a novel internet-delivered intervention, the Therapeutic Education System (TES), was substituted for roughly 2 hours of usual care counseling time per week for 12 weeks. Treatment outcomes were compared for participants receiving the TES substitution vs a full complement of treatment as usual (TAU) counseling. Participants were stratified for randomization based on the treatment site (N=10), their primary substance of abuse (dichotomized as stimulant versus non-stimulant), and whether or not they were abstinent at study entry.

2.3 Procedures

Participants reported to the clinic twice a week during the 12-week treatment phase for assessment, usual care counseling and study protocol participation. Self-report drug and alcohol use data were collected weekly using the TLFB calendar method (Sobell and Sobell, 1992) and urine was collected and screened for 10 drugs of abuse; cocaine, opiates (including morphine, codeine, and heroin), amphetamines, cannabinoids (THC), methamphetamines, benzodiazepines, oxycodone, methadone, barbiturates, and MDMA at each visit using standard lateral flow chromatographic immunoassays (QuickTox dip card). A breathalyzer test for blood-alcohol content was also administered at each visit. For purposes of contingent incentive delivery, participants were considered abstinent if the urine screen and breathalyzer was negative. Missing urine or breathalyzer samples were counted as positive for purposes of the CM intervention unless the absence was excused with prior staff notification.

Study Interventions—Usual care counseling provided to participants as well as the content of the 62 TES interactive multimedia cognitive-behavioral skills training modules based on the Community Reinforcement approach (Budney and Higgins, 1998) have been previously described (Campbell et al., 2014). Since the current analysis focused on the contingency management component of TES, these procedures are described in more detail.

TES included a flexible automated system for delivering contingency management according to the prize-based incentive system developed by Petry and colleagues (Petry et al., 2005; Stitzer et al., 2010). Prize draw opportunities based on negative urine test results and/or module completion were entered into the computer, which automatically determined the number of draws available according to the protocol. A ‘prize bowl’ was displayed on the screen and participants could see the results of their automated prize draws. Earning probabilities per draw were pre-determined according to the protocol. For the current study, 50% of the draws provided congratulatory messages (e.g., “Good job”) while the other half yielded prizes with probability inversely related to prize value. Specifically, 41.8% of all draws yielded a ‘small’ prize worth about \$1 (e.g., make-up, socks, restaurant gift certificates), 8% yielded a ‘large’ prize worth about \$20 (e.g., watches, clothing), and 0.2% yielded a ‘jumbo’ prize worth up to \$100 (e.g., TV, Playstation). Tangible prizes were stored on-site and available for immediate distribution when earned, or dollar value of the prize could be carried forward to redeem a more costly item at a later time.

Prize draws were earned for two clinically relevant treatment outcomes: abstinence and treatment participation. Prize draws were awarded under an escalating schedule for primary drug abstinence based on negative urine or breath alcohol screens for the primary substance of abuse previously designated for that participant. Under the escalating schedule, the number of draws increased each week the participant remained abstinent from 1 to a maximum of 12 draws. Participants earned two bonus draws each time they were negative for all substances of abuse. Finally, a bonus 'large' prize (about \$20) was earned the first time the participant achieved 2-weeks of consecutive abstinence from the primary drug of abuse. Positive or missing urine resulted in a reset back to the original 1 draw, from which escalation could then be resumed. With regard to treatment participation, one draw was awarded for each TES module completed up to the recommended four modules per week. A participant who remained abstinent from all substances and completed all recommended modules over the 12-week treatment phase could earn 204 draws for drug abstinence and 48 draws for module completion, which would result in an average of \$600 in prizes, including bonuses.

All draws earned were included in analysis. However, in order to better simulate real world costs, only prizes that were earned and redeemed during the 12-week treatment period were included in analysis. In absence of a paid follow-up research visit, few patients would be expected to return to redeem previously awarded prizes, nor would clinicians be likely to offer such an option. \$65,824 worth of prizes were redeemed during the 12-week treatment period with an additional \$4,832 (6.8% of total) redeemed after 12 weeks (e.g. at follow-up assessment visits) and \$550 (0.8% of total) worth of prizes never redeemed.

2.4 Measures and Statistical Analysis

The goal of the present study was to examine prize draw and prize win patterns as well as prize costs of CM in participants who met criteria for being drug and alcohol abstinent (BL negative) or not abstinent (BL positive) at study entry. Measures examined separately for drug abstinence and TES module completion were: 1) percent of participants earning any draws; 2) percent of participants earning at least \$1 in prizes; 3) percent of participants earning the two-week abstinence bonus; 4) total draws earned per participant; 5) total number of prizes redeemed per participant; 6) total value in dollars of all prizes redeemed by each participant. Dichotomous measures (#1, 2, and 3 above) were compared using Chi-Square tests; continuous measures (#4, 5 and 6) were compared using non-parametric, Kolmogorov-Smirnov tests that compare the observed distribution of values between two samples. Cost distribution results were also examined by site ($N = 10$) to assess consistency of findings across sites.

3. Results

3.1 CM Earnings for Drug Abstinence

Table 1 (top half) displays the statistical comparisons between BL positive and BL negative for contingencies based on drug abstinence. As expected, patients who were BL negative vs BL positive had substantially different outcomes on a range of CM-related measures. There were significant differences between the percentage of BL negative vs BL positive patients

that earned any draws (95% vs 78%, $X^2(1)=15.72$, $p<.0001$), redeemed at least \$1 in prizes (92% vs 75%, $X^2(1)=13.79$, $p<.001$), and redeemed a special 2-week abstinence bonus prize (85% vs 51%, $X^2(1)=32.91$, $p<.0001$). As shown in Figure 1 (top), the distribution of total draws earned for drug-abstinence differed markedly for BL negative (range = 0–211, median = 119 draws) vs BL positive (range = 0–205, median = 17 draws) participants (KSa (asymptotic Kolmogorov-Smirnov statistic) = 3.0, $p<.0001$). Participants who were drug negative at BL were more likely to earn large numbers of draws for drug-abstinence, including 19% who earned more than 200 draws (vs 3% of BL positive). Those who were positive at baseline for drugs or alcohol were more likely to reside at the lower earning end of the draw distribution; for example 22% (vs 5% of BL negative) earned no draws at all for drug-abstinence and over half (53%) of the BL positive participants earned 20 draws or less for drug-abstinence vs only 18% for BL negative participants.

The distributions for total number of prizes redeemed between BL negative (range = 0–116, median = 54) and BL positive (range = 0–104, median = 9) participants were also significantly different (KSa=2.72, $p<.0001$; Table 1) as shown in Figure 1 (bottom). As the number of prizes redeemed is directly related to the number of draws earned for drug-abstinence, the distributions are similar. BL negative were more likely to reside at the higher end of the prize earning distribution, while BL positive participants tended to earn relatively few prizes. For example, 24% BL positive participants vs 8% BL negative participants redeemed no prizes. In contrast, BL negative participants were more likely than BL positive to earn 70 or more prizes.

Lastly, the distributions for total prize value (\$) redeemed between BL negative (range = 0–658, median = \$237) and BL positive (range = 0–643, median = \$44) participants were significantly different (KSa=2.74, $p<.0001$; Table 1). The average total value (\$) of prizes redeemed for drug-abstinence (including the special 2-week abstinence ‘large’ prize) for BL negative participants was \$245 per participant and \$33,373 total, whereas BL positive participants earned \$125 per participant on average and \$14,899 total (Figure 2). If the prizes that were not redeemed during the 12-week treatment period are included, BL negative participants would have redeemed \$35,561 in prizes (mean = \$261 per participant), while BL positive participants would have redeemed \$16,109 worth of prizes (mean = \$135 per participant).

The earnings and cost distribution pattern across each of the 10 study sites was generally consistent with that for the collapsed sample. Median value of prizes redeemed was substantially larger for BL– vs BL+ participants in 9 of 10 sites with median earnings being 1.6 to 40 times greater in the BL negative participants. As shown in Table 2, proportion of total earnings distributed to BL negative participants ranged from 39% to 89% across sites with a mean across sites of 69% of the total earnings for abstinence distributed to BL negative participants. The variability in percent of abstinence prizes earned by BL negative participants is likely influenced by relative sample sizes as well as other factors that impacted outcomes of BL + vs BL – participants at any given study site.

3.2 CM Earnings for Module Completion

Table 1 (bottom half) displays the statistical comparisons between BL positive and BL negative for contingencies based on TES module completion. Virtually all BL negative and BL positive participants earned at least one draw for module completion (97% vs 95%, $X^2(1)=0.74$, $p=.39$); however, some separation of the BL negative and positive participants was seen in the percentage who redeemed at least one prize from module completion (94% vs 83%, $X^2(1)=7.75$, $p<.01$).

Total number of draws earned for module completion per participant for BL negative (range = 0–50, median = 42) vs BL positive (range = 0–58, median = 36) was significantly different ($KSa=1.71$, $p<.01$; Table 1). BL negative participants were more likely to complete close to the recommended number (48) of modules. Specifically, 54% of BL negative vs 36% of BL positive participants completed more than 40 modules.

The BL positive and negative groups differed also on number of prizes redeemed for module completion (BL negative range = 0–30, median = 17; BL positive range = 0–31, median = 15; $KSa=1.47$, $p<.03$; Table 1) and on total value of prizes redeemed for module completion (BL negative range = 0–258, median = \$65; BL positive range = 0–240, median = \$51; $KSa=1.43$, $p<.03$). Mean value of prizes redeemed for module completion was \$78 for BL negative versus \$59 for BL positive participants.

4. Discussion

The goal of this analysis was to examine prize earning costs of abstinence-based contingency management (CM) in relation to participants' pre-study enrollment drug use status (positive vs negative) and relate these to previously reported patterns of intervention effectiveness in a sample of polysubstance users entering psychosocial counseling treatment. There were substantial and significant differences between BL negative and BL positive participants in number of draws earned and dollar amount of prizes redeemed within the CM intervention. BL negative participants, who maintained high overall rates of drug-abstinence during treatment, earned twice as much in prizes on average compared to those BL positive, and thus accounted for two-thirds of the total prize money expenditure. Median prize value was even more discrepant with BL negative participants redeeming 5.4 times the amount compared to BL positive participants in the sample overall. These prize earning differentials reflect both differences in urine test results per se as well as differences in attendance and retention rates between the two patient sub-groups. Findings at individual clinic sites were generally consistent with the overall sample with 50% or more of total earnings distributed to baseline negative participants in 9 of 10 sites.

Importantly, among BL negative participants, abstinence rates at the end of treatment were not differentially improved by TES compared to TAU, both groups showing high rates of abstinence across the 12-week trial. In contrast, TES was effective in improving abstinence outcomes among BL positive participants ($OR=2.18$, $p=.003$) (Campbell et al., 2014). Thus, these data highlight a substantial discrepancy between abstinence incentive prize costs and overall intervention effectiveness.

Data on module completion earnings documents the financial consequences of including this component of the TES intervention, recognizing that payment for module completion would be an optional element of TES use in clinical settings. Since module earnings were independent of drug use, the two groups had equal opportunity to earn module draws. There was a relatively small but statistically significant difference in module completion with BL positive participants completing somewhat fewer modules than did BL negative on average. This difference may be a function of differential attendance and treatment retention (i.e. opportunity) rather than motivation to complete modules. The quantitative similarity in exposure to modules across the two subgroups suggests that CM was the primary component determining differential outcomes. However, it would be important to examine the independent effect of module completion and abstinence incentives as well as their interaction using a design (e.g., 2×2 design) in which the two TES components were presented independently as well as together. Such a study could also inform the question of whether it is worthwhile to incentivize module completion to achieve better outcomes.

Even though CM has clearly demonstrated efficacy, it is not widely implemented. When it is implemented, however, considerations of equity and fairness usually dictate that the same program should be offered to all patients. Cost of the intervention is routinely cited by clinicians as their most important concern. Thus, any strategy that reduces cost while retaining benefits could increase the adoption of CM. TES uses an automated program to keep track of CM schedules, draws, prizes, and prize redemption. Computerized delivery may in itself reduce cost and facilitate adoption by eliminating some of the specialized training and staffing required with manual operation. The present study suggests that further cost savings could potentially be gained through treatment tailoring by targeting clinically relevant patient subgroups- in this case, those who are actively using drugs at study entry- for whom the intervention is particularly effective. However, there could be clinical concerns about the potential for relapse should abstinence reinforcement be omitted for those who begin treatment having already stopped their drug use.

Petry and colleagues (Petry et al., 2012) approached this question by stratifying cocaine users entering treatment on baseline urine test results (positive vs negative) and examining outcomes for the BL negative subgroup when offered incentives of comparable magnitude for negative urines vs treatment attendance.. The study found no clear evidence for relapse. Those who received incentives for attendance rather than abstinence submitted a similar percentage of negative urines based on expected samples (59% vs 62% difference, not significant) and had similar longest durations of abstinence (5.3 vs 6.0 weeks during a 12 week study, not significant). A small but significantly lower percentage of negative urines was seen among samples that were actually submitted (84% vs 90%). Costs could be reduced by targeting abstinence incentives primarily to those who are likely to receive the most benefit (i.e., BL positive) and omitting or re-focusing (e.g. on attainment of other treatment goals) the CM intervention component for BL negative patients who are expected to do well in treatment without an abstinence-focused intervention. The Petry study supports the safety of doing this, although monitoring and clinical interventions would still be advisable to detect drug use slips or relapses in the BL negative group and respond accordingly, including the potential re-introduction of abstinence-based CM upon detection of use.

In considering the allocation of incentives, it is also important to remember that the higher the value of incentives that can be earned, the better the outcome that is likely to be observed (Lussier et al., 2006; Petry et al., 2004; 2012). It is notable (Fig. 1) that half the baseline positive participants still earned less than 20 draws during the study, indicating that they did not achieve any meaningful duration of abstinence despite the available incentives. Thus, an additional strategy for allocation of available funds may be to increase incentive magnitude for those who are BL positive and decrease magnitude for those who are BL negative.

The study was limited to patients entering one treatment modality - outpatient psychosocial counseling. There was differential retention, with participants who were BL negative being less likely to drop out (Campbell et al., 2014) and therefore contributing more to both outcome data and cost. However, this is an expected clinical reality. Conclusions drawn are also limited to the particular reinforcement schedule employed, and may not generalize to all possible reinforcement schedules. The cost data presented are averages obtained from a large sample of diverse patients being treated at ten different clinics. Specific costs and cost-to-benefit ratios are likely to vary across sites as well as across subgroups that differ on a variety of clinical characteristics besides BL drug use status (e.g. primary drug of abuse) that may influence outcome of a CM intervention. However, the principle would remain unchanged. This analysis was not a systematic cost analysis of implementing CM, as operational costs of delivering a CM intervention (e.g., personnel and drug testing supplies) were not considered. Inclusion of these costs would have altered the absolute cost amounts reported, but divided equally across participants, would not have altered the relative cost differential identified for the BL positive vs negative patient sub-groups.

There are also several strengths. First, this study was open to all patients entering outpatient psychosocial counseling treatment who had a variety of drug use problems and patterns, thus increasing the generalizability of findings. Use of computer-based CM supports fidelity of the intervention and total monetary value of prizes offered is in line with amounts used in previous effectiveness trials of abstinence incentives (e.g. Petry et al., 2005). Finally, the treatment tailoring strategy suggested is based on a clear outcome reported in the main study where those testing positive at baseline showed improved outcomes with TES versus TAU while those testing negative did not show improved drug use outcomes with TES.

5. Conclusions

The current results show that two-thirds of the expenditures for an abstinence incentive program were paid to individuals entering the study with a negative urine toxicology or breath alcohol test, a group whose outcomes were not significantly improved compared to standard treatment controls by exposure to an abstinence incentive intervention delivered as part of the computer-assisted Therapeutic Education System. These results are important because CM implementation is limited by perceived costs (McGovern et al., 2004; Willenbring et al., 2004; Benishek et al., 2010). These data suggest that the overall effectiveness of CM interventions may be improved by tailoring treatments based on early treatment drug use status. One approach, for example, would be to adjust reinforcement magnitude such that patients with active drug use could receive higher and those in remission lower magnitude incentives. The construct of treatment algorithms should be

considered to guide incentive targets and magnitude based on important patient characteristics including baseline drug use status.

Acknowledgements

Research was supported by the following NIH grants: U10 DA013034 (Maxine Stitzer; Robert Schwartz); T32 DA07209 (George Bigelow); U10 DA013035 (Edward Nunes; John Rotrosen); K24DA022412 (Edward Nunes).

Abbreviations

BL	baseline
CM	contingency management
TAU	treatment as usual
TES	Therapeutic Education System

References

- Alterman AI, Kampman K, Boardman CR, Cacciola JS, Rutherford MJ, McKay JR, Maany I. A cocaine-positive baseline urine predicts outpatient treatment attrition and failure to attain initial abstinence. *Drug and Alcohol Dependence*. 1997; 46(1–2):79–85. [PubMed: 9246555]
- Barry D, Sullivan B, Petry NM. Comparable efficacy of contingency management for cocaine dependence among African American, Hispanic, and White methadone maintenance clients. *Psychology of Addictive Behaviors*. 2009; 23(1):168–174. [PubMed: 19290703]
- Benishek LA, Dugosh KL, Kirby KC, Matejkowski J, Clements NT, Seymour BL, Festinger DS. Prize-based contingency management for the treatment of substance abusers: a meta-analysis. *Addiction*. 2014; 109:1426–1436. [PubMed: 24750232]
- Benishek LA, Kirby KC, Dugosh KL, Padovano A. Beliefs about the empirical support of drug abuse treatment interventions: a survey of outpatient treatment providers. *Drug and Alcohol Dependence*. 2010; 107(2–3):202–208. [PubMed: 19959299]
- Bickel WK, Marsch LA, Buchhalter AR, Badger GJ. Computerized behavior therapy for opioid-dependent outpatients: a randomized controlled trial. *Exp Clin Psychopharmacol*. 2008; 16:132–143. [PubMed: 18489017]
- Budney AJ, Higgins ST, Delaney DD, Kent L, Bickel WK. Contingent reinforcement of abstinence with individuals abusing cocaine and marijuana. *Journal of Applied Behavioral Analytics*. 1991; 24(4):657–665.
- Budney, A.; Higgins, S. *Therapy manuals for drug addiction, a community reinforcement plus vouchers approach: Treating cocaine addiction*. Rockville, MD: National Institute on Drug Abuse; 1998.
- Campbell AN, Nunes EV, McClure EA, Hu MC, Turrigiano E, Goldman B, Stabile PQ. Characteristics of an outpatient treatment sample by primary substance of abuse. *Journal of Addiction Medicine*. 2013; 7(5):363–371. [PubMed: 24089040]
- Campbell AN, Nunes EV, Miele GM, Matthews A, Polsky D, Ghitza UE, Turrigiano E, Bailey GL, VanVeldhuisen P, Chapdelaine R, Froias A, Stitzer ML, Carroll KM, Winhusen T, Clingerman S, Perez L, McClure E, Goldman B, Crowell AR. Design and methodological considerations of an effectiveness trial of a computer-assisted intervention: an example from the NIDA Clinical Trials Network. *Contemporary Clinical Trials*. 2012; 33(3):386–395. [PubMed: 22085803]
- Campbell AN, Nunes EV, Matthews AG, Stitzer M, Miele GM, Polsky D, Turrigiano E, Walters S, McClure EA, Kyle TL, Wahle A, Van Veldhuisen P, Goldman B, Babcock D, Stabile PQ, Winhusen T, Ghitza UE. Internet-delivered treatment for substance abuse: a multisite randomized controlled trial. *American Journal of Psychiatry*. 2014; 171(6):683–690. [PubMed: 24700332]

- Cochran G, Stitzer M, Campbell AN, Hu MC, Vandrey R, Nunes EV. Web-based treatment for substance use disorders; Differential effects by primary substance. *Addictive Behaviors*. 2015; 45:191–194. [PubMed: 25697725]
- Ehrman RN, Robbins SJ, Cornish JW. Results of a baseline urine test predict levels of cocaine use during treatment. *Drug and Alcohol Dependence*. 2001; 62(1):1–7. [PubMed: 11173162]
- Higgins ST, Delaney DD, Budney AJ, Bickel WK, Hughes JR, Foerg F, Fenwick JW. A behavioral approach to achieving initial cocaine abstinence. *American Journal of Psychiatry*. 1991; 148(9): 1218–1224. [PubMed: 1883001]
- Higgins ST, Budney AJ, Bickel WK, Foerg FE, Donham R, Badger GJ. Incentives improve outcome in outpatient behavioral treatment of cocaine dependence. *Archives of General Psychiatry*. 1994; 51(7):568–576. [PubMed: 8031230]
- Kidorf M, Stitzer ML, Brooner RK, Goldber J. Contingent methadone take-home doses reinforce adjunct therapy attendance of methadone maintenance patients. *Drug and Alcohol Dependence*. 1994; 36(3):221–226. [PubMed: 7889813]
- Lussier JP, Heil SH, Mongeon JA, Badger GJ, Higgins ST. A meta-analysis of voucher-based reinforcement therapy for substance use disorders. *Addiction*. 2006; 101(2):192–203. [PubMed: 16445548]
- McGovern MP, Fox TS, Xie H, Drake RE. A survey of clinical practices and readiness to adopt evidence-based practices: Dissemination research in an addiction treatment system. *Journal of Substance Abuse Treatment*. 2004; 26(4):305–312. [PubMed: 15182895]
- Olmstead TA, Petry NM. The cost-effectiveness of prize-based and voucher-based contingency management in a population of cocaine- or opioid-dependent outpatients. *Drug and Alcohol Dependence*. 2009; 102(1–3):108–115. [PubMed: 19324501]
- Olmstead TA, Sindelar JL, Petry NM. Clinic variation in the cost-effectiveness of contingency management. *American Journal of Addictions*. 2007; 16(6):457–460.
- Petry NM, Martin B, Cooney JL, Kranzler HR. Give them prizes, and they will come: contingency management for treatment of alcohol dependence. *Journal of Consulting and Clinical Psychology*. 2000; 68(2):250–257. [PubMed: 10780125]
- 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, with whom? *Addiction*. 2004; 99(3): 349–360. [PubMed: 14982548]
- Petry NM, Peirce JM, Stitzer ML, Blaine J, Roll JM, Cohen A, Obert J, Killeen T, Saladin ME, Cowell M, Kirby KC, Sterling R, Royer-Malvestuto C, Hamilton J, Booth RE, Macdonald M, Liebert M, Rader L, Burns R, DiMaria J, Copersino M, Stabile PQ, Kolodner K, Li R. Effect of prize-based incentives on outcomes in stimulant abusers in outpatient psychosocial treatment programs: A National Drug Abuse Treatment Clinical Trials Network study. *Archives of General Psychiatry*. 2005; 62:1148–1156.
- Petry NM, Rash CJ, Easton CJ. Contingency management treatment in substance abusers with and without legal problems. *Journal of the American Academy of Psychiatry and the Law*. 2011; 39(3): 370–378. [PubMed: 21908754]
- Petry NM, Barry D, Alessi SM, Rounsaville BJ, Carroll KM. A randomized trial adapting contingency management targets based on initial abstinence status of cocaine-dependent patients. *Journal of Consulting and Clinical Psychology*. 2012; 80(2):276–285. [PubMed: 22229758]
- Rash CJ, Olmstead TA, Petry NM. Income does not affect response to contingency management treatments among community substance abuse treatment-seekers. *Drug and Alcohol Dependence*. 2009; 104(3):249–253. [PubMed: 19586727]
- Robles E, Stitzer ML, Strain EC, Bigelow GE, Silverman K. Voucher-based reinforcement of opiate abstinence during methadone detoxification. *Drug and Alcohol Dependence*. 2002; 65(2):179–189. [PubMed: 11772479]
- Secades-Villa R, Garcia-Fernandez G, Pena-Suarez E, Garcia-Rodriguez O, Sanchez-Hervas S, Fernandez-Hermida JR. Contingency management is effective across cocaine-dependent outpatients with different socioeconomic status. *Journal of Substance Abuse Treatment*. 2012; 44(3):349–354. [PubMed: 22999380]

- Shoptaw S, Jarvik ME, Ling W, Rawson RA. Contingency management for tobacco smoking in methadone-maintained opiate addicts. *Addictive Behaviors*. 1996; 21(3):409–412. [PubMed: 8883490]
- Silverman K, Wong CJ, Higgins ST, Brooner RK, Montoya ID, Contoreggi C, Umbricht-Schneiter A, Schuster CR, Preston KL. Increasing opiate abstinence through voucher-based reinforcement therapy. *Drug and Alcohol Dependence*. 1996; 41(2):157–165. [PubMed: 8809505]
- Silverman K, Wong CJ, Umbricht-Schneiter A, Montoya ID, Schuster CR, Preston KL. Broad beneficial effects of cocaine abstinence reinforcement among methadone patients. *Journal of Consulting and Clinical Psychology*. 1998; 66(5):811–824. [PubMed: 9803700]
- Sobell, LC.; Sobell, MB. Timeline followback: A technique for assessing self-reported alcohol consumption. In: Litten, RZ.; Allen, J., editors. *Measuring alcohol consumption: Psychosocial and biological methods*. New Jersey: Humana Press; 1992. p. 41-72.
- Stitzer ML, Iguchi MY, Felch LJ. Contingent take-home incentive: effects on drug use of methadone maintenance patients. *Journal of Consulting and Clinical Psychology*. 1992; 60(6):927–934. [PubMed: 1460154]
- Stitzer M, Petry N. Contingency management for treatment of substance abuse. *Annual Review of Clinical Psychology*. 2006; 2:411–434.
- Stitzer ML, Peirce J, Petry NM, Kirby K, Roll J, Krasnansky J, Cohen A, Blaine J, Vandrey R, Kolodner K, Li R. Abstinence-based incentives in methadone maintenance: interaction with intake stimulant test results. *Experimental and Clinical Psychopharmacology*. 2007; 15(4):344–350. [PubMed: 17696681]
- Stitzer ML, Petry NM, Peirce JM. Motivational incentives research in the National Drug Abuse Treatment Clinical Trials Network. *Journal of Substance Abuse Treatment*. 2010; 38(S1):S61–S69. [PubMed: 20307797]
- Weinstock J, Alessi SM, Petry NM. Regardless of psychiatric severity the addition of contingency management to standard treatment improves retention and drug use outcomes. *Drug and Alcohol Dependence*. 2007; 87(2–3):288–296. [PubMed: 17005329]
- Willenbring ML, Hagedorn HJ, Postier AC, Kenny M. Variations in evidence-based clinical practices in nine United States Veterans Administration opioid agonist therapy clinics. *Drug and Alcohol Dependence*. 2004; 75(1):97–106. [PubMed: 15225893]

Highlights

- We provide a perspective on the cost of abstinence incentives for SUD
- Substance abusers enter treatment with (BL+) or without (BL-) on-going drug use
- BL- earn twice as much money as BL+ due to providing more negative UA's
- But only in BL+ were outcomes improved by participation in the incentive program
- Costs may be reduced while benefits are retained by offering incentives only to BL+

Figure 1.

Distribution of the total number of drug abstinent draws earned by each participant (top panel) and total number of prizes (bottom panel) redeemed by each participant. Data are shown separately for participants who tested positive (grey) versus negative (black) for ten drugs and alcohol at pre-study baseline.

Figure 2.

Average value of prizes redeemed per-person for drug-abstinence in dollars ($\pm$ SEM) for participants who tested positive (grey) versus negative (black) for drugs and alcohol at pre-study baseline.

Table 1

Statistical comparisons of contingency management values for BL positive vs BL negative participants (N=255)

	BL positive (N=119)	BL negative (N=136)	Test Statistic	p-value
Drug Abstinence				
% with any draws	78% (n=93)	95% (n=129)	$\chi^2(1)=15.72$	<.0001
% with any prizes redeemed by the end of treatment	75% (n=89)	92% (n=125)	$\chi^2(1)=13.79$	<.001
% with 2-week bonus redeemed by the end of treatment	51% (n=61)	85% (n=115)	$\chi^2(1)=32.91$	<.0001
Total number draws per person	Range=0–205, Median=17	Range=0–211, Median=119	KSa=3.0	<.0001
Total number prizes redeemed <85 days per person	Range=0–104, Median=9	Range=0–116, Median=54	KSa=2.72	<.0001
Total prize value (\$) redeemed<85 days per person	Range=0–643, Median=44	Range=0–658, Median=237	KSa=2.74	<.0001
Module completion				
% with any draws	95% (n=113)	97% (n=132)	$\chi^2(1)=0.74$	.39
% with any prizes by the end of treatment	83% (n=99)	94% (n=128)	$\chi^2(1)=7.75$	<.01
Total number draws per person	Range=0–58, Median=36	Range=0–50, Median=42	KSa=1.71	<.01
Total number prizes redeemed <85 days per person	Range=0–31, Median=15	Range=0–30, Median=17	KSa=1.47	.03
Total prize value (\$) redeemed <85 days per person	Range=0–240, Median=51	Range=0–258, Median=65	KSa=1.44	.03

KSa=Kolmogorov-Smirnov non-parametric two-sample test

Table 2

Sample size, median and range of value of prizes for abstinence redeemed by BL+ vs BL−, total value of prizes earned and redeemed for drug abstinence, and percentage of prizes earned for drug abstinence by BL− participants.

Site	Total Sample	BL +	BL −	Total Value (\$) prizes redeemed (abstinence)	% value (\$) prizes redeemed BL− (abstinence)
	N	N	N	Sum	%
1	26	14	12	3,245	57
2	26	10	16	7,640	78
3	29	6	23	7,495	89
4	19	10	9	2,889	59
5	23	10	13	3,517	64
6	28	6	22	7,049	89
7	27	18	9	5,534	39
8	25	13	12	2,995	52
9	27	14	13	5,268	66
10	25	18	7	2,640	55
TOTAL SAMPLE	255	119	136	48,272	69