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# Contingency management abstinence incentives: Cost and implications for treatment tailoring

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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 over 12-weeks 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 positive 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.



## 1. Introduction

Contingency management (CM) is a highly efficacious intervention (Benishek et al., 2014; Lussier et al., 2006; Stitzer and Petry, 2006 for review) to promote abstinence in drug users but it is not widely implemented in usual care (Benishek et al., 2010; McGovern et al., 2004; Willenbring et al., 2004). 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., 1994, 1991), 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 (Kidorf et al., 1994; Silverman et al., 1998; Stitzer et al., 1992) 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.

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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 and Petry, 2009; Olmstead et al., 2007) 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., 2014, 2012). 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.

### 2.4. 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) has 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

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