Drug and Alcohol Dependence xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Short communication

Prize contingency management for smoking cessation: A randomized trial☆

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ARTICLE INFO

Article history:
Received 30 October 2013
Received in revised form 27 March 2014
Accepted 27 March 2014
Available online xxx

Keywords:
Prize
Contingency management
Cigarette
Tobacco
Treatment efficacy

ABSTRACT

Background: Adjunctive behavioral smoking cessation treatments have the potential to improve outcomes beyond standard care. The present study had two aims: (1) compare standard care (SC) for smoking (four weeks of brief counseling and monitoring) to SC plus prize-based contingency management (CM), involving the chance to earn prizes on days with demonstrated smoking abstinence (carbon monoxide (CO) ≤6 ppm); and (2) compare the relative efficacy of two prize reinforcement schedules—one a traditional CM schedule, and the second an early enhanced CM schedule providing greater reinforcement magnitude in the initial week of treatment but equal overall reinforcement.
Methods: Participants (N = 81 nicotine-dependent cigarette smokers) were randomly assigned to one of the three conditions.
Results: Prize CM resulted in significant reductions in cigarette smoking relative to SC. These reductions were not apparent at follow-up. We found no meaningful differences between the traditional and enhanced CM conditions.
Conclusions: Our findings reveal that prize CM leads to significant reductions in smoking during treatment relative to a control intervention, but the benefits did not extend long-term.

1. Introduction

Cigarette smoking results in 1 of every 5 deaths and in extraordinary economic costs (Centers for Disease Control and Prevention, 2008). Contingency management (CM) has demonstrated efficacy for treating substance use disorders (Dutra et al., 2008; Prendergast et al., 2006), including smoking (Ledgerwood, 2008). However, CM can be costly, with reinforcement exceeding $1000 (Higgins et al., 2004; Lamb et al., 2004). Petry et al. (2000, 2012) developed a prize reinforcement program lower-cost by design, with demonstrated efficacy with cocaine, opioid, alcohol and poly-substance-dependent patients. To date, one small, non-randomized pilot has examined prize CM for smoking among substance abuse patients, with prize CM engendering greater proportions of negative CO tests than standard care (Alessi et al., 2008). The present study examines the efficacy of Prize CM for smoking in a randomized trial.

A second purpose is to evaluate a scheduled increase in reinforcement magnitude early in treatment. Reinforcement magnitude is a parameter that can increase treatment response (Petry et al., 2004) and may thereby increase long-term abstinence (Kenford et al., 1994; Higgins et al., 2006), but this has not yet been examined in a randomized clinical trial of treatment-seeking smokers.

The two aims of the present study are: assess the efficacy of prize-based CM for cigarette smoking; and compare a traditional versus early-treatment enhanced reinforcement schedule.

2. Methods

2.1. Participants

Participants were nicotine-dependent smokers (N = 81) who responded to advertisements in local newspapers, bulletin boards and at health fairs, and broadcast messages to staff of a large health center and university. Inclusion criteria were: Fagerström Test of Nicotine Dependence (Heatherton et al., 1991) score ≥4; age ≥18; and English literacy. Exclusion criteria were: uncontrolled psychiatric disorders (acute suicidality, psychosis); current substance dependence excluding nicotine or caffeine; in

☆ Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:...

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http://dx.doi.org/10.1016/j.drugalcdep.2014.03.032
0376-8716/

recovery for pathological gambling; or already receiving smoking treatment. Recruitment occurred December, 2007 to January, 2011.

2.2. Procedures

Individuals were screened for eligibility and scheduled for intake if appropriate. During intake, written informed consent and self-report assessments and CO and urine cotinine tests were completed.

After intake, participants attended the clinic twice daily (separated by 5+ hours) Monday–Friday for 5 weeks. Unexcused absences were considered positive CO readings; excused absences (e.g., family emergency) were without consequences. Follow-up assessments occurred 2- and 6-months after starting treatment, with $20 compensation per follow-up.

2.3. Measures

2.3.1 Demographic. Demographic data were collected at intake. A brief screen of suicidality, psychosis and substance abuse was adapted using the Structured Clinical Interview for the DSM-IV-TR (First et al., 2002) to assess *inclusion/exclusion*. Pathological gambling was assessed using the NORC-DSM Screen (Gerstein et al., 1999).

2.3.2 Smoking history. Smoking history included ages first smoked and smoked daily, and cigarettes smoked daily.

2.3.3 Fagerström test for nicotine dependence. Fagerström test for nicotine dependence questionnaire assessed nicotine dependence (Fagerstrom, 1978).

2.3.4 Expired carbon monoxide (CO). Expired carbon monoxide (CO) levels were assessed at intake, twice daily during baseline and treatment, and at follow-ups using an EC50-MP Micro CO monitor (Bedfont). Levels ≤6 ppm were considered smoking-negative for reinforcement purposes, consistent with other studies (range: 4–8 ppm; Corby et al., 2000; Lamb et al., 2004).

2.3.5 Urinary cotinine. Urinary cotinine samples were collected at intake, Mondays weeks 2–5, and follow-ups, and tested using the Accutest® NicAlert™ test-strip system (JANT Pharmacal Corporation, Encino, CA). During treatment weeks 2–4, cotinine samples served as a measure of weekend smoking abstinence (≤100 ng/mL) to establish CM bonus draws.

2.4. Baseline

All participants received $1 per sample, independent of results, with a $20 bonus for submitting all 10 samples, to motivate compliance. Submitting ≥5 samples was required for randomization, or else individuals were discontinued and referred for treatment elsewhere.

The baseline phase allowed for assessment of smoking pretreatment and time to prepare to quit. On the last baseline visit, participants met with a research therapist to review a smoking cessation self-help quit guide to prepare to quit (U.S. Public Health Service, June 2000). Based on standards of care (Fiore et al., 2008), the materials emphasize motivation, social support and behavioral skills to help reduce smoking.

Random assignment to one of the three treatment conditions and stratification by gender and any CO ≤6 ppm during baseline (none or ≥1) occurred on treatment day 1 (quit date). Statistician-prepared sequentially numbered randomization envelopes concealed group assignments until assigned. Randomization to CM conditions and standard treatment occurred at a 2:1 ratio to ensure adequate power to compare the two CM conditions.

2.5. Treatments

2.5.1. Standard care (SC). Standard care (SC; weeks 2–5) involved monitoring CO and cotinine, and brief counseling (Fiore et al., 2008). Participants received $1/sample regardless of test results and a $20 weekly bonus for submitting all samples (maximum $120). During each session, the therapist provided immediate feedback about CO/cotinine test results, briefly (≈5 min) discussed recent smoking/abstinence, and praised quit efforts.

2.5.2. Traditional prize CM (TCM). In addition to SC, TCM patients earned chances to win prizes for negative CO and cotinine samples (similar to Petry and Martin, 2002; Petry et al., 2000), with no compensation for compliance with only submitting samples.

On treatment day 1, participants drew for a prize if CO was reduced at least 3 ppm from his/her intake level. Subsequently, draws were contingent on CO reading ≤6 ppm. Draws from the prize urn increased by 1 (up to 5) on each consecutive day when both daily CO tests met criterion. CO levels >6 ppm, refusal to submit a sample, or unexcused absences reset draws to one for the next negative sample.

The TCM prize urn contained 250 slips of paper, with typical prize percentages (e.g., Petry and Martin, 2002); 50% (125) did not result in prizes, 44.8% were Small (worth about $1, e.g., snacks, toiletries); 4.8% were Large (worth about $20, e.g., gift certificates, electronics); and 0.4% were Jumbo (worth $100, e.g., DVD players, gift certificates).

To reinforce weekend abstinence, each cotinine sample ≤100 ng/ml on Mondays resulted in five bonus draws in weeks 3–5. Overall, 180 draws and 15 bonus draws were possible for CO- and cotinine-negative tests, respectively.

2.5.3. Early-treatment enhanced prize reinforcement (ECM). ECM participants received SC, CO and cotinine monitoring and reinforcement criteria, described above. Draws available and reinforcement criteria were identical to TCM, but the chance of receiving reinforcement early in treatment was scheduled to be enhanced by providing guaranteed prizes (100% probability, versus 50% chance in TCM) for negative CO tests during treatment week 1.

During week 1, the ECM urn included 91.2% Small, 8% Large and 0.8% Jumbo prizes. For the remaining three weeks, an urn with 65.8% slips resulting in no prize, and 30% Small, 4% Large and 0.2% Jumbo prizes was used. Draws for cotinine-negative tests were made from the urn with 100% winning slips, for the same overall reinforcement magnitude in both CM conditions.

2.6. Analysis

We employed an intent-to-treat approach, including all participants who entered the treatment phase. Analyses compared combined CM conditions versus SC, and TCM versus ECM. Chi-square and *t*-tests were used to analyze baseline characteristics.

Outcomes were average CO, longest duration of smoking abstinence (days; LDA), and percent CO tests <4 ppm. The CO criterion for reinforcement was ≤6 ppm to maximize opportunities for reinforcement, but CO <4 ppm was used for analysis to ensure conservative reporting of findings. A day of abstinence was defined as two consecutive CO tests <4 ppm. If sessions encompassed a weekend, the participant was considered abstinent for three consecutive days if tests

Please cite this article in press as: Ledgerwood, D.M., et al., Prize contingency management for smoking cessation: A randomized trial. Drug Alcohol Depend. (2014), http://dx.doi.org/10.1016/j.drugalcdep.2014.03.032