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Contingency management for smoking cessation among treatment-seeking patients in a community setting

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ABSTRACT

Background: Contingency management (CM) is an efficacious intervention for reducing cigarette smoking. However, CM is rarely adopted as a smoking cessation treatment in the community. This study analyzed the effectiveness of a CM procedure in combination with a cognitive-behavioral treatment (CBT) for smoking cessation among treatment-seeking patients from the general population.
Methods: A total of 92 patients were randomly assigned to one of two treatment conditions: CBT ($N = 49$) or CBT + CM ($N = 43$). The CM procedure included a voucher program through which nicotine abstinence was reinforced on a schedule of escalating magnitude of reinforcement with a reset contingency. Self-reported smoking status was confirmed with both carbon monoxide (CO) level in expired air and cotinine levels in urine.
Results: Of the patients who received CBT + CM 97.7%, completed 6 weeks of treatment, versus 81.6% of those who received CBT ($p = .03$). At the post-treatment assessment, 95.3% of the patients assigned to the CBT + CM condition achieved abstinence in comparison to the 59.2% in the CBT group ($p = .000$). At the one-month follow-up, 72.1% of the patients who received CBT + CM maintained smoking abstinence, versus 34.7% in the CBT group ($p = .001$). At the six-month follow-up, 51.2% of the patients who received CBT + CM maintained smoking abstinence in comparison to the 28.6% in the CBT group ($p = .04$).
Conclusions: Results from this randomized clinical trial showed that adding CM to a CBT is effective, and is feasible as an intervention approach with treatment-seeking patients in a community setting.

1. Introduction

Tobacco smoking is the leading preventable cause of premature death worldwide (World Health Organization, 2012), and the societal costs in terms of smoking-attributable productivity losses and smoking-related health care are substantial (WHO and Guidon, 2006). Despite the many therapies available for smoking cessation (Fiore et al., 2008), additional efficacious interventions are sorely needed (Sigmon and Patrick, 2012), since many quit attempts are unsuccessful (Rafful et al., 2013), and a high percentage of patients relapse within the months following a quit attempt (Fiore et al., 2008; García-Rodríguez et al., 2013).

Contingency management (CM) is an empirically-supported behavioral treatment with demonstrated effectiveness across a wide range of drugs and in diverse types of population (Knapp et al., 2007; Lussier et al., 2006; Prendergast et al., 2006; Stitzer and Petry, 2006). This approach typically involves financial incentives delivered contingent upon the patient meeting a predetermined therapeutic target (usually abstinence from drug use; Higgins et al., 2008; Sigmon and Patrick, 2012). CM has shown itself to be successful in reducing tobacco use in both non-treatment-seeking and complacent smokers (Alessi et al., 2004; Heil et al., 2003; Lamb et al., 2007; Roll and Higgins, 2000) and in treatment-seeking adults (Dallery et al., 2007; Lamb et al., 2004, 2010). CM is also an efficacious intervention for special populations, such as young smokers (Cavallo et al., 2010; Correia and Benson, 2006; Krishnan-Sarin et al., 2006), pregnant and post-partum smokers (Donatelle et al., 2000; Higgins et al., 2004, 2012) or substance dependent populations (Dunn et al., 2010; Robles et al., 2005; Shoptaw et al., 1996; Wiseman et al., 2005).

However, previous CM studies in general population have tended to be aimed at assessing feasibility or exploring various experimental issues other than smoking cessation per se, and the

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scarce work that has evaluated the efficacy of CM in promoting smoking cessation has been carried out in special populations of smokers. Barriers to their widespread adoption include their perceived cost, complexity and staff burden (Ledgerwood, 2008). In naturalistic settings, the use of financial incentives has generally been limited to organizations-based settings using "captive" study participants (Cahill and Perera, 2011), such as Veterans hospital clinics (Volpp et al., 2006), methadone clinics (Dunn et al., 2008, 2009, 2010; Shoptaw et al., 1996), schools (Correia and Benson, 2006; Krishnan-Sarin et al., 2006, 2013) or workplace contexts (Volpp et al., 2009). Community clinics have been used to a lesser extent. While using a organizational approach has the potential to reach many smokers, not all smokers are part of an organization large enough to warrant a full-scale CM program (Ledgerwood, 2008). In addition, these studies have generally involved non-treatment-seeking smokers and frequent study visits (between 1 and 3 visits per day), since abstinence reinforcement procedures require frequent objective evidence of smoking status. These procedures may be too burdensome and infrequent for clinical practice and for effective implementation in an outpatient clinic. Although requiring patients to make visits to the clinic on a daily basis may be more practical and rigorous, this requirement represents a substantial cost response for most patients, and this may limit the access to the treatment and its success. Also, because most clinics are only open on working days, such visits can occur only five days a week (Dallery and Raiff, 2011).

To our knowledge, no published studies have examined the effectiveness of using a CM-based intervention in promoting smoking cessation with treatment-seeking smokers from the general population, without other special characteristics or comorbid conditions.

The present study aims to address these gaps in the literature. Given the preliminary evidence supporting the utility of cognitive behavioral therapy (CBT) in reducing tobacco use (Killen et al., 2008; McDonald et al., 2003; Webb et al., 2010), we sought to develop an efficacious approach that combined CM with group-based CBT. The main goal of this randomized controlled trial was to analyze whether adding a CM protocol to CBT intervention would significantly increase rates of program completion and smoking cessation among treatment-seeking patients in a community setting.

2. Methods

2.1. Participants

This study was conducted at the Addictive Behaviors Clinic of the University of Oviedo (Spain). Participants were treatment-seeking smokers from the general population, recruited through advertisements in the local media and flyers posted in the community and by word of mouth. Inclusion criteria were age over 18, meeting the diagnostic criteria for nicotine dependence according to the Diagnostic and Statistical Manual of Mental Disorders (fourth ed., text rev.; DSM–IV–TR; American Psychiatric Association, 2000) as assessed using the Structured Clinical Interview for DSM-IV (SCID), and having smoked 10 or more cigarettes per day for the previous 12 months. Objective verification of smoking status was also required. We excluded patients who presented a severe psychiatric disorder (including substance use disorder) or who were receiving any other smoking cessation treatment, such as pharmacotherapy.

Participants provided informed consent, and the procedures followed were in accordance with the ethical standards of our institution. Fig. 1 shows the flow of participants through the enrollment, treatment, post-treatment and one-month follow-up phases. Of a total of 103 people screened, 92 (35.9% men and 64.1% women) met the inclusion criteria and were enrolled in the study. The mean age was 45.8 years (SD = 12.1), mean number of cigarettes smoked per day at intake was 21.7 (SD = 8.7), and mean score on the Fagerström Dependence Test was 5.7 (SD = 1.8).

Eligible participants were randomly assigned to a CBT group ($n = 49$) or a CBT plus CM group ($n = 43$), in accordance with a computer-generated randomization list. Patients' baseline characteristics in each of the experimental groups are shown in Table 1. There were no significant differences ($p < .05$) in baseline characteristics between the two groups.

Table 1
Sample characteristics.

	CBT ($n = 49$)	CBT + CM ($n = 43$)	p value
Age (years)[a]	46.9 ± 12.3	44.4 ± 11.9	.92
Gender (% women)	59.2	69.8	.40
Years of education[a]	12.1	12.6	.35
Employed full time (%)	35.4	55.8	.08
Previous quit attempts[a]	2.47 ± 2.1	2.21 ± 2.4	.77
Cigarettes per day[a]	21.8 ± 8.14	21.6 ± 9.01	.49
Age first used tobacco[a]	15.7 ± 2.4	14.8 ± 2.5	.69
Years of smoking[a]	26.7 ± 12.0	25.2 ± 11.6	.50
CO (ppm)[a]	15.9 ± 7.4	14.7 ± 6.2	.18
Cotinine (ng/ml)[a]	2170.02 ± 1101.75	2203.92 ± 1226.85	.89
Fagerström Test[a]	5.7 ± 1.8	5.6 ± 1.8	.74

CBT = cognitive-behavioral treatment; CM = contingency management; CO (ppm) = carbon monoxide (parts per million); ng/ml = nanograms per milliliter.
[a] Means ± SD.

2.2. Assessment

During the intake session, which lasted for approximately 90 min, participants filled out a clinical history form to provide data on sociodemographic and smoking-related characteristics. The Fagerström Dependence Test (Heatherton et al., 1991) was used to assess nicotine dependence, in addition to the DSM-IV-TR criteria. Participants also provided a baseline CO sample in expired air using a Micro Smokerlyzer (Bedfont Scientific Ltd., Rochester, UK) for objective verification of self-reported smoking status. A BS-120 fully-automated and computer-controlled chemistry analyzer (Shenzhen Mindray Bio-medical Electronics, Co., Ltd., Shenzhen, PR China) designed for in vitro determination of clinical chemistries was used to determine quantitative urine cotinine levels through a homogeneous enzyme immunoassay system. All cotinine specimens were obtained under direct supervision by a same-gender staff member, and measured immediately.

2.3. Treatment interventions

Therapists were members of the staff at the institution, all masters-level psychologists with previous intensive training in the specific protocols. Each therapist practiced with two or three training cases before treating any study participant. To ensure the therapist's adherence to the protocols and competence in implementing the techniques, all sessions were audio-recorded and there was a 1-h weekly supervision session throughout the entire treatment program. Table 2 shows a detailed description of the treatment interventions by session.

2.3.1. CBT. This consisted of an intervention based on previous studies (Becona and Vazquez, 1997; Secades-Villa et al., 2009), implemented in group-based sessions of five or six patients. Each session took about 1 h, and sessions were carried out once a week over a six-week period. The main component of the CBT program was nicotine fading. From the first to the fourth week, patients are asked to gradually reduce their nicotine intake, and they have an individualized pattern of nicotine intake for each week based on a weekly reduction of 30%. To achieve this objective, a maximum number of cigarettes per day and also specific cigarette brands with lower nicotine levels are recommended. From the fifth week onwards, abstinence is required. Other components of the CBT program included: information about tobacco, a behavioral contract through which the patients pledged to attend the sessions and quit smoking, self-monitoring and graphical representation of cigarette smoking, stimulus control, strategies for controlling nicotine withdrawal symptoms, physiological feedback (measured by CO and cotinine), training in alternative behaviors, social reinforcement of objectives completion and abstinence, and relapse prevention strategies.

CO and cotinine specimens were collected twice a week. One of the measures coincided with the weekly CBT session and the other was scheduled midweek between sessions. A total of eleven samples were collected for each participant during the treatment. Participants were informed of their CO level and urinalysis results (cotinine) immediately after submitting their specimens, but received no type of incentive in exchange for obtaining or maintaining abstinence.

2.3.2. CBT plus CM. The CBT plus CM was provided as in the above CBT condition, but with the addition of a CM procedure. CO and cotinine samples were collected in accordance with the procedure explained above. The CM procedure included a voucher program through which nicotine abstinence was reinforced on a schedule of escalating magnitude of reinforcement with a reset contingency. The voucher program was implemented as follows: points were earned for specimens testing negative for cotinine collected in the fifth CBT session (first session after the patient was required to be abstinent), between the fifth and sixth CBT sessions, and in the sixth CBT session. A negative urine cotinine test was defined as less than 80 nanograms per milliliter (ng/ml), in order to avoid residual effects. Points were worth the equivalent of 1€ each. The first cotinine-negative specimen earned 80 points, with a 20-point increase for each subsequent and consecutive

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