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Using prize-based incentives to enhance daily interactive voice response (IVR) compliance: A feasibility study

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Abstract

This study examined the feasibility of a prize-based contingency-management (CM) approach to encourage interactive voice response (IVR) compliance in a cocaine-treatment study and explored the association between IVR call rate and outcome during a cocaine abstinence-induction trial. Subjects called into the IVR system daily to complete a brief interview assessing cocaine use for past 24 hours. One group earned $1 for each call; the other earned one draw per call from a "prize bowl" with a range of awards. Abstinence was rewarded according to a high-value voucher incentive schedule, which was the same for both groups, and confirmed by thrice-weekly urine testing at clinic visits. Odds of calling were 4.7 times greater (95% CI: 1.23, 17.91) in the prize-CM group than in the fixed dollar CM group. In addition, the percent of IVR calls was significantly associated with abstinence achievement, χ^2 (1) = 5.147, p<0.023. The use of prize-based CM to increase the use of IVR is feasible and deserves examination as an innovation for helping participants engage in treatment.

Keywords

interactive voice response; contingency management; compliance enhancement; variable reinforcement; feasibility study

1. Introduction

Studies using remote monitoring technology to assess key clinical information in real time and in a person's natural environment are becoming common in clinical-trial protocols

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Preliminary results were presented at the annual meeting of the College of Problems on Drug Dependence in 2008 by Jan Lindsay, Ph.D.

(Shiffman, Stone, & Hufford, 2008). One implementation of this innovative data-collection method is the interactive voice response (IVR) system, in which subjects use their telephone's touch-tone keypad to respond to confidential, computerized assessment interviews (Corkrey & Parkinson, 2002). Unlike traditional assessment methods involving retrospective and infrequent sampling procedures, IVR technology can be used to track daily ratings on targeted behaviors, at the time of their occurrence, thus providing a prospective and fine-grained analysis of individual changes over time.

Although IVR-assisted monitoring has produced reliable and clinically meaningful data across substance-abuse treatment interventions, problems with compliance reduce its utility. To improve compliance with IVR, contingency management (CM) interventions have been used (Searles, Helzer, Rose, & Badger, 2002; Simpson, Kivlahan, Bush, & McFall, 2005). Most studies have used fixed methods of reinforcement to reward participation. Recently, variable schedules of reinforcement, or prize-based systems, have been shown to be efficacious in improving treatment retention and reducing drug use (Petry, Alessi, Marx, Austin, & Tardif, 2005; Petry et al., 2006). Prize CM has not been used in clinical trials to target number of IVR calls but, potentially, could be used to provide a cost-effective alternative.

The primary aim of the present study was to demonstrate the feasibility of a prize CM approach to encourage IVR compliance in the context of a cocaine-treatment study. IVR compliance-enhancement strategies were compared by evaluating the system under two CM conditions. It was hypothesized that the prize CM would generate higher call rates, i.e., better compliance, than a fixed dollar-per-call CM approach. In addition to its being a useful remote measurement tool, we were interested in the potential clinical utility of IVR monitoring as a marker of motivation to change behavior, i.e., cocaine use. Thus, a secondary aim was to explore the association between IVR call rate and treatment outcome within the context of a brief abstinence-induction trial.

2. Methods

2.1. Study Design

The IVR protocol was conducted as an add-on study during a brief behaviorally-based cocaine abstinence-induction phase of treatment prior to randomization into the larger parent study (Clinicaltrials.gov Identifier: NCT00218023). We used a quasi-experimental sequential cohort design to systematically evaluate the effects of CM without introducing contamination with parent study interventions. The two cohorts consisted of participants consecutively enrolled in the abstinence induction phase of the parent trial. The first cohort (n = 20) was assigned to prize CM; the second cohort (n = 37) was assigned to the fixed-dollar CM. Enrollment phases were approximately 8 months in duration, with a 3 month non-enrollment "washout" phase between cohorts. Subjects were treatment-seeking adults (≥ 18 years old) who met inclusion and exclusion criteria for the parent study that required a diagnosis of current cocaine dependence (*Diagnostic and Statistical Manual of Mental Disorders-IV*: (American Psychiatric Association, 1994) and the absence of a current nonsubstance-induced Axis I disorder or a major medical illness or condition.

Subjects were asked to call into the IVR system daily and complete a brief interview. At thrice-weekly clinic visits, subjects provided urine samples to test for the presence of benzoylecgonine and, if negative, received CM rewards according to a high-value voucher incentive schedule shown to promote initial cocaine abstinence (Bisaga et al., 2010). Under the escalating reinforcement schedule, voucher values began at $15 and increased by $10 for each consecutive cocaine-negative urine. Bonus vouchers worth $10 were given for three consecutive cocaine-negative urines. Provision of a cocaine-positive urine or failure to

provide a scheduled urine resulted in no vouchers earned and the value of the next earned voucher being reset to the initial value ($15). Subjects could redeem their earned vouchers for cash (≤ $25) and/or certificates for goods and services. In addition to CM, participants received two 1-hour individual sessions of motivational interviewing during the induction phase.

Abstinence was operationally defined as six consecutive cocaine-negative urines (i.e., 2 weeks) achieved within an induction phase lasting up to 4 weeks. All subjects entered the randomized clinical trial upon achievement of abstinence or at the end of the induction phase (week 4). The present study examined feasibility using data collected during the first 14 days of the induction phase, regardless of actual time spent in the induction phase) to ensure an equal number of IVR call opportunities per participant.

2.2. IVR Procedure

IVR, a computerized telephone system, requires only access to a telephone from any location. Participants called a dedicated 800 number to provide reports. Subjects were asked to call into the IVR system daily and complete a brief (3-minute or less) computerized interview assessing use of cocaine in the past 24 hours, withdrawal symptoms, mood, and general functioning. After entering his or her Subject Identification Number and Password verification, the subject heard a recorded voice asking a series of questions (e.g., “In the past 24 hours, did you use cocaine? Yes, press 1; No, press 2”; or “Please rate your craving for cocaine in the past 24 hours: 1=none; 10=very severe”). Responses were made by pressing numbers on the telephone keypad. Following the phone interview, responses were automatically stored in a Microsoft Access data file.

During the intake phase of the study, research staff explained the protocol to the participants, who then practiced using the call-in system over the next few days. Research staff were available to ascertain any reporting problems and provide additional assistance as needed. Prepaid phone cards were given to participants. Research staff reviewed IVR calls weekly and provided appropriate feedback (praise, reminders) to participants throughout the trial.

2.3. CM Conditions

Two reinforcement conditions, following fixed or variable schedules, were used to enhance compliance with the IVR protocol. In the fixed-dollar CM condition, subjects earned $1 for each call made to the IVR system. In the variable CM (prize CM) condition, subjects earned “draws” (one draw per call) from the “prize bowl” for each call made to the IVR system. Modeled after Petry’s approach (Petry et al., 2006), the prize bowl contained non-winning slips (50%, “good job”) and winning slips (43.6% “mini” prizes < $1; 6% “medium” prizes = $5; 0.4% “jumbo” prizes = $100). No rewards ($1 or drawings) were given for missed calls.

A designated research assistant managed all aspects of both CM procedures, including dispensing of earned rewards. Slips in the prize bowl were returned following each drawing so that probabilities remained constant. Vouchers earned were able to be exchanged at any time for gift certificates (e.g., local restaurants, movie theater) or redeemed as direct cash payments. At one clinic visit per week (Friday) participants received a written and verbal statement indicating their previous week’s IVR activity and associated earnings.

2.4 Statistical Methods

Summary statistics were stratified by study group and presented as means with standard deviations or frequencies with percentages as appropriate. Participation rates were estimated

by the number of days that subjects called into the system divided by the total number (14) of possible IVR call days. A generalized linear mixed model assuming a binomial distribution and logit-link function was used to compare participation rates in the two CM groups and estimate the respective odds ratio. A logistic-regression model was used to estimate the odds of achieving abstinence in the prize-versus fixed-CM groups.

3. Results

3.1. Sample Characteristics

In all, 57 subjects participated in this study, with 20 (35.1%) participating in the prize-CM group and 37 (64.9%) participating in the fixed-CM group. Most were African American (66.7%), male (79%), and either unemployed (49.1%) or employed part time (29.8%), with an average age of 42.94 years (SD = 8.65) and education level of 12.65 years (SD = 1.62). Mean reported days of cocaine use in the 30 days prior to treatment was 15 (SD = 8.10), and mean years of cocaine use was 13.81 (SD = 7.79). The two cohorts did not differ significantly on demographic and current drug-use variables as shown in Table 1.

3.2. IVR Call Rate by CM Condition

A total of 375 calls were made to the IVR system during the abstinence induction period. The mean number of calls made per subject was 3.09 (SD=4.51) of total possible calls during the two-week period. As shown in Figure 1, percentage of participation days was higher in the prize-CM condition (M=42.1%, S.D. = 38.9%) than in the fixed dollar-per-call CM condition (M=13.0%, S.D. = 24.8%), $F(1, 55) = 5.37$, $p = 0.024$), with the odds of calling 4.7 times greater (95% CI: 1.23, 17.91) in the prize-CM group than in the fixed-CM group.

3.3. IVR Call Rate and Abstinence Achievement

Sixteen (28%) of the 57 study participants achieved cocaine abstinence. Five participants in the prize-CM cohort (25%) achieved abstinence compared with 11 participants in the fixed-CM cohort (29.7%), (p=0.7668). There was no statistically significant difference in the odds of achieving abstinence in the prize-versus fixed-CM group, X^2 (1) = 0.143, $p = 0.70$. When we adjusted for CM group in the multiple regression model, the percent of IVR calls was significantly associated with achievement of cocaine abstinence, X^2 (1) = 5.147, $p < 0.023$. Subjects who participated in at least 10% of the scheduled call days were about 1.27 times more likely to attain abstinence compared with those who did not participate (95% CI: 1.01, 1.05).

Discussion

This study examined the utility of an automated IVR system for monitoring daily cocaine use within the context of a brief, behaviorally based cocaine-abstinence-induction treatment. To address compliance, two CM interventions were compared. The hypothesis that compliance (i.e., IVR call rate) would improve with a prize-based CM strategy compared with a fixed dollar-per-call CM strategy was supported.

Our findings are consistent with previous research demonstrating the efficacy of prize-based CM and its utility across a broad range of target behaviors. Compared with a continuous fixed (dollar-per-call) reinforcement schedule, an intermittent and less predictable schedule of reinforcement showed greater behavior change (IVR calling). This fits with a well-known body of basic science research showing that variable schedules of reinforcement lead to more robust and persistent responding than fixed schedules (Ferster, 1957; Yukl, Latham, & Pursell, 1976). Anecdotally, we observed a high level of enthusiasm for earning draws,

regardless of actual winning outcome or prize size. In fact, average earnings for the prize-bowl ($3.34) and dollar-per-call ($1) groups were comparable and low, suggesting that the observed CM effect on IVR calling was the result of differences in delivery schedule rather than magnitude of the reinforcer.

This study found a positive relationship between IVR compliance and treatment outcome. Regardless of incentive condition, those who called the IVR system frequently were more likely to achieve cocaine abstinence during a brief behaviorally based treatment. Previous studies using IVR to administer therapy have reported that participants' willingness to use the system strongly predicts outcome (Mundt, 1997). Here we used IVR as a data-collection tool and found similar effects. The intensity of our brief cocaine-abstinence-induction treatment, consisting of high-magnitude CM and motivational interviewing, may have obviated the need for IVR-delivered treatment interventions to further promote behavior change. Rather, completing the phone calls as instructed served as a marker of motivation to achieve abstinence. We can only speculate about mechanisms underlying IVR-related effects on treatment outcome and suggest that this would be an appropriate topic for further study; however, our findings add to the growing literature supporting IVR and other remote monitoring tools as feasible and clinically useful (Cranford, Tennen, & Zucker, 2010; Helzer et al., 2008; Mundt, Moore, & Bean, 2006).

Telephone-based data collection has benefits beyond traditional paper-and-pencil methods in terms of ease, flexibility, and convenience. We learned from this study how to integrate IVR technology with behavioral incentives to improve compliance and treatment outcome. Using the benefit of hindsight, we recommend that future research use a stronger methodology for evaluating CM effects on both quantity and *quality* of IVR calls. For example, prize-based incentives might target IVR responses that show agreement with other measures of cocaine use, such as in-clinic urine drug-screen results. We viewed IVR as an adjunct data-collection method; but with reliable evidence of validity, it is certainly possible to foresee IVR and other smart mobile phone apps being promoted as primary outcome assessment tools. Our study has several limitations. Cohort sizes were small, unbalanced, and received nonconcurrent CM conditions. In quasi-experimental sequential designs there is the potential confound that changes in the study population over time may affect the target outcomes. In the present study the cohorts were similar on baseline characteristics and enrollment of each cohort occurred over a relatively short accrual period (2 years) during which time the characteristics of the participant pool would be expected to remain relatively stable. Nevertheless, given these design limitations, order of presentation, i.e., prize-followed by fixed-CM, cannot be ruled out when interpreting the significant CM effect. In conclusion, the present findings recommend using prize-based incentives to enhance compliance with an IVR system. We acknowledge that these recommendations are based on a study that was quasi-experimental in design and conducted in the unique clinical setting of a brief cocaine abstinence-induction intervention. To offset these concerns, however, it should be noted that the effects of intermittent schedules of reinforcement for changing targeted behaviors have been demonstrated to last over time and across situations. As advances in technology continue to offer innovative options for researchers and clinicians, the need to identify effective compliance strategies becomes increasingly important. Prize-bowl incentives as used here or incorporated directly into the automated system should be further considered.

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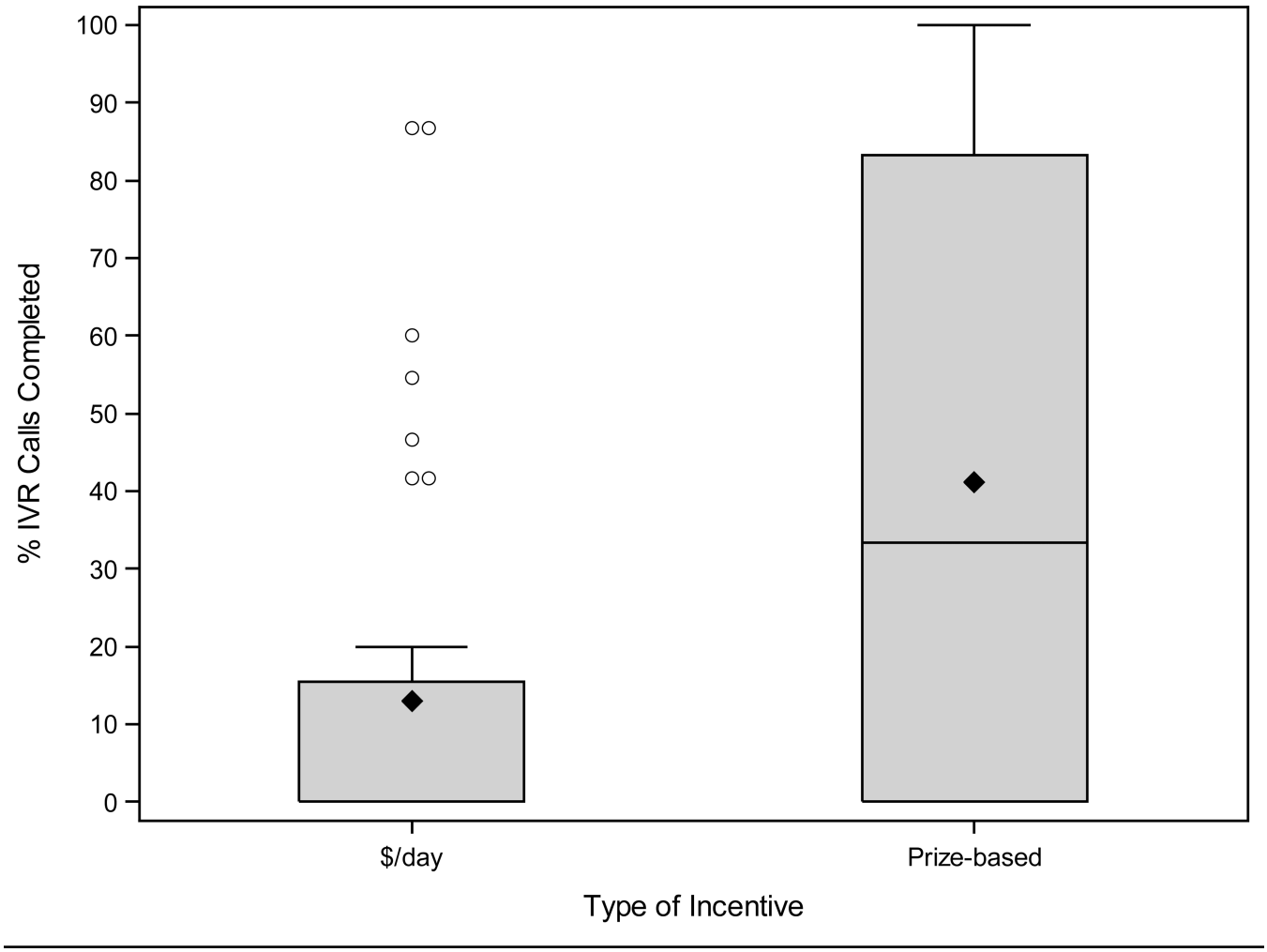

Figure 1.
Box plots for percent interactive-voice-response calls completed by contingency-management-incentive group with means (diamonds), medians (horizontal bars), interquartile range (box), and whiskers (1.5*IQR). The sample included 20 in the prize CM group and 37 in the fixed-dollar group. Circles represent outliers, defined as values more than 1.5 interquartile range above the median.

Table 1

Subject characteristics

Variable	Prize-CM (n=20)	Dollar-per-call (n=37)	p-Value
Demographics			
Age in years (M, SD)	45.1 (7.4)	42 (8.8)	.21
Sex, Male (%, n)	80 (16)	78.4 (29)	.89
Race			.681
African American (%, n)	70 (14)	64.9 (24)	
Hispanic	10 (2)	16.2 (6)	
White	20 (4)	18.9 (7)	
Employment (%, n)			.43
Fulltime	15 (3)	24.3 (9)	
Part time	40 (8)	24.3 (9)	
Unemployed	45 (9)	51.4 (19)	
Years education (M, SD)	12.1 (1.5)	13.0 (1.6)	.60
Drug use: M (SD)			
Cocaine, days in past month	15.2 (7.2)	14.3 (8.9)	.89
Cocaine, years in lifetime	16.4 (7.5)	12.4 (7.6)	.06
Alcohol, days in past month	9.3 (9.2)	7.9 (8.1)	.56
Alcohol, years in lifetime	23.3 (12.2)	16.4 (12.6)	.05 *
Marijuana, days in past month	1.35 (2.7)	4.67 (9.0)	.12
Marijuana, years in lifetime	10.9 (9.4)	13.6 (11.9)	.37