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Income Does Not Affect Response to Contingency Management Treatments Among Community Substance Abuse Treatment-seekers

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Abstract

The present study examined a commonly held belief that contingency management (CM) may be less effective for substance abusers with relatively more economic resources compared to those with relatively few resources. Using a combined sample of 393 treatment-seeking cocaine abusers from 3 clinical trials involving randomization to standard care or standard care plus CM conditions, we assessed the impact of past-year income, alone and in combination with treatment condition, as well as income type (i.e., earned, illegal, unstable) on the longest duration of continuous verified abstinence (LDA) achieved during treatment. Results suggested that income had no effect on LDA in either condition, and that CM's effectiveness did not deteriorate among those with better economic resources in the present sample. This finding may be of value to clinicians and administrators who are considering the addition of CM to standard care treatments in community outpatient substance abuse clinics and have concerns about the generalizability of CM across clients with various economic resources.

Keywords

socio-economic status; income; cocaine abuse; substance abusers; contingency management

1. Introduction

Contingency management (CM) is a behavioral intervention that provides rewards for verified attainment of target behaviors (e.g., abstinence, goal-related activity completion, or attendance) and has demonstrated efficacy for use in the treatment of cocaine use disorders (Lussier et al., 2006; Prendergast et al., 2006). Even when using fairly robust contingencies such as vouchers or prizes with monetary value, the strength of a given reinforcer may vary both within and across individuals, and across geographic regions. One such contextual factor that may impact the effectiveness of CM is economic stability. For example, an individual earning minimum wage may place a different (presumably higher) value on earned contingencies than an individual with comfortable and stable finances.

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The majority of published CM studies have used largely low-income, low socioeconomic status samples, a feature reflective of many treatment-seeking substance abusing populations. While treatment-seeking substance abusing samples typically dominate the lower end of the economic scale, considerable variability in economic resources is often present within these groups. Economic indices (e.g., education, housing situation, employment, earned income) vary greatly among published reports, making comparisons across studies difficult. Possibly due to use of these differing variables across studies, reports investigating the impact of economic stability on treatment outcome among treatment seeking substance abusing samples provide mixed findings.

Economic stability predicts greater treatment engagement and abstinence in both insured samples (Green et al., 2002; Mertens & Weisner, 2000) and general samples of treatment-seeking substance users (Walton et al., 2003). In addition, some studies have identified significant positive relationships between economic stability and posttreatment substance use outcomes among treatment-seeking samples of substance abusers (Gregoire & Snively, 2001; Stephens et al., 1993). Still other studies fail to find significant relations between economic indices and substance use outcomes (McKay et al., 2005; also see literature review by Littlejohn, 2006), and one study finds a significant negative relation between income and improvement following treatment (Snowden, 1984).

One potential mechanism through which income levels may impact response to substance abuse treatment is treatment retention. In a sample of marijuana dependent individuals receiving outpatient treatment services, early treatment dropouts (defined as ≤ 4 sessions) demonstrated significantly less stable economic resources compared to either late dropouts or treatment completers (Roffman et al., 1993). Similar results were present for excessive drinkers completing a brief intervention, where treatment dropouts were less well educated compared to nondropouts, and treatment attenders (≥ 2 sessions) were of higher socio-economic status than nonattenders (Richmond et al., 1995). In addition to improving length of abstinence, CM significantly increases treatment retention and may provide an avenue for overcoming low income-related problems in treatment engagement and outcomes.

Although CM outcome research continues to grow, relatively few studies have examined associations between individual-level characteristics and response to CM treatments. Strong Kinnaman et al. (2007) examined the impact of baseline characteristics, including monthly income, on CM payment receipt for substance abstinence among a sample of mentally ill patients and found no significant effect of income. To our knowledge, the present study joins Strong Kinnaman et al. (2007) in being among the first to examine the impact of income on treatment outcome among participants randomized to standard care or CM, and it is the first study to examine the impact of income on the *effectiveness* of CM compared to standard care among treatment-seeking cocaine abusers in community outpatient substance abuse clinic settings. Specifically, we assessed whether an individual's past year income affects (1) abstinence during treatment for those randomized to standard care or CM, and (2) the difference in abstinence during treatment between standard care and CM (i.e., the effectiveness of CM compared to standard care), thereby examining a criticism raised as a possible limitation of CM, that CM would be comparatively less effective for individuals with relatively more economic resources. Given the mixed findings of the effect of income on treatment outcomes among non-CM studies, hypotheses were not specified *a priori*.

2. Method

2.1 Rationale for Combining Samples across Trials

The three primary trials (Petry et al., 2004; Petry et al., 2005a; Petry et al., 2006) were designed with parallel procedural elements, which facilitated combining of the samples for secondary

analyses. The three primary studies shared the same targeted population (treatment-seeking cocaine abusers), recruitment methods, and use of community outpatient substance abuse treatment clinics. Measures and data collection schedules were consistent across the studies. Each of the three trials involved randomization to one of three conditions (standard care treatment or one of two CM conditions, detailed below). Additionally, standard care treatments were similar across trials in treatment type, orientation, intensity, and duration. No differences in participants' mean age, years of education, marital status, employment status, or years of cocaine use were present across the studies (all p 's > .05).

2.2 Participants

Participants ($N = 393$) for the present analyses represented a combined dataset from three randomized clinical trials (Petry et al., 2004; Petry et al., 2005a; Petry et al., 2006). Study eligibility was determined at initiation of services at local community substance abuse treatment clinics. All participants met diagnostic criteria (American Psychiatric Association, 1994) for past year cocaine abuse or dependence and were at least 18 years of age. Study exclusions were medically uncontrolled psychotic or bipolar disorders, active suicidal ideation, inability to understand study procedures, or currently in recovery for pathological gambling. All participants provided written informed consent, and the study procedures received approval from the university's Institutional Review Board.

2.3 Procedure

At the initial 2-hour interview, participants provided demographic information and completed baseline measures, including the Addiction Severity Index (ASI; McLellan et al., 1985). Past year income was assessed via the Services Utilization Questionnaire (Rosenheck & Lam, 1997), measuring income from a variety of sources and providing a global estimate of economic resources and demonstrating adequate validity among substance abusers (Rosen et al., 2006). The income sources included earned income, social security benefits (e.g., disability, supplemental income), social welfare programs (e.g., food stamps, rent supplements), unemployment compensation, retirement funds, veterans compensation, alimony and child support, other support from family or friends, illegal sources, and legal gambling wins. All income values reported in this study were converted to 2003 dollars using the Consumer Price Index. Table 1 provides the number of participants receiving funds from given income sources and the median amounts received for individuals reporting this funding source. Total past year income for the entire sample from all sources was low, with a median of \$9,600 (interquartile range [IQR] = \$4,600–21,250) and a mean of \$16,350 ($SD = 19,800$). Starting at study intake, breath (Alco-sensor IV Alcometer; Intoximetrics, St. Louis, MO) and urine (OnTrak TesTsticks; Varian Inc., Walnut Creek, CA) samples were regularly screened throughout the study intervention period for alcohol, cocaine, and opioids. Although the specimen collection schedule was consistent across studies, the number of submitted urine and breath samples differed across the CM conditions ($p < .001$), with participants in the higher magnitude conditions (see below) submitting more samples.

2.4 Treatments

Following the intake interview, participants in each trial were randomized to standard care or standard care plus one of two CM conditions. We provide a brief description of the standard care and CM conditions. More detailed descriptions of the treatments are available from the primary sources (Petry et al., 2004; 2005a; 2006).

2.4.1 Standard Care Treatment—The standard intensive outpatient substance abuse treatments were similar in intensity and format across studies, and consisted of group therapy sessions involving psychoeducation, skills-based instruction, and 12-step treatment. Up to 21

sets of breath and urine samples were scheduled during the 12-week study intervention period. Research assistants collected samples 3 days per week during weeks 1–3, 2 days per week during weeks 4–6, and 1 day per week for the remainder of the intervention period.

2.4.2 CM Treatment—In addition to standard care, participants in the CM conditions received prize- or voucher-based reinforcement for verified abstinence and/or completion of activities related to treatment goals. Table 2 provides a comparison of the CM conditions in the three clinical trials. Overall, these studies were carefully designed to parallel one another, and were consistent with the exception of the primary aim of the study. For the Petry et al (2004) study, a primary aim was a comparison of two different prize reinforcement magnitudes. Consistent with a primary aim of the Petry et al. (2005a) study, CM participants were randomized to either prize or voucher reinforcement. CM participants in the Petry et al. (2006) study received reinforcement solely for either abstinence or verified completion of goal-related activities (also see Petry et al., 2001).

2.5 Data Analysis

We chose the longest duration of objectively verified continuous abstinence obtained (LDA) during the 12 week treatment period as the primary treatment outcome variable for our analyses. LDA (ranging 0–12 weeks) indicates the longest number of consecutive weeks an individual submitted all negative urine and breath samples in a given week. To be considered negative, urine and breath samples tested negative for alcohol, cocaine, and opioids. Positive samples and unexcused absences interrupted the duration of abstinence for LDA. This outcome variable was chosen based on evidence suggesting that the longest duration of abstinence achieved during treatment is among the best predictors of improved outcomes at follow-up periods (Higgins et al., 2000; Higgins et al., 2003; Petry et al., 2005b; Petry et al., 2006; Petry et al., 2007).

To investigate the effect of income on response to standard care and CM treatments, we conducted a series of four regression analyses. Beginning with a base model containing our primary variables of interest (Model 1), we included additional explanatory variables in each regression analysis to assess the stability of the coefficients of interest.

Model 1 included treatment condition (standard care = 0, CM = 1), past year total income (mean-centered), and the interaction of treatment condition and (mean-centered) income. We examined the following: (1) the relation between income and the effectiveness of CM compared to standard care, measured by the coefficient on the interaction of treatment condition and income, (2) the relation between income and LDA in the standard care condition, measured by the coefficient on past year income, and (3) the relation between income and LDA in the CM condition, measured by the sum of the coefficients on past year income and the interaction term. Model 2 introduced three dichotomous income source codes in addition to the base model variables. These income source codes included earned income, illegal income, and unstable income (including legal gambling wins and support from family/friends); participants could report income from any, all, or none of these categories. We hypothesized that earned income might signify a more stable source for income, and possibly a positive predictive value for treatment outcome. In contrast, income from illegal and unstable sources, while increasing the overall past year income, may not have the same positive effects on treatment outcome.

In Model 3, we included a number of demographic and baseline characteristics to assess the impact of controlling for individual characteristics on coefficient stability. Categorical variables (e.g., marital status) were entered as dummy codes, using the most prevalent category as reference. Model 3 included treatment condition, mean-centered income, treatment condition by income interaction term, and the three income source codes in addition to the following individual characteristics: age, years of education, years of cocaine use, sample

results at intake (positive/negative), gender, race dummy codes (3), employment dummy codes (3), marital status dummy codes (2), and the seven baseline ASI scores. Model 4 included all of the above variables in addition to two dummy codes for study, with the goal of statistically controlling for procedural differences across the studies.

We note that income was nonnormally distributed. We repeated Models 1–4 first using a log-transformed income variable, using an adjusted income variable in which the top 5 or top 10 highest income values were reduced to the next highest value and increased sequentially by 0.10, and last by excluding the highest income values. For all these iterations, the results were similar. Thus, we present analyses using the least adulterated income variable below (mean-centered income).

3. Results

Table 3 presents the unstandardized coefficients and associated significance values for independent variables included in Models 1–4. In cases where Table 3 does not list associated coefficients (e.g., for multiple dummy codes), coefficients and p -values are presented in the following text for significant predictors only. Model 1, with the minimal inclusion of treatment condition, mean-centered past year income, and the treatment condition by mean-centered income interaction, accounted for 5% of the variance (adjusted R^2), $F(3, 389) = 8.350$, $p < .001$. Treatment condition was the only significant predictor ($p < .001$), with individuals randomized to the CM condition obtaining longer periods of LDA on average while controlling for other variables in the model. Importantly, the coefficient on the interaction of treatment condition and income was non-significant ($p = .495$), suggesting that income does not impact the effectiveness of CM treatments compared to standard care. In addition, the coefficient on income ($p = .387$) and a test of the sum of the coefficients on income and the interaction term ($p = .933$; result not shown) were also non-significant, suggesting that income is not related to LDA in the standard care condition or the CM condition, respectively.

In Model 2, we assessed whether the inclusion of income source types would enhance prediction of LDA. For this purpose, codes indicating whether participants reported earned income, illegal income, and income from unstable sources were included in addition to the Model 1 variables. Model 2 was significant, but suggested that income type (earned: $B = -0.533$, $p = .258$, illegal: $B = -0.869$, $p = .182$, unstable: $B = -0.210$, $p = .659$) did not improve the prediction of LDA (adjusted $R^2 = 0.053$), $F(6, 386) = 4.657$, $p < .001$. Treatment condition remained a significant predictor of LDA, and neither income, the interaction term, nor their sum ($p = .624$, result not shown) was significant.

Model 3 assessed the impact of controlling for individual characteristics through the inclusion of demographic and baseline characteristics. The overall model was significant, $F(26, 365) = 4.294$, $p < .001$, and accounted for substantially more variance (adjusted $R^2 = 0.180$) than prior models. Among predictors, treatment condition remained significant, and again neither income, the interaction term, nor their sum ($p = .675$, result not shown) was significant. For demographic and baseline characteristics, only specimen results at intake and ASI legal scores predicted LDA. Positive specimen results at intake were associated with shorter durations of LDA while controlling for other variables in the model. ASI legal scores ($B = -2.294$, $p = .023$) were negatively associated with LDA, indicating that individuals with more legal problems on average obtained shorter periods of LDA.

Model 4 included all of the above variables in addition to dummy codes for study to control for procedural differences across the studies. The overall model was significant and showed the same pattern of individual predictors, adjusted $R^2 = 0.204$, $F(28, 363) = 4.578$, $p < .001$. Treatment condition, intake specimen results, and ASI legal scores ($B = -2.130$, $p = .034$) were

significant predictors of LDA. The Petry et al. (2005a) study was positively associated ($B = 1.479, p = .005$) with LDA compared to the Petry et al. (2004) study. As with prior models, income, the interaction term, and their sum ($p = .432$, result not shown) remained non-significant predictors of LDA.

4. Discussion

In our study (and in others, i.e., Littlejohn, 2006; McKay et al., 2005), no effect of income on treatment outcome was present. Specifically, self-reported past-year income did not predict LDA for either the standard care or CM conditions (i.e., in all models, the coefficient on income was non-significant, as was the sum of the coefficients on income and the interaction term). Further, income did not impact the relative effectiveness of CM compared to standard care (i.e., in all models, the coefficient on the interaction term was non-significant). Thus, the lack of a relation between income and CM could not be explained by an attenuation of effects present in non-CM conditions (e.g., through improving treatment retention among low income earners). Nor did income attenuate the effectiveness of CM among the higher income earners in our sample, an oft raised concern about CM's utility in real-world applications. Rather, we observed a global non-effect of income on treatment outcomes. Similarly, source of income (i.e., earned, illegal, or unstable) was not significantly related to LDA, suggesting that these income sources do not modify the overall lack of income effect. These results add to the evidence indicating that income is not a reliable predictor of treatment outcome among substance abusers receiving standard care, and that this nonsignificant effect holds as well for individuals receiving CM. Clinicians and administrators might make note of these findings as suggesting CM is effective across the range of incomes observed in our sample of treatment-seeking cocaine abusers in community outpatient substance abuse clinics.

Similar to our findings for the CM condition, Strong Kinnaman et al. (2007) found no significant effect of monthly income on receipt of CM payments in dual diagnosis patients. Our results build on this finding by providing further evidence that income does not impact response to CM treatment, and suggest that the lack of income effects extend to the standard care conditions as well. Further, the results of this study suggest that income does not impact the relative effectiveness of CM treatments in comparison to standard care. The variability in economic indices may partially explain inconsistencies in study findings regarding the impact of socio-economic status on treatment outcomes. In particular, we did not assess type of occupation, homelessness, or housing quality, all of which are variables that have been included in non-CM studies investigating socio-economic status effects on treatment outcome. We also note our findings, and that of Strong Kinnaman et al. (2007), are limited to examining the effects of income on treatment response during the treatment period. To our knowledge, post-treatment effects of income have not been examined in CM studies.

Among individual characteristics, both intake breath/urine sample results and ASI legal scores predicted treatment outcome. Consistent with a growing number of studies (e.g., Petry et al., 2005a; Stitzer et al., 2007a; Stitzer et al., 2007b), positive samples at intake negatively predicted treatment outcome. As for the association between greater legal problems and negative treatment outcome, we are reluctant to speculate at this point as to the link between ASI legal problems and outcome.

Economic stability is largely a function of both "income" (flow) and "wealth" (stock). A potential limitation of this paper is that it uses income as the only proxy for economic stability, with no information about the wealth (such as savings) of our sample. Further, the use of self-reported income may be subject to error. We attempted to reduce errors by asking about all sources of income individually, and we conducted analyses using past-year income, rather than past 30 days income, as past-year measurements may be more stable. To examine the possibility

that current financial status may differ from past year status (e.g., recent unemployment), and perhaps motivate individuals to participate in our study, we repeated the analyses using income data from the past 30 days reported at the baseline intake, and found a similar pattern of results. Specifically, all four overall models remained significant and the same variables emerged as significant predictors. The only variation was the addition of the illegal income source code as a significant predictor (for Model 2 only). Thus, current financial status does not affect LDA, nor does it modify the effect of CM on LDA.

We note the restricted income range and overall low income in our sample compared to the incomes of the general United States population. However, the present sample was recruited from local community substance abuse treatment clinics, and the income levels observed are reflective in range and distribution of these populations. For comparison, we examined data from the National Survey on Drug Use and Health (USDHHS, 2003). Using adults reporting an outpatient treatment episode within the last 12 months for illicit drugs or drugs and alcohol, an estimated 70% reported past year income from all sources of less than \$20,000 in this nationally representative sample. This estimate is similar to the 73% of our sample reporting yearly incomes from all sources of less than \$20,000. Generalization of these results to higher socioeconomic status populations (e.g., smokers or private pay treatment settings) may not be possible from this study, but these results likely will apply to many community treatment clinic substance abuse populations.

The use of a combined sample from three randomized clinical trials provided a large, heterogeneous sample of treatment-seeking cocaine abusers. The combined sample may also be viewed as a limitation, as this practice increases variability. However, we view the benefits of increased sample size, which permit secondary analyses that would otherwise be underpowered, to outweigh any associated limitations. Additionally, the use of multiple CM protocols in several clinics supports the generalizability of the noted effects, and suggests that CM's effectiveness is not limited to one specific CM protocol. Moreover, our findings do not change when 'study' is controlled for explicitly (see Model 4).

This study provides an initial analysis of the effects of income on treatment response using standard care and standard care plus CM treatments among treatment-seeking cocaine abusers in a community outpatient substance abuse clinic setting. The results provide initial support for the generalizability of CM across the range of income levels observed in our sample of treatment-seeking cocaine abusers. Despite demonstrating consistent and positive results in clinical trials, CM has not yet been integrated into routine clinical practice. Barriers to dissemination of this evidence-based practice may include concerns about the effectiveness of CM among the comparatively more economically stable substance abusers in community-based treatment clinics. The present findings suggest that income does not interfere with the effectiveness of CM, such that both low and comparatively higher income substance abusers among our sample benefited from CM (compared to standard care) in terms of longer durations of abstinence.

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Table 1**Sources of Self-reported Past Year Income**

Sources of Income	% Endorsing out of <i>N</i> = 393	Median (Interquartile Range) for Participants Endorsing Income Source
Earned income	72% (<i>n</i> = 281)	\$8,200 (\$3,000–21,350)
Social Welfare		
Food Stamps	39% (<i>n</i> = 153)	\$1,350 (\$350–1,700)
Other (e.g., rent supplements)	18% (<i>n</i> = 72)	\$4,100 (\$700–5,500)
Support from Family, Spouse, Friends	24% (<i>n</i> = 93)	\$1,000 (\$450–2,900)
Illegal Sources	14% (<i>n</i> = 53)	\$10,250 (\$1,800–25,650)
Social Security		
Supplemental Security Income (SSI)	7% (<i>n</i> = 29)	\$6,650 (\$1,400–7,050)
Other (e.g., disability)	8% (<i>n</i> = 32)	\$6,600 (\$5,850–7,450)
Unemployment	5% (<i>n</i> = 21)	\$1,850 (\$650–4,500)
Alimony and Child Support	4% (<i>n</i> = 17)	\$3,100 (\$1,750–5,250)
Legal Gambling Wins	3% (<i>n</i> = 12)	\$200 (\$100–1,950)
Other (e.g., retirement)	2% (<i>n</i> = 8)	\$2,400 (\$950–4,650)

Notes. Reported median and interquartile range amounts for each income source pertain to the *n* provided for each category. Participants may have reported income from more than one source. All monetary values were rounded to nearest \$50 and are reported in 2003 dollars.

Table 2
Features of the Contingency Management Conditions in the Three Primary Clinical Trials

	Targeted Behavior(s)	Reinforcement Type	Average Maximum Available	Average Earned
Petry et al. (2004)				
CM Condition As	Abstinence & Activities	Prizes	\$240	\$68
CM Condition B	Abstinence & Activities	Prizes	\$80	\$36
Petry et al. (2005a)				
CM Condition A	Abstinence & Activities	Prizes	\$889	\$295
CM Condition B	Abstinence & Activities	Vouchers	\$882	\$335
Petry et al. (2006)				
CM Condition A	Abstinence Only	Prizes	\$445	\$118
CM Condition B	Activities Only	Prizes	\$460	\$60

Notes. When more than one behavior is targeted, reinforcement schedules were independent. To receive reinforcement for abstinence, samples must have been negative for alcohol, cocaine, and opiates. CM = Contingency Management.

Table 3
Unstandardized Regression Coefficients and *p*-values for Models 1–4

Variables	Model 1 (<i>N</i> = 393)		Model 2 (<i>N</i> = 393)		Model 3 (<i>N</i> = 392)		Model 4 (<i>N</i> = 392)	
	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>	<i>B</i>	<i>p</i>
Treatment Condition	2.231	<.001	2.170	<.001	2.248	<.001	2.182	<.001
Past Year Income ^a	−0.017	.387	−0.008	.683	−0.018	.342	−0.015	.444
Treatment Cond*Income	0.015	.495	0.015	.523	0.024	.267	0.025	.237
Income Type Dummies	No	--	Included	all <i>ns</i>	Included	all <i>ns</i>	Included	all <i>ns</i>
Age	No	--	No	--	0.020	.550	0.017	.597
Years of Education	No	--	No	--	−0.093	.493	−0.086	.518
Years of Cocaine Use	No	--	No	--	−0.017	.561	−0.015	.599
Positive Sample at Intake	No	--	No	--	−3.680	<.001	−3.383	<.001
Female	No	--	No	--	0.162	.706	0.118	.780
Race Dummies	No	--	No	--	Included	all <i>ns</i>	Included	all <i>ns</i>
Employment Status Dummies	No	--	No	--	Included	all <i>ns</i>	Included	all <i>ns</i>
Marital Status Dummies	No	--	No	--	Included	all <i>ns</i>	Included	all <i>ns</i>
Baseline ASI Scores	No	--	No	--	Included	see text	Included	see text
Study Dummies	No	--	No	--	No	--	Included	see text
Adjusted R ²	.053		.053		.180		.204	

Notes. Values represent the unstandardized regression coefficients and associated *p*-values for independent variables included in each model. Individual coefficients and significance values are provided in text when variable has more than one associated *p*-value (e.g., multiple dummy codes).

^aIncome was mean-centered prior to analyses. Treatment Condition (standard care = 0, CM = 1). ASI = Addiction Severity Index.