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Comparable Efficacy of Contingency Management for Cocaine Dependence Among African American, Hispanic and White Methadone Maintenance Clients

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Abstract

Cocaine use is a significant problem among methadone maintenance clients. Contingency management (CM) is a reinforcement-based approach with demonstrated efficacy for reducing cocaine use. This study examines whether the efficacy of CM treatment for cocaine-dependent individuals receiving methadone maintenance for opioid dependence differs by ethnicity. Participants were 191 African American, Hispanic and White cocaine-dependent methadone maintenance clients, randomly assigned to standard methadone treatment or standard methadone treatment plus CM for 12 weeks. Hispanic participants were younger, less educated, and reported fewer years of cocaine use than African American and White participants and reported fewer years of heroin use than African American participants. African American participants were less likely to report a history of psychiatric symptoms or treatment compared to Hispanic and White participants. While CM was associated with longer duration of continuous cocaine abstinence and a greater proportion of submitted urine samples negative for cocaine, ethnicity was not related to treatment outcomes, and there was no significant interaction between treatment and ethnicity. CM appears to be an efficacious treatment for cocaine dependence among methadone maintenance clients, regardless of ethnicity.

Keywords

Ethnicity; Contingency management; Cocaine dependence; Methadone maintenance

Introduction

Ethnic disparities in access and response to mental health and substance abuse treatment are well documented (McGuire & Miranda, 2008). African Americans and Hispanics are less likely to receive needed care for mental health and substance use disorders than Whites. (McGuire & Miranda, 2008; Wells, Klap, Koike, & Sherbourne, 2001). Members of ethnic minority groups are also more likely to discontinue treatment early (Sue, Zane, & Young, 1994), suggesting treatments may not be equally effective for all (McGuire & Miranda, 2008).

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The construct of ethnicity is not without controversy (Bhopal & Donaldson, 1998; Bhopal, 2007). In contrast to race, which was thought to represent innate biological group differences, ethnicity encompasses social, cultural, and language-based aspects of identity, as well as those based on physical appearance (Oppenheimer, 2001; Williams, 1997). Ethnic disparities in access to health care arise from a complex interplay among cultural characteristics and others, like income, education, and experience with discrimination. Identifying ethnic differences in access and response to treatments is important to the goal of providing equal opportunities for effective care (Bhopal & Donaldson, 1998; Williams, 1997).

Ethnicity is associated with different patterns of drug use. Cocaine is the principal problem drug among African Americans (Castro, Proescholdbell, Abeita, & Rodriguez, 1999; Compton et al., 2000), who appear to develop cocaine dependence more rapidly after first use than drug users from other ethnic groups (O'Brien & Anthony, 2005). For Hispanics, heroin is the major problem drug, whereas alcohol is listed as the chief problem by most Whites entering treatment (Castro et al., 1999).

Methadone maintenance is effective in reducing heroin use, but cocaine use is a significant problem in methadone clients (Condelli, Fairbank, Dennis, & Rachal, 1991; Grella, Anglin, & Wugalter, 1997). Comorbid cocaine use is associated with greater attrition (Magura, Nwakeze, & Demsky, 1998), poorer treatment outcomes (Williamson, Darke, Ross, & Teesson, 2006), and greater risk of HIV infection (Grella, Anglin, & Wugalter, 1995) in methadone clients. Despite its efficacy in reducing opioid use, methadone appears to have little effect on cocaine use (Condelli et al., 1991). Contingency management (CM) is a behavioral treatment that provides tangible reinforcement for objectively verified drug abstinence or other target behaviors. CM is efficacious in reducing cocaine use and extending periods of abstinence among cocaine dependent methadone clients (Peirce et al., 2006; Petry, Alessi, Hanson, & Sierra, 2007; Petry & Martin, 2002; Petry et al., 2005; Preston, Umbricht, Wong, & Epstein, 2001; Rawson et al., 2002; Silverman, Chutuape, Bigelow, & Stitzer, 1999; Silverman et al., 1996).

Although numerous studies support CM's efficacy in a variety of settings and populations (Lussier, Heil, Mongeon, Badger, & Higgins, 2006; Prendergast, Podus, Finney, Greenwell, & Roll, 2006), there are currently no published studies examining associations between ethnicity and CM treatment outcomes, the object of this study. Based on prior research, we predicted that CM would be more effective in reducing cocaine use than standard methadone treatment and that response to CM would vary by ethnicity. CM, like most drug abuse interventions, arises from a tradition of empirically based treatments developed in predominantly White research settings and tested on predominantly White clients (e.g., Higgins et al., 1994). Studies in ethnically diverse samples continue to support its efficacy (Petry et al., 2005; ²⁰⁰⁷; Petry & Martin, 2002), but samples from individual clinical trials have not been large enough to examine ethnic differences in CM outcomes. Combining samples from multiple clinical trials of CM increases power for detecting ethnic differences if they exist.

Methods

Participants

Participants were 191 cocaine-dependent methadone-maintenance clients, participating in one of three clinical trials conducted at a methadone clinic in Hartford, CT between 1999 and 2006 (Petry et al., 2005; ²⁰⁰⁷; Petry & Martin, 2002). Clinical trial eligibility criteria included: (a) stable methadone dose for ≥ 1 month, (b) past year DSM-IV cocaine dependence diagnosis (American Psychiatric Association, 2000), (c) age 18 or older, and (d) English speaking. Exclusion criteria were (a) dementia (score of <21 on the Mini-Mental Status Exam; Folstein, Folstein, & McHugh, 1975), (b) serious uncontrolled psychiatric disorder or suicidal ideation,

or (c) in recovery from pathological gambling. Participants provided informed consent as approved by the University of Connecticut Health Center Institutional Review Board. There were 76 African American, 79 Hispanic, and 36 White participants based on self-identified ethnicity.

Evaluations

Participants completed a 2-hour baseline interview including questions about demographics and substance use patterns. Cocaine dependence diagnosis were established using the Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1997). Participants completed the Addiction Severity Index (ASI; McLellan et al., 1985), a reliable and valid instrument (Bovasso, Alterman, Cacciola, & Cook, 2001; Kosten, Rounsaville, & Kleber, 1983; McLellan et al., 1985) for assessing severity of psychosocial problems in medical, employment, alcohol, drug, legal, family/social, and psychiatric domains. Each domain yields a composite score ranging from 0 to 1, with higher scores reflecting greater problem severity. Urinalysis for opioids and cocaine used OnTrak Teststiks (Varian Inc., Lake Forest, CA).

Treatment

Randomization—Minimum likelihood allocation (Aiken, 1982) was used to randomize participants to conditions: standard methadone treatment plus regular urine monitoring (ST), or ST plus contingency management (CM). The active phase of the clinical trial lasted 12 weeks. Research assistants were trained to ensure that CM was administered correctly and that specific CM interventions (described below) were not applied to ST patients. Throughout the clinical trials, project coordinators visited sites monthly to observe administration of treatments, monitor treatment records, and provide corrective feedback as necessary.

ST—Treatment, provided by regular clinic staff, consisted of daily methadone doses, weekly group counseling, and at least monthly individual counseling. Clinical trial participation did not impact these services. Participants submitted observed urine samples on 2–3 randomly selected days per week, with 2–4 days between tests. Samples were screened for opioids and cocaine. These urine tests were in addition to any conducted by the clinic as part of standard care, and results were not shared with clinical staff. Participants were congratulated for negative samples and encouraged to discuss positive samples with their counselors. If a participant failed to provide a scheduled sample, that sample was considered positive unless an excused absence was granted (e.g., for a court date). Excused absences comprised fewer than 2% of all scheduled samples in the three clinical trials.

CM—Participants assigned to the CM condition received the same ST with urine sample monitoring described above. In all CM conditions, participants earned reinforcement for each submission of a cocaine-negative specimen. Reinforcement was provided in the form of draws from an urn with the possibility of winning prizes, or vouchers exchangeable for retail goods and services, depending on the specific clinical trial and condition. Number of draws started at one and number of vouchers started at \$3. Draws escalated by one and vouchers escalated by \$3 for each consecutive negative sample, up to a maximum of 10–15 draws or \$30 in vouchers. Participants who failed to provide a sample, or provided a cocaine-positive sample, earned no draws or vouchers that day. For the next negative sample, they were reset to 1 draw or \$3 in vouchers, and then draws and vouchers again escalated for consecutive negative samples.

The prize urn in the Petry et. al (2005; 2007) clinical trials contained 500 cards, of which 250 (50%) were non-winning, reading “Good Job.” The other half were winning: 219 (43.8%) were small prizes valued up to \$1 (choice of \$1 fast food coupon, bus tokens, etc.), 30 (6%) were

large prizes worth up to \$20 (movie tickets, CDs, watches, etc.), and one card (0.2%) was a jumbo prize valued at up to \$100 (stereo, television). The Petry and Martin (2002) clinical trial used a prize urn containing 250 cards. Half of the cards were non-winning, 109 resulted in small prizes, 15 in large prizes, and one in a jumbo prize. Participants in the voucher condition (Petry et. al, 2007) could earn up to \$585 in vouchers if all 24 submitted urine samples tested negative. They could spend the vouchers on almost any item or exchange them for prizes. Routinely, participants exchanged vouchers for gift certificates, clothing, food, and electronic equipment.

All three clinical trials employed CM to reinforce cocaine abstinence. Petry and Martin (2002) also reinforced opioid-abstinence by allocating additional draws for abstinence from both substances. Petry et. al (2005) also reinforced group attendance on an independent schedule. Detailed descriptions of specific conditions in each clinical trial are in the referenced articles.

Six months after the start of each clinical trial (3 months after completion of treatment), participants submitted urine samples at a follow-up evaluation. Follow-up data were available for 162 participants (85%) of those originally entering the clinical trial, including 64 (84%) African American, 66 (84%) Hispanic, and 32 (89%) White participants.

Data Analysis

Baseline characteristics of the three ethnic groups (African American, Hispanic, White) were compared using analyses of variance (ANOVA) for continuous variables and chi-square tests for nominal variables. Non-normally distributed continuous variables were compared using Kruskal-Wallis tests. The specific clinical trial and variables that differed significantly among ethnic groups were included as covariates in analysis of the primary treatment outcomes.

Multivariate analysis of covariance (MANCOVA) was used to examine relationships of treatment group (CM vs. ST), ethnicity (African American, Hispanic, or White), and the interaction between ethnicity and treatment group to two dependent variables: (a) weeks of continuous abstinence from cocaine, and (b) proportion of samples submitted during treatment that were cocaine negative. A week of abstinence was defined as a 7-day period during which all urinalysis tests were cocaine-negative, and not more than 4 days elapsed without a test. Duration of abstinence violated the homogeneity of variance assumption, so an inverse transformation was used. Complete data were available for all but three participants. Based on the size of the smallest sample (White; $N = 36$), this study had adequate power (.80) to detect an effect size (f) of .30 among ethnic groups (Cohen, 1988; Faul, Erdfelder, Lang, & Buchner, 2007).

In order to examine longer term outcomes, logistic regression was used to evaluate the relationship of treatment group, ethnicity, specific clinical trial and the significant covariates to urine toxicology cocaine test results at the 6-month follow-up.

Results

Baseline Characteristics

Table 1 shows demographic and substance use variables by ethnic group. Age and education differed significantly by group, with Hispanic participants being younger and less educated than their African American and White counterparts. Hispanic participants reported fewer years of cocaine and heroin use than the other groups. African American participants had lower ASI Psychiatric composite scores than Hispanic and White participants.

Individual items on the Psychiatric section of the ASI (Table 2) showed African American participants were less likely to report symptoms of depression or anxiety, over the lifetime and in the past 30 days, compared to Hispanics and Whites. In addition, African Americans were less likely to have been prescribed psychiatric medications over the lifetime or in the past 30 days, to report lifetime hallucinations, to report lifetime suicidal ideation or attempts, or to receive a psychiatric disability pension.

Associations of CM and Ethnicity with Treatment Outcomes

Length of retention in the clinical trials was comparable across treatment groups, $\chi^2(1) = .01$, $p = .91$, and ethnic groups, $\chi^2(2) = .48$, $p = .79$. Over 85% of participants who entered the clinical trials attended for all twelve weeks.

Table 3 shows treatment outcome variables by treatment group (CM or ST) and ethnic group. Table 4 shows the results of the MANCOVA controlling for education, intake cocaine test result, years of cocaine use, ASI Psychiatric composite score, and clinical trial. Although age and years of heroin use differed across ethnic groups, both variables were highly intercorrelated with years of cocaine use. Of these three potential covariates, only years of cocaine use was correlated with the dependent variables, so it was retained, and age and years of heroin use were not. When included in the analysis, age and years of heroin use were not significantly associated with outcomes and did not alter significant findings. Cocaine test result was included as a covariate because it has been associated with treatment outcomes (Katz, Chutuape, Jones, & Stitzer, 2002).

Treatment group was significantly associated with treatment outcomes as a whole and with both individual measures, controlling for covariates. Participants receiving CM achieved longer durations of continuous abstinence from cocaine, and a higher proportion of their submitted urine samples were negative for cocaine. Ethnicity was not associated with treatment outcomes, nor was the interaction between ethnicity and treatment group significant. Being cocaine positive at intake was associated with shorter duration of abstinence and smaller proportion of negative samples, as was one clinical trial (Petry et al., 2005) relative to the others.

Associations of CM and Ethnicity with Follow-Up Urine Results

Logistic regression analysis showed treatment group and cocaine test result at intake predicted cocaine test result at 6-month follow-up. CM participants were less likely to be cocaine-positive at follow-up, $\beta(\text{SE}) = -0.80(.39)$, Wald $F = 4.10$, $p < .05$, $e^{\beta} = 0.45$ (95% CI = .21–.98), and participants entering the clinical trial with a cocaine positive test were more likely to be positive at the follow-up $\beta(\text{SE}) = -1.91(.39)$, Wald $F = 24.18$, $p < .01$, $e^{\beta} = 6.76$ (95% CI = 3.16–14.47). Ethnicity was not a significant predictor of cocaine use at 6-month follow-up.

Discussion

This study revealed several ethnic group differences in demographics and substance use patterns among cocaine dependent methadone clients. Hispanic clients were younger, less educated, had used cocaine for fewer years on average than African Americans and Whites, and had used heroin for fewer years than African Americans. Younger age and lower educational attainment among Hispanics relative to African Americans and Whites have been identified previously among drug users and in the general population (Bernstein et al., 2005; U.S. Census Bureau, 2007). Differences in length of cocaine and heroin use appear to be driven by age differences, as there were no significant ethnic differences in age of onset of cocaine or heroin use (data not shown, available from authors, all $p > .16$).

ASI Psychiatric Severity scores and lifetime and recent psychiatric symptoms were significantly lower for African American relative to either Hispanic or White clients. This finding is consistent with previous studies comparing African American to White (Compton et al., 2000; Petry, 2003) or White and Hispanic (Bernstein et al., 2005) drug users. Different risk factors may contribute to maladaptive substance use in different ethnic groups. Psychiatric disorders may enhance vulnerability to substance use disorders among Whites and Hispanics, who may use drugs to cope with psychiatric symptoms. African Americans, even those with good mental health, may face a host of other risk factors that increase the likelihood of developing substance use disorders, including poverty, unemployment, and living in neighborhoods where drugs are readily available (Harley, 2005).

Our results indicate that CM is effective in reducing cocaine use and increasing duration of abstinence from cocaine among methadone clients with cocaine dependence. Although conclusions based on failure to reject a null hypothesis should be interpreted cautiously, the three ethnic groups appear to benefit from CM in equal measure. Our analysis controlled for characteristics that varied across ethnic groups, and even when variables that varied by ethnicity were not controlled, no ethnic differences in outcomes were noted (data not shown, available from authors, $p > .32$). One strength of this study was the use of three small samples to create an ethnically diverse sample with sufficient size to provide statistical power for comparing ethnic groups on multiple indicators of treatment outcome. Another strength was the use of objective measures of treatment outcomes. Because frequent urine testing was employed rather than self report, we can be confident that differences in duration of abstinence from cocaine across treatment groups were not due to expectancies or misrepresentation of use. A potential weakness is the somewhat smaller sample of White relative to African American and Hispanic participants, which somewhat reduced power to detect differences. Another is potential undetected biases in assessment of pretreatment ethnic differences. Reliability and validity of the ASI have been demonstrated in samples with substantial representation of African American and White, but not Hispanic, drug treatment patients (McLellan et al., 1992; McLellan et al., 1985), raising the possibility that ASI scores for Hispanic participants may be less accurate.

Finally, the ethnic divisions are somewhat arbitrary. In the current U.S. Census, "White" and "Black or African American" are considered racial categories, while "Hispanic or Latino" is an ethnic category (Oppenheimer, 2001). Non-Hispanic Whites may identify strongly with ethnic categories based on European country of origin, and the culture of African Americans descended from Southern slaves may differ from that of African Americans whose families immigrated voluntarily from Africa or the Caribbean. Many Hispanics report more specific ethnic identities such as Puerto Rican, Dominican, or Mexican. The diversity of potential ethnic identities is not reflected in most social and health sciences research (Oppenheimer, 2001). Our study is no different in that respect, and that limitation must be acknowledged.

The importance of ensuring that treatments for substance use disorders are effective for people from a variety of ethnic and cultural backgrounds has long been recognized (Finn, 1994). There is nevertheless a dearth of research examining potential ethnic variation in treatment response. The results of this study suggest that CM is effective regardless of the ethnic background of individuals participating. Given the applicability of reinforcement principles to all human behavior, it is not surprising that a CM approach is relatively unaffected by ethnicity and culture. The execution of the intervention could, however, have been biased toward the preferences of a particular ethnic group, for instance, in the types of reinforcements available. Our data suggest that the CM procedures described are efficacious for methadone-maintenance clients from diverse ethnic backgrounds.

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Table 1

Demographic and Baseline Characteristics by Ethnicity

Characteristic	African American (N = 76)	Hispanic (N = 79)	White (N = 36)	Significance Test	P
Age	42.5 ± 6.6	37.2 ± 6.6	41.1 ± 7.3	F (2, 188) = 12.82	<.001
Education	11.4 ± 1.8	10.1 ± 1.9	11.8 ± 2.1	F (2, 188) = 13.74	<.001
% Female	63.2	63.3	83.3	$\chi^2(2) = 5.34$	.069
% Unemployed or Disabled	68.4	64.6	77.8	$\chi^2(2) = 2.01$	.366
% Single, Never Married	66	68	47	$\chi^2(2) = 5.08$	.079
Yearly Legal Income	\$7771 ± 5562	\$6935 ± 5596	\$7338 ± 5166	$\chi^2(2) = 1.28a$	.527
Methadone Dose	73.0 ± 26.8	75.9 ± 28.4	83.6 ± 35.6	F (2, 188) = 1.61	.203
Years of Alcohol Use	13.4 ± 11.6	12.4 ± 11.4	15.6 ± 12.5	F (2, 188) = 0.94	.391
Years of Cocaine Use	16.8 ± 10.0	12.3 ± 7.4	17.2 ± 9.6	F (2, 188) = 6.25	.002
Years of Heroin Use	18.9 ± 9.4	14.4 ± 8.7	15.5 ± 8.7	F (2, 188) = 5.14	.007
% Cocaine Positive at Intake	69.7	64.6	47.2	$\chi^2(2) = 5.42$	.067
% Opiate Positive at Intake	18.4	29.1	25.0	$\chi^2(2) = 2.44$	.295
% Receiving Contingency Management	64.5	53.2	58.3	$\chi^2(2) = 2.04$	.360
% In Each Clinical Trial				$\chi^2(4) = 5.72$	.221
Petry & Martin (2002)	19.7	26.6	13.9		
Petry, Martin, & Simeic (2005)	35.5	44.3	41.7		
Petry et al. (2007)	44.7	29.1	44.4		
ASI Psychiatric Composite Score ^b					
Psychiatric	0.140 ± 0.188	0.266 ± 0.250	0.260 ± 0.238	$\chi^2(2) = 13.01^a$	.001

^aKruskal-Wallis Test.^bBetween group differences for all other composite scores were not significant.

Table 2

Addiction Severity Index Psychiatric Variables by Ethnicity

Variable (%)	African American	Hispanic	White	$\chi^2(2)$	P
Depression, Lifetime	56.6	72.2	86.1	10.68	.005
Depression, Last 30 Days	23.7	44.3	41.7	7.90	.019
Anxiety, Lifetime	44.7	62.0	80.6	11.81	.003
Anxiety, Last 30 Days	25.0	45.6	55.6	13.56	.001
Prescribed Psychiatric Medication, Lifetime	38.2	60.8	80.6	19.29	<.001
Prescribed Psychiatric Medication, Last 30 Days	11.8	36.7	36.1	14.25	.001
Hallucinations, Lifetime	3.9	20.3	25.0	12.02	.002
Suicidal Ideation, Lifetime	23.7	48.1	52.8	13.08	.001
Attempted Suicide, Lifetime	17.1	36.7	36.1	8.42	.015
Receive Psychiatric Disability Pension	3.9	13.9	22.2	10.13	.038

Table 3

Treatment Outcomes by Ethnicity and Treatment Condition

Ethnicity	Treatment Condition	N	Longest Duration of Continuous Cocaine Abstinence (Weeks) Mean $\pm$ Standard Deviation	Percent of Submitted Urine Samples Negative for Cocaine Mean $\pm$ Standard Deviation
African American	Standard Care	27	1.7 $\pm$ 3.8	22.3 $\pm$ 34.0
	Contingency Management	48	4.1 $\pm$ 5.0	46.0 $\pm$ 43.6
Hispanic	Standard Care	37	2.2 $\pm$ 3.6	32.2 $\pm$ 39.1
	Contingency Management	42	4.1 $\pm$ 4.3	46.4 $\pm$ 39.7
White	Standard Care	11	2.3 $\pm$ 2.6	40.9 $\pm$ 31.0
	Contingency Management	21	5.5 $\pm$ 4.9	59.4 $\pm$ 40.5

Table 4

Results of Multivariate Analysis of Covariance (MANCOVA) Showing Relationship Of Treatment Group (Contingency Management Vs. Standard Care) And Ethnicity To Cocaine Treatment Outcomes*

Predictor Variable	Wilk's λ (p)	F	Longest Duration of Continuous Abstinence from Cocaine in Weeks	F	% Submitted Samples Negative for Cocaine	p
Treatment Group	.006	10.30	.002	7.30		.008
Ethnicity	.890	0.55	.581	0.46		.631
Treatment Group by Ethnicity	.490	1.58	.208	0.94		.394
Interaction						
Years of Education	.386	0.84	.361	1.65		.201
Years of Cocaine Use	.056	5.79	.017	5.32		.022
Intake Cocaine Test Result	<.001	118.19	<.001	127.00		<.001
ASI Psychiatric Composite	.553	0.65	.421	0.16		.692
Clinical Trial	.027	7.42	.007	5.63		.019

Bold print indicates Wilk's λ significant at $p < .05$ for multivariate test of independent variable and F test significant at $p < .05$ for univariate test of independent variable's effect on treatment outcome.

* Controlling for education, years of cocaine use, intake cocaine test result, Addiction Severity Index Psychiatric Composite Score at intake, and specific clinical trial.