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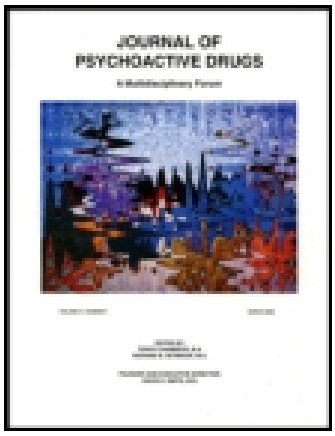

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Lifetime Substance Use and HIV Sexual Risk Behaviors Predict Treatment Response to Contingency Management Among Homeless, Substance-Dependent MSM

Cathy J. Reback Ph.D. [a] , James A. Peck Psy.D. [a] , Jesse B. Fletcher Ph.D. [b] , Miriam Nuno Ph.D. [c] & Rhodri Dierst-Davies M.P.H. [d]

[a] Friends Research Institute; University of California, Los Angeles, Integrated Substance Abuse Programs, Semel Institute for Neuroscience and Human Behavior , Los Angeles , CA , USA

[b] Statistician , Friends Research Institute , Los Angeles , CA , USA

[c] Cedars-Sinai Medical Center, Department of Neurosurgery , Los Angeles , CA , USA

[d] Friends Research Institute , Los Angeles , CA , USA

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Lifetime Substance Use and HIV Sexual Risk Behaviors Predict Treatment Response to Contingency Management Among Homeless, Substance-Dependent MSM

Cathy J. Reback, Ph.D.[a]; James A. Peck, Psy.D.[b]; Jesse B. Fletcher, Ph.D.[c]; Miriam Nuno, Ph.D.[d] & Rhodri Dierst-Davies, M.P.H.[e]

Abstract — Homeless, substance-dependent men who have sex with men (MSM) continue to suffer health disparities, including high rates of HIV. One-hundred and thirty one homeless, substance-dependent MSM were randomized into a contingency management (CM) intervention to increase substance abstinence and health-promoting behaviors. Participants were recruited from a community-based, health education/risk reduction HIV prevention program and the research activities were also conducted at the community site. Secondary analyses were conducted to identify and characterize treatment responders (defined as participants in a contingency management intervention who scored at or above the median on three primary outcomes). Treatment responders were more likely to be Caucasian/White ($p < .05$), report fewer years of lifetime methamphetamine, cocaine, and polysubstance use ($p \leq .05$), and report more recent sexual partners and high-risk sexual behaviors than nonresponders ($p < .05$). The application of evidence-based interventions continues to be a public health priority, especially in the effort to implement effective interventions for use in community settings. The identification of both treatment responders and nonresponders is important for intervention development tailored to specific populations, both in service programs and research studies, to optimize outcomes among highly impacted populations.

Keywords — cocaine, contingency management (CM), homeless, men who have sex with men (MSM), methamphetamine, sexual risk behavior

Homeless men who have sex with men (MSM) exhibit high rates of substance dependence (Gorbach et al. 2009), particularly methamphetamine dependence, which is strongly associated with sexual and drug-using

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[a]Senior Research Scientist, and Principal Investigator, Friends Research Institute; University of California, Los Angeles, Integrated Substance Abuse Programs, Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA.

[b]Co-investigator, Friends Research Institute; University of California, Los Angeles, Integrated Substance Abuse Programs, Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA.

[c]Statistician, Friends Research Institute, Los Angeles, CA.

[d]Assistant Professor of Neurosurgery, Cedars-Sinai Medical Center, Department of Neurosurgery, Los Angeles, CA.

[e]Project Director, Friends Research Institute, Los Angeles, CA.

Please address correspondence to Cathy J. Reback, Ph.D., Friends Research Institute, Inc., 1419 N. La Brea Avenue, Los Angeles, CA 90028; phone: 323-463-1601; fax 323-463-0126; email: reback@friendsresearch.org

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risk behaviors (Semple et al. 2008; Colfax et al. 2005). Methamphetamine use among this population contributes to high rates of HIV (Forrest et al. 2010; Menza et al. 2009; Plankey et al. 2007; Drumright, Patterson & Strathdee 2006; Shoptaw & Reback 2006; Buchacz et al. 2005), hepatitis B and C virus (Hutin et al. 2000), and other sexually transmitted infections (Colfax et al. 2005; Stall et al. 2001). Despite a great need for substance abuse treatment as well as social and health-related support services, homeless MSM experience numerous barriers to care (Feldman & Goldfinger 2006).

Urban, homeless, substance-dependent MSM often utilize low cost or no cost community-based programs (Holbrook 2008) for social services and health care. Thus, the application of a contingency management (CM) intervention, delivered in a community setting, is an ideal opportunity to reach this population (Tracy et al. 2007). Contingency management is a well-researched behavioral intervention based on the principles of operant conditioning (Stitzer & Petry 2006; Higgins & Petry 1999; Higgins et al. 1991) that has demonstrated efficacy for reducing substance use and sexual risk behaviors, and increasing healthy behaviors, in methamphetamine-dependent MSM in outpatient treatment settings (Shoptaw & Reback 2007; Shoptaw et al. 2004). Prior to this work, CM had not been evaluated with homeless, substance-dependent MSM. However, the need to find efficacious interventions for this extremely high-risk population is critical for reducing substance use and the concomitant sexual risk behaviors that increase HIV acquisition and transmission.

The parent study for the current analyses (Reback et al. 2010) evaluated the efficacy of CM for reducing substance use and increasing health-promoting behaviors among homeless, nontreatment-seeking, substance-dependent (predominantly methamphetamine) MSM in a low-intensity, community-based HIV prevention program. It was hypothesized that participants would be more responsive to reinforcing drug and alcohol abstinence *and* numerous health-promoting behaviors than reinforcing drug and alcohol abstinence only. Findings indicated that participants in the CM condition achieved greater drug and alcohol abstinence and accomplished more health-promoting behaviors than participants in the control condition and that reductions in substance use were maintained at 12-month follow-up evaluations (Reback et al. 2010).

When evaluating substance abuse interventions primary outcomes generally focus on attendance, overall reductions in substance use, and longest consecutive periods of sustained abstinence. To our knowledge, it is less common in intervention research to explore factors associated with outcomes among subgroups, including treatment "responders" and "nonresponders." In pursuit of overcoming this gap in the literature, the goal of this secondary analysis was to identify characteristics of participants achieving the best treatment outcomes (i.e., "responders"). Identification of factors associated with better treatment response is extremely important for the development of interventions tailored to specific subgroups of homeless, substance-using MSM and contributes to greater understanding of the efficacy of CM interventions.

METHOD

Participants

Participants were recruited from a community-based, low-intensity, health education/risk reduction HIV prevention program serving homeless, substance-using MSM in the Hollywood/West Hollywood area of Los Angeles County. The study was conducted at Friends Community Center, the Hollywood, CA community-based site of Friends Research Institute. The Friends Research Institute, Inc. Institutional Review Board provided oversight for all study activities.

Potential participants were deemed eligible for the study if they were active participants in the HIV prevention program, as defined by verified attendance in a minimum of three groups or counseling sessions; at least 18 years of age; substance-dependent (verified by the Structured Clinical Interview for DSM-IV [SCID] assessment; Spitzer et al. 1995); nontreatment seeking; homeless; and self-reported sex with a man in the previous 12 months. Individuals were excluded if they did not meet all criteria, were unable to understand the consent forms (unable to pass a consent quiz), or were determined, based on SCID results, to have a psychiatric condition requiring a higher level of care (for example, those assessed as being in a current manic or psychotic episode, not taking medication for those conditions, and/or unwilling to be referred to a local mental health clinic for psychiatric evaluation).

Procedure

Participants were recruited from April 2005 through February 2008. Study procedures, interventions, and primary outcomes are described elsewhere (Reback et al. 2010), thus a brief summary is presented here. The study utilized a two-group randomized, controlled experimental design with repeated measures. Data were collected at baseline, biweekly during the intervention period (24 weeks), and at seven-, nine- and 12-months post-randomization follow-up evaluations. After a comprehensive description of study procedures and potential risks/benefits, participants provided informed consent and were randomized to a CM or control condition. Participants in both conditions earned points for attending scheduled semiweekly study visits and participating in the

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HIV prevention program activities. Participants in the CM condition also earned points for alcohol and other drug abstinence and for completion of targeted health-promoting behaviors. Points earned during the 24-week intervention period acted as the study's CM incentive and were redeemable at an onsite store that participants could access during any study visit. Each point earned was equivalent to $1 in purchasing power.

Outcomes Evaluated

Drug and alcohol abstinence. Substance use was measured through urine drug screens, breathalyzer, and through participants' self-reports. At all study visits a urine drug screen using a six-panel FDA-approved urine test cup (Accutest - JANT Pharmacal, Inc.) was administered. Metabolites for amphetamines, methamphetamine, cocaine, PCP, THC and opioids were screened. An alcohol breathalyzer (Alco-Sensor III, Intoximeters Inc.) was also utilized. Drug and alcohol testing was administered twice-weekly, on two nonconsecutive days. An aggregate variable was created to represent the combination of stimulants and alcohol, which are frequently used substances in the study population (Reback, Shoptaw & Grella 2008). Urine samples free of metabolites for amphetamines (including methamphetamine), cocaine, and breathalyzer results indicating a blood alcohol level less than .05 g/dl (slightly more than half the California legal driving limit) (Barnett et al. 2011) at each time point were aggregated into a composite measure known as the Treatment Effectiveness Score (TES; Ling et al. 1997). The TES is the total number of substance metabolite-free urine samples and breathalyzer results provided by each participant during the intervention period, divided by the total number of scheduled urine samples (48 in the present study), providing a proportional measure of abstinence adherence. Participants were also administered the Addiction Severity Index (ASI; McLellan et al. 1992) which measures addiction-related problems across seven domains (drug use, alcohol use, medical, psychiatric, legal, family/social, and employment/support). Included in these questions are self-report items regarding recent and lifetime substance use. Participants were asked about their lifetime use of both individual substances (e.g., methamphetamine, cocaine), as well as polysubstance use (i.e., self-reported number of years simultaneously using two or more of the substances included on the ASI).

Health-promoting behaviors. Behaviors that could be verified, such as requesting a referral to a medical, psychiatric, or social service agency; scheduling and attending an appointment; enrolling in a General Education Development (GED) certificate program; or obtaining a job were assigned point values, as was attendance at scheduled study visits. The number of health-promoting behavior points that participants could earn during the 24-week intervention period was unlimited, and the total amount of points earned is the operationalized measurement of how many targeted health behaviors the participant performed.

Sexual risk behaviors. The Behavioral Questionnaire—Amphetamine (BQA; Chesney, Chambers & Kahn 1997) was administered to determine recent sexual risk behavior. The BQA is an interview questionnaire validated for use with methamphetamine-dependent samples (Twitchell et al. 2002) that measures recent sexual risk behaviors. Unprotected anal intercourse is defined as any insertive or receptive anal intercourse with a male during which a condom was not used. The BQA was collected at baseline, every four weeks through the intervention, and at the seven-, nine- and 12-month evaluations.

Treatment responders. Of the 131 study participants, 64 were randomized into the CM condition. Treatment responders were defined as those individuals in the CM condition who scored at or above the median score on all three primary treatment outcomes relevant to the study: (1) TES (i.e., proportional adherence to abstinence from stimulants and alcohol (mean = .28, median = .21, SD = .24); (2) targeted health-promoting behavior earnings (mean = 327.73, median = 188, SD = 432.49); and (3) attendance to scheduled study visits (mean = .52, median = .55, SD = .30). The rationale for distinguishing responders from nonresponders along these three dimensions was derived directly from the structure of the CM intervention. The CM intervention was designed to produce greater levels of abstinence and health promoting behaviors in participants, and CM incentives were tied directly to these two outcomes and attendance to scheduled study visits. As such, a "responder" has been defined as an individual that scored above the median on all three of these outcomes. Of the 64 participants randomized into the CM condition, 17 (26.6%) met this standard and were identified as "treatment responders."

Statistical Analysis

T-tests for the difference in means were carried out to evaluate baseline characteristics and differences among responders and nonresponders. Because treatment responder status is partially determined by substance use outcomes, treatment responders and nonresponders cannot be assumed to be derived from the same population in terms of substance use, and the statistical correction for unequal sample variances was applied to all t-tests involving substance use (e.g., lifetime methamphetamine use). To further account for differences between participants in the responder/nonresponder groups, multivariate analyses were carried out which regressed responder status on lifetime substance use, sexual behaviors at baseline, and sociodemographics. Given the dichotomous nature of the outcome variable (responder/nonresponder) and the cross-sectional nature of the covariates, multivariate logistic regressions were used. Given the small sample size,

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TABLE 1
Treatment Responders versus Nonresponders (N = 64)

Characteristic	Responders (N = 17) N (%) or Mean (SD)	Nonresponders (N = 47) N (%) or Mean (SD)	Total (N = 64) N (%) or Mean (SD)
Race/Ethnicity			
Caucasian/White	13 (76.5%)*	22 (46.8%)*	35 (54.7%)
African American/Black	3 (17.7%)	11 (23.4%)	14 (21.9%)
Hispanic/Latino	1 (5.9%)	10 (21.3%)	11 (17.2%)
Other/Multiracial	0 (0%)	4 (8.5%)	4 (6.3%)
Lifetime Cocaine Use (Years)	2.5 (3.6)*	5.9 (7.7)*	5 (7)
Lifetime Methamphetamine Use (Years)	3.8 (4.2)*	6.7 (6.7)*	5.9 (6.1)
Lifetime Polysubstance Use (Years)	7.8 (4.4)*	12.9 (8.5)*	11.6 (7.9)
# Male Sexual Partners (Last six Months)	11.8 (16.7)†	5.5 (8.5)†	7.2 (11.4)
# Unprotected Anal Intercourse (Last Six Months)	24.9 (61.4)*	2.5 (9.9)*	8.5 (33.6)

†$p \leq .1$; *$p \leq .05$
All sig. tests two-tailed.

significant findings are reported at $\alpha = .1$ (two-tailed tests). All analyses were conducted using an "intent-to-treat" model (i.e., all participants were included in the analyses, regardless of whether they completed the full intervention period). Analysis was conducted using Stata v10 SE (StataCorp).

RESULTS

The full study sample was comprised of 131 participants who were Caucasian/White (53%), African American/Black (23%), and Hispanic/Latino (17%); had a mean educational attainment of a high school or high school-equivalent education (mean = 12.4 years of education; SD = 2.8); and whose mean age was 36 (SD = 9). Approximately 28% reported an HIV-seropositive status at baseline. Methamphetamine was the most frequently used drug (63%), followed by cannabis (34%), alcohol (33%), and crack cocaine (19%) (Reback et al. 2010).

Treatment Responders versus Nonresponders

Treatment responders were more likely to be Caucasian/White than treatment non-responders (76.5% vs. 46.8%; p < .05) (see Table 1). While there were no significant differences between treatment responders and nonresponders across any other racial category, it should be noted that while there were 14 Hispanic/Latino and multiracial nonresponders, there was only one Hispanic/Latino treatment responder. With a larger sample size, this difference may have reached significance. Additionally, treatment responders and nonresponders showed no significant differences in terms of age, educational attainment, or HIV status (results omitted).

Treatment responders reported significantly fewer years of lifetime cocaine use than nonresponders (2.5 [SD = 3.6] vs. 5.9 [SD = 7.7]; $p < .05$), fewer years of lifetime methamphetamine use than nonresponders (3.8 [SD = 4.2] vs. 6.7 [SD = 6.7]; $p < .05$), and fewer years of lifetime polysubstance use than nonresponders (7.8 [SD = 4.4] vs. 12.9 [SD = 8.5]; $p < .05$). Additionally, treatment responders' mean number of male sexual partners in the previous six months was more than twice that of nonresponders (11.8 [SD = 16.7] vs. 5.5 [SD = 8.5]; $p = .0587$), and their mean number of reported unprotected anal intercourse events was ten times that of the nonresponders (24.9 [SD = 61.4] vs. 2.5 [SD = 9.9]; $p < .05$).

The results of five multivariate logistic regressions are presented in Table 2, each estimating the effects of a lifetime substance use or sexual behavior variable on responder status while controlling for the sociodemographic characteristics of race, age, HIV status, and education. Only years of lifetime cocaine use fails to reach significance at $\alpha = .1$ while controlling for sociodemographics. Each of the estimated effects occurs in the same direction as was found at the zero-order level. A sixth analysis was carried out which regressed responder status on all predictors and sociodemographics simultaneously, but issues of multicollinearity arose due to the small sample size. The resultant full model (results not shown) produced a significantly good fit to the data ($\chi^2_9 = 24.31$; $p < .01$), and provided a robust estimate of the explained variance (pseudo $R^2 = .35$), but failed to produce any significant predictors, a clear indicator of artificially inflated standard errors.

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TABLE 2
Multivariate Logistic Regressions of Responder Status on Lifetime Substance Use, Sexual Behaviors, and Sociodemographics (N = 64)

Models	Predictor	AOR (SE)	Sig.
Model 1	Lifetime Cocaine Use	0.91 (0.07)	$p = 0.22$
Model 2	Lifetime Methamphetamine Use	0.86 (0.06)	*
Model 3	Lifetime Polysubstance Use	0.86 (0.05)	**
Model 4	# Male Sexual Partners	1.05 (0.03)	†
Model 5	Unprotected Anal Intercourse	1.02 (0.01)	†

† $p \leq .1$; * $p \leq .05$; ** $p \leq .01$
Statistical Controls: Race/Ethnicity, Age, Education, HIV Status

DISCUSSION

Implementing CM in a community-based HIV prevention program for homeless, nontreatment seeking, substance-dependent MSM represents an early effort to intervene with this population as well as a novel use of CM. The analysis reported here reveals that a subgroup of participants in the CM condition who achieved better outcomes relative to the entire CM group could be distinguished along two primary factors: lifetime substance use, and HIV sexual risk behaviors. There were also significant differences in the racial/ethnic make-up of the two groups.

Treatment responders were significantly more likely to be Caucasian/White than nonresponders. Given the overrepresentation of racial and ethnic minorities in homeless, substance-using populations (Johnson et al. 1997; Hopper 1996; Link et al. 1994), this racial disparity in outcomes is of potential concern for service and treatment providers. Future work with this population might include qualitative measures of participant satisfaction to identify factors associated with a differential response based on race/ethnicity.

Treatment responders reported significantly fewer years of lifetime stimulant (methamphetamine and cocaine) and polysubstance use. As severity of dependence tends to increase with length of stimulant use, results suggest the magnitude and reinforcement schedule of the CM condition was powerful enough to override the drug reinforcement paradigm of participants with shorter lifetime substance use histories. They also suggest that the magnitude and schedule of the CM condition was not powerful enough to compensate for the longer-established reinforcement paradigms of those with longer substance use histories.

This clear association between years of lifetime substance use and response to CM has implications for future work. On the one hand, targeting interventions to those with fewer years of lifetime stimulant and/or polysubstance use could optimize health outcomes and provide the greatest cost benefit. On the other hand, providing a CM schedule and magnitude of reinforcers based on reported years of stimulant and/or polysubstance use might improve outcomes among those with a greater lifetime history of substance use. The tailoring of CM interventions to optimize outcomes is supported in the literature. A meta-analysis of 30 CM studies that examined variables thought to moderate CM effect sizes revealed that more immediate voucher delivery and greater monetary value of the voucher were associated with larger effect sizes (Lussier et al. 2006). Additionally, schedules providing enhanced or escalating reinforcement contingent specifically on sustained abstinence from methamphetamine or cocaine result in better outcomes than low or fixed schedules (Sindelar, Elbel & Petry 2007; Roll et al. 2006; Petry et al. 2004; Silverman et al. 1999). Greater voucher magnitude has also been shown to increase attendance and length of participation in substance abuse continuing care for veterans (Businelle et al. 2009). Thus, service programs and research studies employing CM interventions might utilize any or all of these strategies (e.g., escalating reinforcement, greater voucher magnitude) to enhance outcomes among specific subgroups of substance users.

Treatment responders also reported significantly more sexual partners, and significantly more HIV sexual risk behaviors at baseline than nonresponders. This implies an association between fewer years of lifetime stimulant and/or polysubstance use, as noted above, and greater sexual partners and risk behaviors. Thus, it may be that sexual activity declines with longer lifetime use of stimulants due to progressively severe medical and psychological effects. Additionally, the greater magnitude of HIV sexual risk associated with treatment responder status may imply that those who are at the greatest risk for acquisition or transmission of HIV or other sexually transmitted infections are the most likely to respond favorably to a CM intervention. This is encouraging, as HIV infection rates continue to be disproportionately high in this population (Shoptaw & Reback 2006), thus interventions that show high efficacy in reducing substance use and increasing health-promoting behaviors in such a high-risk population are extremely important for reducing HIV transmission rates. Future studies would, ideally, seek to replicate and expand upon this finding.

The findings reported here are limited by the parameters of the parent study (Reback et al. 2010): the work was conducted with homeless, nontreatment-seeking, substance-dependent MSM enrolled in an urban HIV prevention program. Findings from these secondary analyses are likely not generalizable beyond this population. However, even if these findings are only reproducible in similar populations (e.g., urban, homeless, substance-using MSM), the finding that those with the highest level

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of sexual risk are the most likely to respond is very encouraging. Also, the nature of the research question limited us to performing exploratory analyses from which we cannot infer causality. However, the secondary analyses did yield significant findings that are not typically reported and that may have major implications for further work in this area and with this, or similar, populations. Researchers or service providers looking to define and characterize responders should be careful to do so in a way that is meaningful to their stated goals, can clearly distinguish between participants, and that best reflect the needs of their target population. Care should be taken to review and understand content and substantive importance of the variables chosen to define responder status.

The application of evidence-based interventions continues to be a public health priority, especially in the effort to implement effective interventions for use in community settings. The identification of both treatment responders as well as nonresponders is important for intervention development, both in service programs and research studies, to optimize outcomes. Understanding the characteristics of nonresponders is useful in identifying those individuals who may require a more intense and higher magnitude intervention to produce similar outcomes. Conversely, the identification of treatment responders provides a benchmark of success for tailoring of interventions for highly impacted populations such as homeless, substance-dependent MSM.

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