Correlates of Stimulant Treatment Outcome Across Treatment Modalities

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Abstract

Objective—This study evaluated variables associated with stimulant use outcomes in stimulant users (N = 800) receiving care in community outpatient psychosocial or methadone maintenance treatment clinics as part of a national multi-site clinical trial.

Methods—Results from the full sample were examined first, and then predictors were examined separately in the two treatment modalities.

Results—A cocaine-positive urine sample at study intake was the most robust and consistent correlate of stimulant use outcome in all analyses. Psychiatric distress, social environment and employment had differential effects on outcome across modalities.

Conclusions/Significance—This study confirms that intake assessments have considerable value in identifying problems to be addressed in treatment.

Keywords

cocaine; methamphetamine; methadone maintenance; outpatient psychosocial; treatment outcome

Stimulant abusers most often present for psychosocial treatment, but stimulant abuse also occurs in about half of methadone maintained patients (1). Typically, stimulant abuse treatment in either setting consists of individual and group counseling based on 12-step and cognitive-behavioral principles. Another powerful intervention for stimulant use in both psychosocial and methadone settings is contingency management, which provides tangible positive reinforcers for drug-negative urine results (2). Little research to date has compared characteristics or predictors of outcome in stimulant abusers who are treated in these different modalities, although identifying similarities and differences would help determine whether treatment for stimulant use may need to vary across modalities.

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One of the most consistent predictors of during-treatment stimulant abstinence, regardless of treatment modality, is early or pre-treatment stimulant use, which can be conceptualized as a marker of drug use severity. In outpatient psychosocial settings, a cocaine-positive urine result at intake predicts lower rates of cocaine abstinence (3), shorter retention in treatment (4), or both (5). In methadone maintenance clinics, a cocaine-positive intake urine test result is associated with lower rates of during-treatment abstinence (6–8). Recent work suggests that methamphetamine use early in treatment has a similar predictive value (9). Although less commonly included in studies of stimulant outcomes, another marker of drug use severity is comorbid substance use disorders. Available research is equivocal with regard to the predictive value of non-stimulant drug use on stimulant outcomes across modalities. Alcohol use was associated with poorer stimulant outcomes in one study (10) but unrelated to outcomes in another (6), and cannabis use is typically a neutral factor or associated with better outcomes (11–12).

Several characteristics aside from drug use severity have also been implicated in treatment outcome for stimulant users across treatment modalities. Drug-free social networks are commonly related to better treatment outcome (13), as is economic stability provided by a strong current and past employment history (14). Psychiatric history and problem severity are associated with poorer prognosis (10). Criminal justice system involvement is positively associated with outcome when treatment is a condition of probation or parole (15), and when outpatient treatment immediately follows a stay in a controlled environment, such as jail or prison (16).

A multi-site study conducted within the National Drug Abuse Treatment Clinical Trials Network (CTN) recruited over 800 stimulant users nationwide from psychosocial (17) and methadone maintenance (18) treatment modalities, who received similar treatments for stimulant use and were carefully followed with respect to objective indicators of drug use over a 12-week treatment period. This large and heterogeneous sample of stimulant abusers permitted in-depth analyses of predictors of outcome within and across modalities. Our primary hypotheses were: 1) stimulant abusers treated in the two modalities would differ on some patient characteristics including drug use severity at study entry; 2) recent stimulant use at study entry would be strongly associated with stimulant use outcomes in both modalities; and 3) other predictors of stimulant outcomes would vary across modalities, with methadone maintained stimulant abusers showing greater correlation of poor psychosocial functioning with poor outcome.

Method

Participants

Data for this secondary analysis come from a CTN study that tested the benefit of adding lower-cost incentives for stimulant abstinence to usual care treatment in 8 outpatient psychosocial and 6 methadone maintenance treatment clinics across the country. Complete details about study methods are provided elsewhere (17–18). Outpatient psychosocial treatment patients were new admissions and those in methadone maintenance were in treatment for an average of 9 months (range: 1 month to 3 years). The original study reported on 415 participants in outpatient psychosocial treatment and 388 participants in methadone maintenance treatment. All participants provided written informed consent, in accordance with local institutional review board regulations. Three participants (1 outpatient psychosocial, 2 methadone maintenance) were excluded for the present study because they were missing intake urine result data.

Procedures and Instruments

Participants completed an intake assessment on the first day of the study that included: 1) a shortened version of the Addiction Severity Index (ASI; 19); 2) an interviewer-administered checklist of DSM-IV substance use disorder symptoms for alcohol, methamphetamine, cannabis, cocaine, and opiates; 3) demographic information; and 4) the Brief Symptom Inventory (BSI; 20). A breath alcohol and a urine sample were collected and immediately tested for cocaine, methamphetamine, amphetamine, tetrahydrocannabinol (cannabis), and morphine. During the 12-week study, all participants were expected to provide two breath and urine samples per week for a possible total of 24 samples. The target of the intervention study was stimulant use; primary outcomes have been reported previously (17–18).

Study Variables

Twenty-three independent variables were chosen for analysis, based on study hypotheses regarding drug use severity and other characteristics. Treatment modality (outpatient psychosocial vs. methadone maintenance) was both an independent variable and a stratification variable. Demographic variables included age, gender, and race. Characteristics of social environment were measured by ASI items on marital status (married/cohabiting vs. other status), report of living with a drug or alcohol user (yes vs. no), current employment (at least part-time vs. no employment), and usual employment (employed at least part-time in the past three years vs. not typically employed). Legal problem severity was represented by ASI items on recent incarceration in the past 30 days (yes vs. no) and current probation or parole (yes vs. no). Current psychiatric distress was represented by the BSI Global Symptom Index T-score, split at one standard deviation above the mean (i.e., 55 and over vs. below 55). A history of any prior psychiatric treatment (yes vs. no) was created from ASI items about inpatient and outpatient treatment. Drug use severity was measured with the following: 1) a report on the ASI of inpatient drug abuse treatment in the past 30 days (yes vs. no); 2) results of the urine/ breath sample given at study intake (positive vs. negative on each test); and 3) 12-month substance use disorder diagnoses.

The dependent variable used was the number of stimulant-negative urine results provided during the 12-week study intervention. This measure incorporates study retention, attendance, and during-study drug use, which makes it ideal for use in clinical trials of drug treatment (21). It was particularly appropriate in the current study because it could adequately characterize study outcome for both outpatient psychosocial treatment, where study retention was the primary outcome influenced by incentives (17), and methadone maintenance treatment, where ongoing stimulant use was the primary outcome influenced by incentives (18).

Statistical Analyses

Distributions and inter-variable associations were examined prior to analysis. The distribution of the number of stimulant-negative urine results was neither normal nor Poisson, but it was not highly skewed and the kurtosis approached 1. Attempts to normalize the variable were unsuccessful. In our judgment, this dependent variable remained the best choice for the planned analyses and its characteristics did not strongly violate assumptions for mixed model regression. Most independent variables were not strongly correlated, except treatment modality with cocaine or opiate positive. The effect of potential multicollinearity was considered minimal, considering the utility of the variables, and all were retained.

Participants from each treatment modality were compared on the continuous dependent variable using t-test, and on dichotomous independent variables using prevalence ratios with 95% confidence intervals. Regression modeling (using the SPSS mixed procedure) consisted of entering all variables simultaneously into a full model with number of stimulant-negative urine results as the dependent variable adjusting for site as a random effect. Participants with

missing data were excluded, slightly reducing the usable sample from 800 to 775 participants. There was an *a priori* plan to compare the regression models stratified by treatment modality, collapsed across intervention groups. Full models are presented with unstandardized beta coefficients (B), standard error (SE) and significance for each variable. To allow comparison of results across models, all p-values under .1 are presented, with those significant at *p* < .05 or lower indicated in bold. Analyses were conducted using SPSS (version 13 for Mac OS X).

Results

Participant Characteristics

Characteristics of the study sample and comparisons across treatment modality are presented in Table 1. Psychosocial outpatient participants submitted more stimulant-negative urines during the study than methadone maintenance participants. In addition, methadone maintenance participants were more likely to be cocaine- and opiate-positive and less likely to have a methamphetamine, cannabis or alcohol use disorder.

Models Predicting Outcome in Full Sample

The full regression model is shown in Table 2 (left-hand columns). The single largest effect was for participants who were cocaine-positive at study intake, which resulted in nearly 8 fewer stimulant-negative urine results of a possible 24 provided during the study. Site was not significant (B (SE) = 2.15 (1.38), *p* = .119).

Models Predicting Outcome in Outpatient Psychosocial and Methadone Maintenance Samples

As shown in Table 2 (right-hand columns), the pattern of outcome correlates was overlapping but not identical for the outpatient psychosocial and methadone maintenance treatment modalities. Again, the largest effect on outcome in both modalities was associated with submitting a cocaine-positive urine sample at study intake, and the magnitude of this effect was very similar across modalities. Site did not contribute significantly to outcome in either the outpatient psychosocial sample (B (SE) = 3.15 (2.50), *p* = .207) or the methadone maintenance sample (B (SE) = 0.59 (1.08), *p* = .585).

Discussion

Treatment Modality Sample Comparisons

A number of cross-modality sample differences were identified in this study. In support of our hypothesis about overall drug use severity levels, participants in outpatient psychosocial counseling treatment submitted far more stimulant-negative urine samples during treatment than did methadone-maintained stimulant users. In addition, outpatient psychosocial participants had a profile suggesting greater social stability (i.e., marriage and employment) as well as more criminal justice system involvement. These characteristics likely indicate more external contingencies have been placed on the drug use of outpatient psychosocial stimulant users. Accordingly, outpatient psychosocial participants were much less likely than those in methadone maintenance to enter treatment with recent cocaine use, in spite of being more likely to meet criteria for methamphetamine, cannabis, or alcohol use disorders. These results highlight the important population differences that must be taken into account when treatment outcomes are considered.

Early Stimulant Use as Predictor

One of the striking findings of the present study was the powerful predictive value of the intake urinalysis test results, with the submission of a cocaine-positive urine sample at study entry

reducing the expected number of during treatment stimulant-negative urine results by one-third (8 out of 24) in all participants regardless of treatment modality. Interestingly, a methamphetamine-positive result was also associated with a poorer stimulant use outcome, although the magnitude of the effect was smaller. Clearly, drug use severity is a robust predictor of drug use outcomes across settings, and these data suggest that intake urine test results are a useful marker of severity. The finding is consistent with earlier work identifying intake and early treatment urine results as strong predictors of stimulant use during treatment (e.g., 3, 8) but greatly expands its reach to different treatment modalities and drug use profiles (cocaine vs. methamphetamine) in community-based treatment clinics nationwide.

Other Predictors: Similarities and Differences

As hypothesized, the population differences between modalities were associated with a mixed pattern of non-stimulant predictors of stimulant use outcome. While a cannabis-positive urine result, which suggests current active use, was associated with a poorer outcome, cannabis use disorder was associated with a better treatment outcome across modalities. Recent cannabis use may serve as a marker of ongoing polydrug use in this sample, which is more resistant to intervention than is single-drug use (2). Although counterintuitive, better stimulant outcomes for patients with cannabis use disorders have been reliably shown in both outpatient psychosocial (11) and methadone maintenance settings (12). Overall, the cannabis data suggest that urinalysis testing should routinely include cannabis, since current use may be an additional negative risk factor for outcome in patients who use stimulants.

Outpatient psychosocial patients who endorsed high ratings of psychiatric distress at study entry had fewer stimulant-negative urine results, although this pattern did not hold for methadone maintenance patients. Psychiatric distress has been related specifically to poorer retention, which is more relevant for the outpatient psychosocial sample and is incorporated into the outcome variable used here (10). For methadone maintenance patients, but not outpatient psychosocial patients, living with people who use drugs had a significant negative effect on their ability to abstain from stimulants. Continued association with drug users while in treatment signifies a more pervasive drug-related lifestyle that will likely require specific attention to building drug-free social networks (13). The positive prognosis conferred by a history of employment in the outpatient psychosocial sample is consistent with a body of literature showing that employed drug-dependent patients have better retention and higher abstinence rates than unemployed patients (22). Interestingly, *current* employment was a negative predictor for methadone maintenance patients, which suggests that employment is not protective while drug use is ongoing (23). All of these variables are modifiable by treatment, which suggest that psychiatric care and social stability should be incorporated into treatment plans with different targets in each modality.

Study Limitations

The present study has two limitations that are common to any regression analysis examining influences on treatment outcome. First, the findings from this study may have depended on the particular sample employed, as well as the particular independent and dependent variables chosen. For example, we used stimulant urine test results as one measure of drug use severity rather than self-reported stimulant use, which has also been strongly correlated with stimulant use outcomes (e.g., 24). The results may have been different had self-report measures been used, although objective indicators of drug use are typically more reliable (25). Second, the reader is cautioned against overinterpretation of the final models as representing causative relationships. More longitudinal research is needed to establish causation, although it is suggested that the significant variables from this study be included in future work.

Summary

This study found that stimulant use severity, as measured by intake urine results, provided highly valuable information, with a positive result being robustly and consistently associated with significantly poorer stimulant outcomes in both outpatient psychosocial and methadone maintenance settings. Although similar results have been reported before, this is the first study to do so in a large, geographically- and treatment-diverse community-based sample of stimulant users and to directly compare outcomes for two treatment modalities. Other drug use, as well as social network and stability, was related to stimulant outcome differently across treatment settings. Early treatment drug use and psychosocial functioning is predictive of during-treatment stimulant use and should be routinely collected and incorporated into each patient's treatment.

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Table 1

Participant characteristics compared across treatment modality

Variable	Full sample (N=800)	Outpatient psychosocial[a] (n=414)	Methadone maintenance[b] (n=386)	Prevalence Ratio
Number of stimulant-negative urine results[c]	9.15 (0.30)	11.11 (0.42)	7.05 (0.40)	$t(797.69) = 6.95$ **$p < .001$**
Demographic characteristics				
Age 40 years or more	45	31	60	**0.52 (0.44, 0.61)**
Female	50	55	44	**1.26 (1.09, 1.45)**
Caucasian	31	36	26	**1.36 (1.10, 1.68)**
Social characteristics				
Married/cohabiting	19	24	14	**1.72 (1.27, 2.34)**
Lives with a drug user	23	21	25	0.83 (0.64, 1.07)
Currently employed	34	35	32	1.09 (0.89, 1.32)
Usually employed	58	65	50	1.32 (1.17, 1.49)
Legal problem severity				
Recent incarceration	8	12	4	**2.69 (1.58, 4.58)**
Current probation or parole	26	35	16	**2.23 (1.71, 2.91)**
Psychiatric severity				
High psychiatric distress	19	18	19	0.98 (0.74, 1.32)
Prior psychiatric treatment	51	49	53	0.92 (0.81, 1.06)
Drug use severity				
Recent inpatient drug treatment	13	24	1	**23.31 (8.66, 62.71)**
Drug positive at study intake				
Cocaine	43	17	71	**0.24 (0.19, 0.30)**
Methamphetamine	8	9	7	1.38 (0.85, 2.25)
Cannabis	12	11	12	0.87 (0.60, 1.28)
Alcohol	1	1	1	0.70 (0.16, 3.11)
Opiate	24	3	47	**0.07 (0.04, 0.12)**
Substance use disorder				
Cocaine	69	60	79	**0.76 (0.69, 0.84)**
Methamphetamine	18	27	8	**3.63 (2.48, 5.33)**
Cannabis	15	21	8	**2.50 (1.70, 3.68)**
Alcohol	30	42	17	**2.51 (1.96, 3.22)**

Note. Results are presented as percent of column sample, and comparisons are given as prevalence ratios with 95% confidence intervals, except where noted. The reference category is methadone maintenance treatment modality.

[a]Outpatient psychosocial sample is missing 0–1 participants per variable.

[b] Methadone maintenance sample is missing 0–14 participants per variable.

[c] Mean (SEM); t-test comparison.

Table 2

Variables associated with number of stimulant-negative urine results in outpatient psychosocial and methadone maintenance treatment samples

Variable	Full Model (N = 775)		Outpatient psychosocial (n = 412)		Methadone maintenance (n = 363)	
	Adjusted B (SE)	p-value	Adjusted B (SE)	p-value	Adjusted B (SE)	p-value
Outpatient psychosocial treatment	−1.17 (1.10)	ns	--	--	--	--
Abstinence Incentive group	2.98 (0.52)	**<.001**	3.00 (0.77)	**<.001**	2.80 (0.70)	**<.001**
Demographic variables						
Age 40 years or more	0.84 (0.57)	ns	1.51 (0.87)	.085	0.37 (0.76)	ns
Female	−0.88 (0.57)	ns	−0.29 (0.89)	ns	−1.37 (0.73)	.063
Caucasian	−1.07 (0.63)	.093	−0.98 (0.92)	ns	−1.37 (0.89)	ns
Social characteristics						
Married/cohabiting	1.05 (0.67)	ns	0.77 (0.91)	ns	1.95 (1.06)	.066
Lives with drug user	−1.30 (0.63)	**.041**	−0.98 (0.97)	ns	−1.76 (0.84)	**.036**
Currently employed	−1.30 (0.62)	**.038**	−0.61 (0.91)	ns	−2.31 (0.94)	**.015**
Usually employed	1.35 (0.59)	**.023**	1.96 (0.87)	**.025**	1.42 (0.88)	ns
Legal problem severity						
Recent incarceration	1.74 (0.98)	.078	1.65 (1.28)	ns	2.86 (1.72)	.098
Current probation or parole	−0.52 (0.63)	ns	−0.72 (0.86)	ns	0.09 (0.98)	ns
Psychiatric severity						
High psychiatric distress	−0.50 (0.70)	ns	−2.03 (1.03)	**.050**	1.16 (0.96)	ns
Prior psychiatric treatment	−0.33 (0.57)	ns	−0.37 (0.86)	ns	−0.41 (0.77)	ns
Drug use severity						
Recent inpatient drug treatment	0.35 (0.93)	ns	0.79 (1.09)	ns	−2.58 (3.90)	ns
Drug positive at study intake						
Cocaine	−7.93 (0.70)	**<.001**	−7.72 (1.16)	**<.001**	−8.21 (0.90)	**<.001**
Methamphetamine	−3.63 (1.17)	**.002**	−2.82 (1.51)	.063	−6.58 (2.27)	**.004**

Variable	Full Model (N = 775)		Outpatient psychosocial (n = 412)		Methadone maintenance (n = 363)	
	Adjusted B (SE)	p-value	Adjusted B (SE)	p-value	Adjusted B (SE)	p-value
Cannabis	−3.37 (0.94)	.001	−3.75 (1.37)	.007	−3.27 (1.33)	.014
Alcohol	1.04 (2.95)	ns	3.07 (4.50)	ns	−1.83 (3.95)	ns
Opiate	−1.20 (0.71)	.094	0.27 (2.19)	ns	−1.41 (0.72)	.052
Substance use disorder						
Cocaine	−1.33 (0.71)	.061	−1.68 (1.09)	ns	−1.01 (0.94)	ns
Methamphetamine	−0.44 (1.06)	ns	−0.72 (1.38)	ns	0.99 (2.19)	ns
Cannabis	2.33 (0.84)	.006	2.20 (1.08)	.042	3.89 (1.49)	.010
Alcohol	−0.22 (0.64)	ns	0.28 (0.87)	ns	−1.25 (1.02)	ns

Note. All analyses were mixed model regressions adjusting for site as a random effect.