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Process-of-Care Measures as Predictors of Client Outcome Among a Methamphetamine-Dependent Sample at 12- and 36-Month Follow-ups

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Abstract

This study examines the utility of several process-of-care performance measures (initiation, engagement, retention, and monitoring of drug use during treatment) as predictors of methamphetamine (MA) use outcomes at 12- and 36-month follow-ups. MA-dependent individuals (n = 871) participated in a randomized, controlled trial of outpatient psychosocial treatment from 1999–2002 and completed 12- and 36-month follow-up interviews. This sample included a treatment-as-usual group (n = 436) and a 16-week Matrix treatment (n = 435) group. Significant associations were observed between select process-of-care measures and MA use outcomes at both follow-ups. While correlational analyses showed an association between MA abstinence at follow-up and enhanced treatment engagement and retention, mixed logistic regression analyses indicated that sustained abstinence from MA during outpatient treatment was the strongest predictor of testing negative for MA use at both follow-ups. Results suggest that monitoring client drug use during treatment may be a useful process-of-care measure with MA-dependent users.

Keywords

client outcomes; methamphetamine; performance measurement; processes of care

Pressures from federal, state, and local substance abuse agencies have directed the public treatment system for substance use disorders to adopt a performance measurement

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framework, placing a strong emphasis on assessing the extent to which processes of care are related to client outcomes (McLellan, Chalk & Bartlett 2007). Processes of care that have received the most attention include providing accessible care (Herbeck, Hser & Teruya 2008; Lamb, Greenlick & McCarty 1998), engaging and retaining clientsin treatment (Capoccia et al. 2007; McCarty et al. 2007), using practices based on evidence (SAMHSA 2007), monitoring client progress during treatment (McLellan et al. 2005), enhancing client perceptions of care (Bartlett et al. 2005), and ensuring care continuity (Dennis & Scott 2007; Godley et al. 2007).

Recently, important and practical health services research has demonstrated that focusing on administrative and clinical processes of care can dramatically improve engagement and retention rates in existing treatments (Capoccia et al. 2007; McCarty et al. 2007). However, to date, attempts at linking programmatic processes of care with client outcomes have only occurred recently. Of the available public sector research, evidence supports the idea that processes of care are related to positive outcomes among clients in publicly-funded outpatient treatment programs. Specifically, Garnick and colleagues (2007) have found significant associations between process measures of initiation/engagement and decreased criminal involvement. Another study found an association between continuity of care and substance use abstinence among youth three months after their residential treatment (Garner et al. 2010).

Performance-outcome related studies conducted among Veterans Administration (VA) patients show mixed results. Utilizing case-mix adjustment, Harris, Humphreys and Finney (2007) observed no association between process measures of identification and engagement and improvements in VA patient clinical outcomes. However, when process-level effects are controlled for, the associations between process-of-care performance measures on patient outcomes become apparent, in that VA patients who are adequately engaged in care improved significantly more in the alcohol, drug, and legal domains of the Addiction Severity Index than patients who did not engage (Harris et al. 2008). Researchers suggest that mixed findings from studies examining the association of performance measures with improvements in outcomes may be due to differences in methodology and clinical settings rather than the measures themselves; hence, researchers are advised to be cautious in their interpretations (Harris, Humphreys & Finney 2007; McCarty et al. 2007).

In the health care realm, patient compliance, or adherence with the treatment regimen, is a standard process measure linked to positive outcomes. An important process-of-care measure that should be emphasized in the treatment community is the monitoring of client drug use during treatment, especially since an expected clinical/treatment goal for patients is drug abstinence. Abstinence during treatment, especially the number of consecutive weeks of drug-free urine samples, has been linked to successful client outcomes among stimulant users in several clinical studies (Pettinati et al. 2008; Rawson et al. 2004; Reiber et al. 2002; Higgins, Badger & Budney 2000; Shoptaw et al. 1994).

Admission patterns for MA use in publicly funded programs over the past years have remained fairly stable, wavering between 12% and 13% of total treatment admissions (SAMHSA 2009). In the present study, we explore the utility of several process-of-care performance measures as predictors of MA abstinence outcomes at 12-and 36-month follow-ups among a cohort of MA users who participated in the Methamphetamine Treatment Project.

METHODS

Sample

This sample included 1,016 MA-dependent individuals who participated in a multisite psychosocial treatment clinical trial for MA dependence, called the Methamphetamine Treatment Project (MTP), between 1999 and 2002 (see Herrell et al. 2000). MTP participants were randomized to eight different outpatient treatment programs in California, Montana, and Hawaii. Eligibility requirements included adult status (18 years or older), treatment seeking, MA dependence according to *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV; APA 1994) criteria, current MA use (use of MA in the month prior to treatment admission), English language proficiency, ability to provide informed consent, and residency in the same geographic area of the treatment program. Exclusion occurred if individuals exhibited severe medical or psychiatric impairment that warranted hospitalization or other primary treatment. Follow-up interviews were completed after treatment discharge from the MTP at 12 and 36 months. Approximately 875 participants completed the 12-month follow-up interview and 587 completed the 36-month follow-up. All study procedures, including the follow-up interviews, were approved by the Institutional Review Boards of the University of California, Los Angeles, and Friends Research Institute.

Outcome Variable

The primary outcome variable was restricted to negative urinalysis results for MA at 12 months after MTP treatment and at 36 months after MTP treatment. These variables were constructed from urinalysis result reports. The cut-off value for a positive MA result was 300 ng/ml.

Independent Variables

The process-of-care performance measures used in the analyses included initiation, engagement, retention, and monitoring of drug use during treatment. Administrative data used for these measures were taken from the MTP Treatment Tracking Form filled out by providers (see Huber et al. 2000). Operationalization of initiation and engagement were based on the Washington Circle measures (see Garnick et al. 2009). *Initiation* (1 = yes, 0 = no) was defined as having received services at two treatment visits within 14 days of the date that a respondent was enrolled in the study. *Engagement* (1 = yes, 0 = no) was defined as initiation plus having received services at two additional visits between 15 and 30 days from the admission date. The services used in these definitions were individual, group, or conjoint family sessions as well as other types of sessions, check-ins, referrals, and self-help meetings. Services were only used in these measures if a visit was corroborated by either the Substance Use Inventory, which was completed at every visit by study staff, or a urinalysis record. *Retention* was measured by the proportion of the expected length of treatment that a client was retained in treatment, because the programs in the study varied in expected length of treatment (Galloway et al. 2000). In the analysis sample, the average length of expected treatment ranged from three to 16 weeks. *Monitoring drug use during treatment* was operationalized as the client providing three consecutive MA-negative urinalyses (1 = yes, 0 = no), with “yes” referring to urinalysis results that were negative for MA use on three consecutive visits (weeks) during treatment.

Demographic variables were controlled for in the model, including age, gender, race/ethnicity, living situation, and employment as measured from the baseline Addiction Severity Index (ASI). *Age* in years was computed from birth date. *Gender* was coded 1 = male, 2 = female; this coding represents being female in the analytic models. Given that the majority of the sample was White (67.6%), and the remainder Hispanic (14.7%), Asian/Pacific Islander (11.9%), American Indian/Alaska Native (3.6%), and African American (2.0%), *race*/*ethnicity* was re-coded as a dichotomous variable (1 = White, 0 = non-White *(African American, American Indian/Alaskan Native, Asian/Pacific Islander, Hispanic). Usual living arrangement in the past three years* was coded using a dichotomous variable (0 = not in category, 1 = in category) for the following situations: lived without a partner either with or without children, lived with others (parents, family, or friends), and lived in a controlled environment (e.g., jail, residential substance abuse or psychiatric treatment), or without a stable living arrangement (i.e., homeless). These variables had “living with a sexual partner” (either alone or with children) as their reference category. *Lived with a person who used alcohol or drugs* (0 = no, 1 = yes) was based on two items asking whether the respondent lived with a person who used alcohol and whether the respondent lived with a person who used drugs. *Employment status* was trichotomized, with “not working” as the reference category and full- and part-time employment as the included categories (0 = not in category, 1 = in category).

Two measures of drug use were also included in each model because of their likely relationship with a client’s chances of relapse. *The number of alcohol or drug treatments between the MTP treatment and follow-up* consisted of the sums of two ASI items indicating the number of treatments for alcohol and for other drugs that a respondent had since the previous ASI was administered. The measure from baseline to the 12-month follow-up was added to the measure from the 12- to 36-month follow-up in order to create the variable that was included in the model predicting the 36-month MA urinalysis outcome. Additionally, analytic models included a baseline ASI measure indicating the *number of days in the past 30 that a respondent had used MA*.

Statistical Analysis

In the present study, analyses were restricted to the following criteria: from the original MTP sample (N = 1,016), (1) a drug court treatment site was removed because of its noncomparability with other sites; (2) two small sites in the same city were combined; and (3) 34 clients were removed who were in a separate treatment group from the 16-week Matrix treatment group (i.e., an eight-week Matrix group that did not participate in the larger MTP study). This left 871 clients in six sites, each with between 124 and 155 clients in the analysis sample. This sample included two treatment groups, treatment-as-usual (TAU; n = 436) and 16-week Matrix treatment (n = 435). Analyses were conducted on an intent-to-treat

(ITT) sample. In order to assess sensitivity to assumptions about missing data and attrition, we created an ITT data set in two different ways. First, we imputed values for those missing on the dependent variable and on other variables. Second, for the dependent variable, we assumed that all missing urines were positive, and imputed data for other variables' missing values. Prior research supports the comparison of different approaches, including these two, when constructing an ITT data set (Pettinati et al. 2008; Woody et al. 2008; Fiellin et al. 2006; Leon et al. 2006; Fischer et al. 1999).

Descriptive statistics were produced with SAS, Version 9.1.3 (SAS Institute 2004). For the main analyses of MA use outcomes at the 12- and 36-month follow-ups, we wanted to adjust for the correlations among observations within each site, and to adjust for the differences between sites in treatment conventions. Therefore, a mixed logistic regression model was used. This model allowed for intercepts that varied randomly between sites but were the same for all individuals within a site. PROC GLIMMIX in SAS (SAS Institute 2006) was used to do the analysis. The response variable was assumed to follow a binomial distribution with a logit link function. The link function transforms the data so that the nonlinear relationships between the variables can be estimated with a linear model. The model was estimated by means of residual pseudo-likelihood using a subject-specific (i.e., site-specific) Taylor series expansion. The estimation is based on the assumption that the random intercept effects are normally distributed.

Because there is no readily available means to combine multiple imputed data sets for the GLIMMIX procedure, we supplied a seed chosen from a random number table (Blalock 1979) in order to generate a single imputed data set using SAS PROC MI. Several imputations were necessary in order to obtain convergence and impute missing values on all variables; each used a random seed, and only one resulting data set containing all imputations was used in analyses. We then ran all analyses twice, once for each version of the dependent variable (the first, imputed; and the second, missing assumed to be positive). The results for the main variables of interest did not differ between these two methods, so we present only results based upon use of the imputed dependent variable.

Preliminary analyses were done for the sample as a whole and separately for both treatment groups. A variable indicating treatment group membership was not significantly related to the outcomes and thus was omitted from analytic models involving the whole sample. Additionally, initiation and engagement were highly correlated ($r = 0.75$, $p < 0.001$); thus, in order to avoid multicollinearity, only engagement was included in the analytic models.

In order to test sensitivity to the definition of retention, we also re-estimated the model for the full sample and for each treatment group using different cut-off points of the actual number of weeks respondents were in treatment (two, four, six, eight, ten, 14, 15, and 16 weeks). Using this procedure, there was no variation in the effect of retention or in its significance. We therefore used the continuous proportion measure of retention described above.

RESULTS

Sample Description

Descriptive statistics for the analysis sample before and after imputation are presented in Table 1. Variable distributions are quite similar in the two samples. Fifty-seven percent of each sample was women. The mean age in each sample was 33 years. Those in the samples were 63% White. About 70% of those in the samples had negative MA urinalyses at each follow-up point. Almost a third of those in each sample met criteria for engagement, 42% had three consecutive negative MA urinalyses during treatment, and the average proportion of the expected length of treatment for which respondents were retained was between 60% and 65%.

The two treatment groups were compared on the variables in Table 1. The groups differed significantly on three measures. First, those in the 16-week Matrix group more frequently attained three consecutive negative MA urinalyses during treatment (48.1%, vs. 36.0% in the TAU group; $p < 0.001$ based on Fisher's exact test). Second, retention (as measured by the proportion of the expected length of treatment that a client was retained) was higher for the 16-week Matrix group (0.65) than for the TAU group (0.57; $p < 0.001$ based on a t-test). Thus, two of the three performance measures were better in the 16-week Matrix group than in the TAU group.

MA Use Outcomes by Performance Measures

Bivariate Pearson correlations for the entire sample (treatment conditions combined) showed that engagement ($r = 0.08$, $p < 0.05$), retention ($r = 0.09$, $p < 0.01$), and having three consecutive negative MA urinalyses during treatment ($r = 0.22$, $p < 0.001$) were significantly related to testing negative for MA use at 12-months post MTP treatment. However, of these process-of-care performance measures, only having had three consecutive negative MA urinalyses during treatment was significantly related to testing negative for MA use at the 36-month follow-up ($r = 0.13$, $p < 0.001$).

Table 2 shows results from the mixed logistic regression analyses predicting MA use outcomes at the 12-month follow-up, controlling for select demographic and drug-use variables. As shown, of the process-of-care performance measures, monitoring of drug use during treatment (as measured by having three consecutive negative MA urinalyses during treatment) was the only measure that remained significantly related to testing negative for MA at the 12-month follow-up. The effect was strong in the full sample ($OR = 2.82$, $p < 0.001$) and in both treatment groups (TAU: $OR = 3.05$, $p < 0.01$ and 16-week Matrix: $OR = 2.94$, $p < 0.001$). Additional significant findings indicated that, both in the full sample and in the 16-week Matrix group, being older (full sample $OR = 0.97$, $p < 0.01$; 16-week Matrix $OR = 0.95$, $p < 0.01$), and having lived in an unstable situation (i.e., being homeless) at baseline (full sample $OR = 0.43$, $p < 0.05$; 16-week Matrix $OR = 0.42$, $p < 0.01$) were related to having lower odds of testing negative for MA at the 12-month follow-up. In addition, having had a larger number of AOD treatments in the interim between MTP treatment discharge and the 12-month follow-up predicted having greater odds of testing negative for

MA at the follow-up for both the full sample (*OR* = 1.60, $p < 0.001$) and the TAU condition (*OR* = 1.92, $p < 0.01$).

Table 3 presents the mixed logistic regression analyses of predicting MA use outcomes at the 36-month follow-up, controlling for select demographic and drug-use variables. Similar to findings from the 12-month follow-up, having three consecutive negative MA urinalyses during treatment was a strong predictor of testing negative for MA at the 36-month follow-up, but only for the full sample (*OR* = 2.17, $p < 0.01$) and the 16-week Matrix group (*OR* = 3.07, $p < 0.001$). No other performance measures were significantly related to testing negative for MA at the 36-month follow-up. Factors that were related to having lower odds for testing negative for MA at the 36-month follow-up included older age in both the full sample (*OR* = 0.96, $p < 0.001$) and TAU group (*OR* = 0.95, $p < 0.001$), as well as female gender only in the full sample (*OR* = 0.69, $p < 0.01$).

DISCUSSION

Despite diminishing resources for treatment and heightened concern about accountability for use of resources in the public addiction treatment system, adoption of performance measurement has lagged. Increasingly, process-of-care performance measurement has been accepted as an effective tool for not only managing the delivery of quality services, but also for ensuring that desired outcomes have been achieved (Durman, Lucking & Robertson 2008). This study tested the latter assertion by specifically examining the extent to which select performance measures predict long-term MA use outcomes at 12- and 36-month follow-ups post participation in clinical treatment.

Results illustrate that process-of-care measures are predictive of long-term MA use outcomes over time, although they vary in predictive strength. Overall, findings suggest that whereas performance measures of engagement and retention are important determinants of successful long-term outcomes of MA-dependent users, monitoring drug use during treatment is significantly more predictive of better MA use outcomes. In other words, treatment programs that are able to help MA-dependent individuals achieve sustained abstinence for three consecutive weeks or longer are more likely to have more successful follow-up outcomes. This study supports findings documented by Higgins, Badger and Budney (2000), who studied a clinical sample of cocaine clients and found that clients who had consecutive weeks of abstinence under different treatment conditions have the same probability of being abstinent at follow-up.

In the present study, factors that were related to having lower odds of being successful in terms of being MA-abstinent at follow-ups were older age, homelessness at MTP baseline, and female gender. These factors are important to consider as they place MA users at greater risk for relapse and continued use post treatment. On the other hand, factors that predicted having greater odds of testing negative for MA use at the follow-ups included having had a larger number of AOD treatments in the interim between MTP treatment discharge and the follow-ups. Future research should continue to look into how continued involvement in treatment or other social support can enhance treatment recovery outcomes. Such information can help inform and improve the development of intervention strategies that promote long-term recovery and minimize the costs associated with MA dependence.

Limitations

The present study has several limitations. The data used in this study are reflective of treatment seekers who volunteered to participate in a clinical trial (MTP) and follow-up interviews; hence the generalizablity of the results to nontreatment seekers is limited. This study did not take into account criminal status or mental health functioning in terms of severe Axis I disorders, which limits our ability to fully understand factors associated with MA use outcomes over time. In addition, this study solely looked at MA-use outcomes; future research should look into other factors that may predict post treatment MA use patterns, such as polydrug use, to better understand individuals who are at higher risk for poorer outcomes.

CONCLUSIONS

In summary, this study contributes to the developing body of literature on performance measurement. The results extend important findings regarding process-of-care measurement for MA users in relation to predicting long-term treatment outcomes. Our findings demonstrate the importance of looking to process-of-care measures that have been linked to improved patient outcomes in empirical studies among a substance-dependent population (in this case, MA-dependent). Understanding the process-of-care factors that predict outcomes for MA users may help treatment providers identify and tailor programs for this population, leading to improved treatment outcomes. Given that MA users continue to challenge the publicly-funded treatment system, future research should continue to look at the predictive validity of process-of-care performance measures on various clinical outcomes among MA-using populations, such as criminal activity, psychosocial functioning and well-being, and productivity.

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References

American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Disorders. 4. Washington, DC: APA; 1994.

Bartlett BW, Firestone AR, Vig KW, Beck FM, Marucha PT. The influence of a structured telephone call on orthodontic pain and anxiety. American Journal of Orthodontics and Dentofacial Orthopedics. 2005; 128 (4):435–41. [PubMed: 16214624]

Blalock, HM, Jr. Social Statistics. 2. New York: McGraw-Hill, Inc; 1979.

Capoccia VA, Cotter F, Gustafson DH, Cassidy EF, Ford JH II, Madden L, Owens BH, Farnum SO, McCarty D, Molfenter T. Making “stone soup”: Improvements in clinic access and retention in addiction treatment. Joint Commission Journal on Quality and Patient Safety. 2007; 33 (2):95–103. [PubMed: 17370920]

Dennis M, Scott CK. Managing addiction as a chronic condition. Addiction Science & Clinical Practice. 2007; 4 (1):45–55. [PubMed: 18292710]

Durman, J.; Lucking, T.; Robertson, L. Performance Management for Substance Abuse Treatment Providers. Rockville, MD: Center for Substance Abuse Treatment (CSAT), Substance Abuse and Mental Health Services Administration (SAMHSA); 2008. Available at http://tie.samhsa.gov/Documents/pdf/PerfMgmt4SATx.pdf

Fiellin DA, Pantalon MV, Chawarski MC, Moore BA, Sullivan LE, O'Connor PG, Schottenfeld RS. Counseling plus buprenorphine-naloxone maintenance therapy for opioid dependence. New England Journal of Medicine. 2006; 355 (4):365–74. [PubMed: 16870915]

Fischer G, Gombas W, Eder H, Jagsch R, Peternell A, Stühlinger GS, Pezawas L, Aschauer HN, Kasper S. Buprenorphine versus methadone maintenance for the treatment of opioid dependence. Addiction. 1999; 94 (9):1337–47. [PubMed: 10615719]

Galloway GP, Marinelli-Casey P, Stalcup J, Lord R, Christian D, Cohen J, Reiber C, Vandersloot D. Treatment-as-usual in the Methamphetamine Treatment Project. Journal of Psychoactive Drugs. 2000; 32:165–75. [PubMed: 10908004]

Garner B, Godley M, Funk R, Lee M, Garnick D. The Washington Circle continuity of care performance measure: Predictive validity with adolescents discharged from residential treatment. Journal of Substance Abuse Treatment. 2010; 38 (1):3–11. [PubMed: 19553067]

Garnick DW, Lee MT, Horgan CM, Acevedo A. Washington Circle Public Sector Workgroup. Adapting Washington Circle performance measures for public sector substance abuse treatment systems. Journal of Substance Abuse Treatment. 2009; 36:265–77. [PubMed: 18722075]

Garnick DW, Horgan CM, Lee MT, Panas L, Ritter GA, Davis S, Leeper T, Moore R, Reynolds M. Are Washington Circle performance measures associated with decreased criminal activity following treatment? Journal of Substance Abuse Treatment. 2007; 33 (4):341–52. [PubMed: 17524596]

Godley MD, Godley SH, Dennis ML, Funk RR, Passetti LL. The effect of assertive continuing care on continuing care linkage, adherence and abstinence following residential treatment for adolescents with substance use disorders. Addiction. 2007; 102 (1):81–93. [PubMed: 17207126]

Harris AHS, Humphreys K, Bowe T, Tiet Q, Finney JW. Does meeting the HEDIS substance abuse treatment engagement criterion predict patient outcomes? Journal of Behavioral Health Services & Research. 2008; 37 (1):25–39. [PubMed: 18770044]

Harris AH, Humphreys K, Finney JW. Veterans Affairs facility performance on Washington Circle indicators and casemix-adjusted effectiveness. Journal of Substance Abuse Treatment. 2007; 33 (4):333–39. [PubMed: 17400416]

Herbeck DM, Hser YI, Teruya C. Empirically supported substance abuse treatment approaches: A survey of treatment providers' perspectives and practices. Addictive Behaviors. 2008; 33 (5):699–712. [PubMed: 18207334]

Herrell JM, Taylor JA, Gallagher C, Samia DN. A multisite study of the effectiveness of methamphetamine treatment: An initiative of the Center for Substance Abuse Treatment. Journal of Psychoactive Drugs. 2000; 32 (2):143–47. [PubMed: 10908001]

Higgins S, Badger GJ, Budney AJ. Initial abstinence and success in achieving longer term cocaine abstinence. Experimental and Clinical Psychopharmacology. 2000; 8:377–86. [PubMed: 10975629]

Huber A, Lord RH, Gulati V, Marinelli-Casey P, Rawson R, Ling W. The CSAT Methamphetamine Treatment Program: Research design accommodations for "real world" application. Journal of Psychoactive Drugs. 2000; 32 (2):149–56. [PubMed: 10908002]

Lamb, SJ.; Greenlick, MR.; McCarty, D., editors. Bridging the Gap Between Practice and Research: Forging Partnerships with Community-based Drug and Alcohol Treatment. Washington, DC: National Academy Press; 1998.

Leon AC, Mallinckrodt CH, Chuang-Stein C, Archibald DG, Archer GE, Chartier K. Attrition in randomized controlled clinical trials: Methodological issues in psychopharmacology. Biological Psychiatry. 2006; 59:1001–05. [PubMed: 16503329]

McCarty D, Gustafson DH, Wisdom JP, Ford J, Choi D, Molfenter T, Capoccia V, Cotter F. The Network for the Improvement of Addiction Treatment (NIATx): Enhancing access and retention. Drug and Alcohol Dependence. 2007; 88 (2–3):138–45. [PubMed: 17129680]

McLellan AT, Chalk M, Bartlett J. Outcomes, performance, and quality: What's the difference? Journal of Substance Abuse Treatment. 2007; 32 (4):331–40. [PubMed: 17481456]

McLellan AT, McKay JR, Forman R, Cacciola J, Kemp J. Reconsidering the evaluation of addiction treatment: From retrospective follow-up to concurrent recovery monitoring. Addiction. 2005; 100 (4):447–58. [PubMed: 15784059]

Pettinati HM, Kampman KM, Lynch KG, Xie H, Dackis C, Rabinowitz AR, O'Brien CP. A double blind, placebo-controlled trial that combines disulfiram and naltrexone for treating co-occurring cocaine and alcohol dependence. Addictive Behaviors. 2008; 33:651–67. [PubMed: 18079068]

Rawson RA, Marinelli-Casey P, Anglin MD, Dickow A, Frazier Y, Gallagher C, Galloway GP, Herrell J, Huber A, McCann MJ, Obert J, Pennell S, Reiber C, Vandersloot D, Zweben J. the Methamphetamine Treatment Project Corporate Authors. A multi-site comparison of psychosocial approaches for the treatment of methamphetamine dependence. Addiction. 2004; 99:708–17. [PubMed: 15139869]

Reiber C, Ramirez A, Parent D, Rawson RA. Predicting treatment success at multiple timepoints in diverse patient populations of cocaine-dependent individuals. Drug and Alcohol Dependence. 2002; 68 (1):35–48. [PubMed: 12167551]

SAS Institute Inc. The GLIMMIX Procedure. Cary, NC: SAS Institute Inc; 2006 Jun. 2006Available at http://support.sas.com/rnd/app/papers/glimmix.pdf

SAS Institute Inc. SAS OnlineDoc® 9.1.3. Cary, NC: SAS Institute Inc; 2004.

Shoptaw S, Rawson RA, McCann MJ, Obert JL. The Matrix Model of outpatient stimulant abuse treatment: Evidence of efficacy. Journal of Addictive Diseases. 1994; 13 (4):129–41. [PubMed: 7734464]

Substance Abuse and Mental Health Services Administration (SAMHSA). SAMHSA Launches Searchable Database of Evidence-based Practices in Prevention and Treatment of Mental Health and Substance Use Disorders. Rockville, MD: SAMHSA; 2007 Mar 1. (Press release)Available at http://www.samhsa.gov/newsroom/advisories/0703013707.aspx

Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies. Treatment Episode Data Set (TEDS) Highlights. 2007. National Admissions to Substance Abuse Treatment Services; Rockville, MD: SAMHSA; 2009. OAS Series #S-45, HHS Publication No. (SMA) 09-4360

Woody GE, Poole SA, Subramaniam G, Dugosh K, Bogenschutz M, Abbott P, Patkar A, Publicker M, McCain K, Potter JS, Forman R, Vetter V, McNicholas L, Blaine J, Lynch KG, Fudala P. Extended vs short-term buprenorphine-naloxone for treatment of opioid-addicted youth: A randomized trial. Journal of the American Medical Association. 2008; 300 (17):2003–11. [PubMed: 18984887]

TABLE 1

Descriptive Statistics of Analysis Variables Before and After Imputation

		Data Before Imputation				Imputed Data (N = 871)			
Variable	**N**	**Mean**	**SD**	**Min.**	**Max.**	**Mean**	**SD**	**Min.**	**Max.**
Dependent Variables									
Meth UA Negative, One-Year Follow-up	670	0.71	–	0	1	0.69	–	0	1
Meth UA Negative, Three-Year Follow-up	480	0.74	–	0	1	0.71	–	0	1
Independent Variables			–					–	
Performance									
Engagement	871	0.32	–	0	1	0.32	–	0	1
Three Consecutive Negative Urines During Treatment	871	0.42	–	0	1	0.42	–	0	1
Proportion of Expected Length of Treatment R Retained	744	0.65	0.34	0	1.08	0.61	0.34	0	1.08
Demographics									
Age	871	32.9	7.93	18.1	56.5	32.9	7.93	18.1	56.5
Female[a]	871	1.57	–	1	2	1.57	–	1	2
White (vs. Other)	871	0.63	–	0	1	0.63	–	0	1
Living Arrangement at Baseline (Vs. with Partner)			–				–		
No Partner, Alone or with Children	869	0.15	–	0	1	0.15	–	0	1
With Others	869	0.42	–	0	1	0.42	–	0	1
In Controlled Environment	869	0.04	–	0	1	0.04	–	0	1
In an Unstable Situation	869	0.06	–	0	1	0.06	–	0	1
Lived with AOD User at Baseline	871	0.31	–	0	1	0.31	–	0	1
Usual Baseline Employment Status (vs. not Working)			–				–		
Full-time	870	0.49	–	0	1	0.49	–	0	1
Part-time	870	0.12	–	0	1	0.12	–	0	1
Substance Abuse History									
# AOD Treatments between Baseline and One-Year Follow-up	766	0.50	0.84	0	6	0.52	0.82	0	6
# AOD Treatments between Baseline and 3-Year Follow-up	786	1.23	2.13	0	31	1.91	2.30	0	31
# Days in Past 30 used Meth at Baseline	871	11.85	9.70	0	30	11.85	9.70	0	30

Note: SD = standard deviation, Min. = minimum, Max. = maximum. Standard deviations for dichotomous variables are not presented.

[a]Male = 1, female = 2. Mean indicates that 57% of the sample is female.

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TABLE 2

Mixed Logistic Regression Analysis of Having a Negative Urinalysis Result for Methamphetamine One Year Following Treatment

	Full Sample (N = 871)		Treatment as Usual (N = 436)		16-Week Matrix (N = 435)	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Performance						
Engagement	0.93	0.63, 1.36	0.96	0.52, 1.77	1.08	0.50, 2.33
Three Consecutive Negative Urines During Treatment	2.82***	2.04, 3.90	3.05**	1.47, 6.31	2.94***	2.04, 4.22
Proportion of Expected Length of Treatment R Retained	0.98	0.47, 2.06	1.22	0.44, 3.42	0.82	0.29, 2.36
Demographics						
Age	0.97**	0.94, 0.99	0.99	0.95, 1.03	0.95***	0.93, 0.98
Female	0.93	0.60, 1.44	1.29	0.78, 2.13	0.73	0.40, 1.34
White (vs. other)	0.90	0.69, 1.16	0.60	0.33, 1.09	1.14	0.79, 1.64
Living Arrangement at Baseline (vs. with Partner)						
No Partner, Alone or with Children	0.88	0.68, 1.14	0.95	0.67, 1.36	0.99	0.71, 1.38
With Others	1.01	0.74, 1.39	1.14	0.68, 1.92	0.98	0.68, 1.42
In Controlled Environment	1.65	0.95, 2.86	2.45	0.58, 10.25	1.52	0.51, 4.52
In an Unstable Situation	0.43*	0.22, 0.83	0.48	0.19, 1.19	0.42**	0.24, 0.73
Lived with AOD User at Baseline	0.69	0.45, 1.06	0.78	0.47, 1.30	0.62	0.38, 1.01
Usual Baseline Employment Status (vs. not Working)						
Full-time	1.18	0.69, 2.02	1.56	0.76, 3.22	0.82	0.40, 1.66
Part-time	1.58	0.78, 3.18	1.85	0.95, 3.63	1.17	0.33, 4.22
Substance Abuse History						
# AOD Treatments between Baseline and One-Year Follow-up	1.60***	1.27, 2.00	1.92**	1.24, 2.96	1.45	0.78, 2.70
# Days in Past 30 used Meth at Baseline	0.98	0.95, 1.01	0.97	0.93, 1.01	0.98	0.95, 1.02

Note: SAS PROC GLIMMIX was used for analyses. A random-intercept model was specified, using site as the clustering variable. OR = odds ratio, CI = confidence interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 3

Mixed Logistic Regression Analysis of Having a Negative Urinalysis Result for Methamphetamine Three Years Following Treatment

	Full Sample (N = 871)		Treatment As Usual (N = 436)		16-Week Matrix (N = 435)	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Performance						
Engagement	0.84	0.51, 1.37	1.10	0.67, 1.80	0.78	0.37, 1.66
Three Consecutive Negative Urines During Treatment	2.17**	1.26, 3.74	1.49	0.71, 3.10	3.07***	1.75, 5.38
Proportion of Expected Length of Treatment R Retained	0.85	0.47, 1.53	1.06	0.39, 2.89	0.71	0.35, 1.42
Demographics						
Age	0.96***	0.94, 0.98	0.95***	0.93, 0.96	0.97	0.94, 1.00
Female	0.69**	0.53, 0.90	0.70	0.41, 1.20	0.70	0.41, 1.20
White (vs. Other)	1.00	0.64, 1.56	0.80	0.30, 2.14	1.17	0.87, 1.56
Living Arrangement at Baseline (vs. with Partner)						
No Partner, Alone or with Children	1.23	0.61, 2.50	1.41	0.60, 3.29	1.05	0.55, 2.03
With Others	0.95	0.77, 1.16	1.01	0.76, 1.36	0.86	0.70, 1.06
In Controlled Environment	0.64	0.20, 2.01	0.56	0.16, 1.95	0.68	0.18, 2.59
In an Unstable Situation	1.18	0.92, 1.53	1.13	0.41, 3.09	1.18	0.81, 1.72
Lived with AOD User at Baseline	1.47	0.92, 2.36	1.60	0.89, 2.88	1.30	0.70, 2.45
Usual Baseline Employment Status (vs. not Working)						
Full-time	1.10	0.84, 1.44	1.29	0.80, 2.08	0.87	0.78, 1.07
Part-time	0.91	0.51, 1.64	0.67	0.27, 1.65	1.27	0.79, 2.07
Substance Abuse History						
# AOD Treatments between Baseline and Three-Year Follow-up	1.05	0.97, 1.15	1.03	0.93, 1.15	1.10	0.99, 1.22
# Days in Past 30 used Meth at Baseline	0.99	0.97, 1.01	0.98	0.95, 1.01	1.00	0.99, 1.01

Note: SAS PROC GLIMMIX was used for analyses. A random-intercept model was specified, using site as the clustering variable. OR = odds ratio, CI = confidence interval.

* $p < .05$.

** $p < .01$.

*** $p < .001$.