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An Experimental Trial of Adaptive Programming in Drug Court: Outcomes at 6, 12 and 18 Months

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Abstract

Objectives—Test whether an adaptive program improves outcomes in drug court by adjusting the schedule of court hearings and clinical case-management sessions pursuant to *a priori* performance criteria.

Methods—Consenting participants in a misdemeanor drug court were randomly assigned to the adaptive program (n = 62) or to a baseline-matching condition (n = 63) in which they attended court hearings based on the results of a criminal risk assessment. Outcome measures were re-arrest rates at 18 months post-entry to the drug court and urine drug test results and structured interview results at 6 and 12 months post-entry.

Results—Although previously published analyses revealed significantly fewer positive drug tests for participants in the adaptive condition during the first 18 weeks of drug court, current analyses indicate the effects converged during the ensuing year. Between-group differences in new arrest rates, urine drug test results and self-reported psychosocial problems were small and non-statistically significant at 6, 12 and 18 months post-entry. A non-significant trend (p = .10) suggests there may have been a small residual impact (Cramer's ν = .15) on new misdemeanor arrests after 18 months.

Conclusions—Adaptive programming shows promise for enhancing short-term outcomes in drug courts; however, additional efforts are needed to extend the effects beyond the first 4 to 6 months of enrollment.

Keywords

drug court; drug abuse; addiction; crime; criminal justice; offenders; antisocial personality disorder; adaptive programming; adaptive treatment

Adaptive Programming

Outcomes in substance abuse treatment are improved significantly when clinicians receive rapid and continuous feedback concerning participants' progress in treatment, particularly

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counseling attendance rates and urine drug screen results (Goodman et al., 2013). Providing immediate feedback increases the likelihood that clinicians will recognize achievements and infractions by participants and respond in a swift and efficient manner (Marlowe et al., 2008).

The best results are achieved when clinicians employ *a priori* decision rules or algorithms for responding to signs of deteriorating performance (Collins et al., 2004; Murphy et al., 2007). Specifying the decision rules in advance helps to ensure that clinicians' responses are guided by research evidence rather than by individual professional judgment, which may be negatively influenced by such factors as time pressures, insufficient expertise or biases (Andrews & Bonta, 2010; Wormith & Goldstone, 1984). Clinicians retain the prerogative to override an indicated response; however, they are typically requested to articulate the rationale for doing so in the participant's record.

In the treatment research literature, obtaining continuous feedback concerning participants' performance in treatment is referred to as *progress monitoring* or *concurrent recovery monitoring* (McLellan et al., 2005). When progress monitoring is combined with a priori responses to deteriorating performance, it is referred to as *adaptive programming* or *adaptive treatment* (McKay, 2009). The effects of both progress monitoring and adaptive programming have been found to be greatest for participants who are at high risk for treatment failure, such as criminally involved or dually diagnosed patients (Goodman et al., 2013; Harmon et al., 2007; Lambert et al., 2003).

Drug Courts

The current study experimentally examined the effects of adaptive programming in a misdemeanor drug court for offenders charged with drug-related crimes. In drug courts, a judge leads a multidisciplinary team of professionals that commonly includes a prosecutor, defense attorney, treatment professionals, case managers and probation officers. These team members meet frequently in staff meetings to review participants' progress in treatment and offer recommendations to the judge for suitable consequences to impose (National Association of Drug Court Professionals, 1997). The consequences may include punitive sanctions such as community service or brief intervals of jail detention; desired rewards such as verbal praise, reduced supervision requirements or token gifts; or adjustments to participants' treatment regimens. In pre-adjudication drug courts, the ultimate incentive is to have the criminal charge(s) dropped or withdrawn, and in post-adjudication drug courts the ultimate incentive is to avoid incarceration or reduce the length or conditions of probation.

Several meta-analyses (Aos et al., 2006; Bhati et al., 2008; Downey & Roman, 2010; Latimer et al., 2006; Lowenkamp et al., 2005; Mitchell et al., 2012; Shaffer, 2010; Wilson et al., 2006) and a national multisite study (Rempel et al., 2012) concluded that drug courts significantly reduced criminal recidivism—typically measured as re-arrest rates within 2 years of entry—by an average of 8 to 14 percent, and returned an average of more than $2 in financial benefits to the criminal justice system for every $1 invested. Not all drug courts, however, performed at this level. Approximately 16 percent of the drug courts in meta-analyses did not reduce crime and an additional six percent were associated with increased

recidivism. Among those drug courts that did reduce crime, there was wide variation in the effect sizes (ES), ranging from 7 to 45 percent. It is important to identify evidence-based practices in drug courts that can optimize their effects and minimize negative side effects.

Some evidence suggests the efficacy of drug courts may decline precipitously when the census or caseload reaches approximately 125 participants (Carey et al., 2012). It may be difficult for drug court teams to review large numbers of cases during their staff meetings and respond in a consistent and evidence-based manner to signs of problematic performance. If drug courts intend to serve large numbers of criminal offenders, it will become necessary to model how effective drug courts respond to various presentations by participants and standardize or routinize the process so it may be implemented reliably at a large scale (Farole et al., 2004). Adaptive programming offers an efficient way for drug courts to administer evidence-based responses in a reliable and standardized manner. As was noted previously, adaptive methods have shown particular promise for treating participants with substance use disorders and concurrent criminal involvement.

Noncompliance vs. Non-responsiveness

Developing decision rules or algorithms for adaptive programs can be complicated when dealing with drug-offender populations who are supervised jointly by the criminal justice and substance abuse treatment systems. Criminal justice professionals are responsible primarily for protecting public safety and are empowered to respond to misconduct with enhanced supervision or punitive sanctions. Treatment professionals, in contrast, are responsible for improving the health of their clients and may intensify a client's treatment plan in furtherance of this goal. This requires a distinction to be drawn between *noncompliance* with supervision requirements and *non-responsiveness* to clinical interventions (Marlowe & Wong, 2008). If a participant fails to attend counseling sessions, for example, he or she is arguably engaged in willful noncompliance, assuming the absences were unexcused and avoidable. Under such circumstances, it might be appropriate to apply a punitive sanction or increase the participant's supervision requirements as a consequence for the willful infraction. However, if the participant is satisfying his or her obligations in the program but is not responding to the interventions, the fault might lie not with the participant but with the treatment plan. Rather than apply a punitive sanction, it might be preferable to alter the treatment regimen (Marlowe, 2011).

Distinguishing between noncompliance and non-responsiveness addresses a problem that is commonly encountered in correctional rehabilitation programs. Some judges and probation officers may increase participants' treatment requirements as a consequence for misconduct. For example, a participant who misses several counseling sessions might be “sanctioned” with a requirement to attend more intensive treatment. This practice not only risks wasting scarce treatment resources, but may give the inadvertent message to participants that treatment is undesirable and thus something to be avoided. Treatment should be used to address clinical symptoms and not to punish willful misconduct. Therefore, an important feature of adaptive programs in drug courts is to draw a distinction between noncompliance with treatment obligations and non-responsiveness to treatment interventions, and apply responses accordingly.

Current Study

In the current study, participants in a misdemeanor drug court were randomly assigned to an adaptive program or to a baseline-matching control condition. Pursuant to a priori decision rules, the adaptive algorithm required participants to attend more frequent court hearings as a consequence for noncompliance with their attendance obligations in the program, such as missing counseling sessions or failing to deliver urine specimens. The adaptive algorithm required participants to attend more frequent clinical case-management sessions as a consequence for continued drug or alcohol use. Participants in the baseline-matching control condition were required simply to attend court hearings based on a standardized assessment of their criminogenic risk level. Previous studies demonstrated that this baseline-matching procedure significantly improved outcomes over drug court as-usual (Festinger et al., 2002; Marlowe et al., 2006, 2007). The current study sought to determine whether additional incremental utility could be achieved by continuously adjusting the schedule of court hearings and clinical case-management sessions based on participants' ensuing performance in the program.

It was hypothesized that participants in the adaptive condition would have significantly higher graduation rates, fewer positive drug tests and fewer re-arrests than participants in the baseline-matching condition because the adaptive algorithm responds reliably to instances of noncompliant behaviors. It was further hypothesized that participants in the adaptive condition would report fewer psychosocial problems at follow-up because the adaptive program reliably enhances clinical case-management services in response to unmet treatment needs.

As hypothesized, previously published findings (Marlowe et al., 2012) confirmed that participants in the adaptive condition were more than twice as likely as those in baseline-matching to provide drug-negative urine specimens during the first 18 weeks of the program (odds ratio [OR] = 2.34, $p < .01$). The effect size was clinically meaningful and at the high end of the moderate range ($d = .46$). The results also suggested a potential mechanism of action for the adaptive algorithm. Participants in the adaptive condition were more than twice as likely as those in baseline-matching to receive a consequence for noncompliance in the program (64% vs. 30%, $p = .03$, $w = .33$). This suggests that the effects of the adaptive algorithm may have stemmed from holding participants more accountable for meeting their attendance obligations in the program. It should not be surprising that outcomes were less favorable in the baseline-matching condition because there was less than a 1 in 3 chance of receiving a consequence for missing treatment sessions or failing to provide urine specimens. A primary contribution of adaptive algorithms might be to increase the likelihood that such infractions (and perhaps achievements as well) are recognized and addressed by staff.

The current analyses examined longer-term outcomes on this same cohort of misdemeanor drug court participants. Urine drug tests and structured interviews were administered at 6 and 12 months post-admission to the drug court and re-arrest rates were examined from state criminal justice databases at 18 months post-admission.

Methods

Human Subject Protections

The study was approved and monitored by the Institutional Review Boards (IRBs) of the Treatment Research Institute and the Delaware State Department of Health & Social Services. A NIH Certificate of Confidentiality was obtained to shield the data from a court-ordered subpoena. All participants provided written informed consent to be in the study and executed a Health Insurance Portability & Accountability Act (HIPAA) Research Subject Authorization of Confidentiality & Privacy Rights.

Recruitment Procedures

The study was conducted in a misdemeanor drug court located in Wilmington, DE. Because the experimental intervention involved manipulating the court's responses to technical violations, we chose to conduct the first study with a relatively less serious misdemeanor population. If the results are promising and there are no study-related adverse events, future experiments will replicate the findings in felony programs. Eligibility criteria for this drug court require defendants to (1) be at least 18 years of age; (2) be a resident of or have committed their offense in Newcastle County, DE; (3) be charged with a misdemeanor offense including possession or consumption of cannabis, possession of drug paraphernalia, or possession of hypodermic syringes; (4) not have a history of a violent offense involving serious injury to a victim or use of a deadly weapon; and (5) have a substance abuse problem as determined by treatment professionals working in concert with the drug court.

The flow of participants in the study is summarized in the CONSORT diagram depicted in Figure 1. A total of 335 consecutive admissions to the drug court were approached by research staff about potential participation in the study between February, 2009 and March, 2010. Of those, 130 (39%) provided informed consent to participate. This consent rate was not unexpected given that participants were being asked to potentially attend more frequent court hearings and case-management sessions. Individuals who refused to participate in the study did not differ from those who consented in terms of their age, gender, race, current criminal charges or number of prior bench warrants ($p > .45$ in all analyses); however, those who refused to participate in the study were significantly more likely to have been represented by private defense counsel (33% vs. 17%), $X^2(1) = 9.20$, $p = .002$.

Of those individuals who consented initially to participate in the study, three individuals assigned to the adaptive condition and two individuals assigned to the baseline-matching condition withdrew from the study before being exposed to the experimental interventions. This left a final baseline cohort of 125 participants (adaptive n = 62, baseline-matching n = 63). An additional seven participants withdrew subsequently from the study during the follow-up period after being exposed partially to the experimental conditions. Three of those participants were in the adaptive condition and four were in the baseline-matching condition. This left a final follow-up cohort of 118 participants (adaptive $n = 59$; baseline-matching $n = 59$).

A series of attrition analyses confirmed that participants who withdrew from the study did not differ from those who remained in terms of their gender, race, employment status,

criminogenic risk level, criminal charges or the severity of their substance abuse problems (all p-values > .60). There was a non-significant trend suggesting younger participants may have been more likely to have withdrawn from the study (mean age = 20.00 vs. 24.80 yrs., p = .11). Among those participants who withdrew from the study, there were no differences on these variables between those who were assigned to the adaptive condition as compared to the baseline-matching condition.

Brief Description of the Drug Court Program

In this pre-adjudication drug court, defendants are required to plead guilty to the initial charge(s) and the guilty plea is held in abeyance pending graduation or termination from the program. Graduates have the plea and charges withdrawn and are eligible to have the arrest record expunged if they remain arrest-free for an additional 6 months. If the defendant fails to complete the program, the guilty plea is formally entered as a conviction. Convicted offenders lose their drivers license (where applicable) for a term of 2 years and are commonly sentenced to probation with conditions similar to those imposed in drug court (e.g., drug abuse counseling and urine monitoring).

The program is scheduled to be a minimum of 18 weeks in length and has no maximum time limit for enrollment. Participants typically require 6 to 10 months to satisfy the requirements for graduation. The minimum requirements for graduation include attending at least 12 weekly group counseling sessions, providing drug-negative urine specimens for at least 14 consecutive weeks, remaining arrest free, obeying the program rules and procedures, and paying a $200 court fee. The basic group sessions are psycho-educational in format and cover a standard sequence of topics including the pharmacology of drug and alcohol use, progression from substance use to dependence, the impact of addiction on the family, treatment options, HIV/AIDS risk reduction, and relapse prevention strategies. Participants may attend additional group or individual treatment sessions based on clinical need.

Participants are assigned to a clinical case manager who coordinates any indicated treatment referrals and the case manager or a court liaison submits monthly progress reports to the judge and appears at all status hearings. Participants provide urine specimens on a random, weekly basis in direct observation of a same-gender treatment staff person. The urine drug screens are performed by an independent certified laboratory using the enzyme multiplied immunoassay technique (EMIT) with gas chromatography/mass spectrometry (GCMS) confirmation of positive results on a six-panel screen for cannabis, alcohol, opiates, amphetamines, cocaine, and phencyclidine (PCP), plus any additional substances believed to be abused by the individual.

The judge is authorized to administer sanctions or therapeutic consequences for inadequate performance in the program. These include verbal reprimands, homework assignments, additional treatment or supervisory obligations, daylong attendance in court as an observer, and occasionally community service. The team may also administer rewards for good performance including verbal praise, certificates of recognition, and reductions in participants' supervisory obligations.

Baseline-Matching Condition

The baseline-matching condition was derived from previous experiments (Festinger et al., 2002; Marlowe et al., 2006, 2007) demonstrating improved outcomes when certain high-risk participants were required to appear before the judge every two weeks for status hearings (bi-weekly condition), whereas low-risk participants were required only to appear in court if they were noncompliant with their attendance obligations (as needed condition). The a priori decision rule for assessing risk level was derived from two dichotomous measures employed on an either/or basis. If participants either (1) met diagnostic criteria for antisocial personality disorder (APD) according to the 4th edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV; American Psychiatric Association, 2000) or (2) had a history of at least one prior unsuccessful drug abuse treatment episode (excluding self-help groups), they were determined to be high risk. If they had neither APD nor a prior drug abuse treatment episode, they were determined to be low risk. The instruments that were used to make these assessments are described below.

Adaptive Condition

Participants who were randomly assigned to the adaptive condition were eligible for all of the services that are available in the drug court. However, consequences from the bench were scheduled to be imposed according to the adaptive algorithm depicted in Figure 2 unless the judge elected to override an indicated consequence. The adaptive algorithm was developed and pilot-tested through a collaborative and iterative process involving the drug court staff and research team (Marlowe et al., 2008). Interventions were selected that are commonly administered in drug courts and adaptive criteria were developed that are objective and readily measurable.

The first step in the adaptive algorithm was identical to the baseline-matching procedure described above. Subsequently, participants were assessed at monthly intervals to determine how they were performing in the program and status hearings or clinical case-management sessions were increased pursuant to the adaptive algorithm. Those who had two or more unexcused absences from counseling sessions, or two or more unexcused failures to provide a valid urine specimen, were considered to be noncompliant with the conditions of the program. For them, the schedule of court hearings was increased. If they were previously assigned to as-needed court hearings, they were re-assigned to biweekly hearings. If they were already on a bi-weekly schedule, they were placed on a jeopardy contract. A jeopardy contract involves “zero tolerance” for further violations of the rules of the program. Any further violation leads to a show-cause hearing at which the participant is terminated from the program and sentenced on the original charge(s) unless he or she can provide a good-cause reason to be given another chance. The decision whether to grant another chance is within the discretion of the judge and is generally granted in approximately 30 percent of cases.

Participants who provided two or more drug-positive urine specimens were considered to be non-responsive to the clinical interventions. Those individuals were referred to an intensive clinical case-management (ICCM) track. Participants in ICCM are required to attend at least two additional therapeutic group sessions per week and one additional individual treatment

session per month. The interventions are administered by a clinically trained case manager and focus on motivational-enhancement and relapse-prevention techniques. These interventions differ from the standard group sessions in the drug court in that they are individualized in format and clinical as opposed to psycho-educational in content.

Attendance information and urine drug test results were entered by clinical staff members or the drug court manager into a web-based management information system called the Treatment Research Institute Court Evaluation Program (TRI-CEP™). The TRI-CEP™ issued an automated alert to the drug court staff members whenever a participant in the adaptive condition met criteria for noncompliance or non-responsiveness and described the indicated consequence. The drug court team was free to deliberate about whether to impose the indicated consequence and the judge could override the consequence at her discretion.

The participants in the baseline-matching condition were also assessed on a monthly basis in the same manner as participants in the adaptive condition; however, the results of the assessments were not communicated to the drug court team. The drug court team responded to the participants' presentation with no influence or communication from research personnel.

Baseline Measures

Participants provided informed consent granting the research team access to their treatment records including drug test results and attendance information. Participants also received a $40 money order for completing a baseline assessment battery. This battery included the Risk and Needs Triage (RANT™), which has been validated to significantly predict outcomes among drug-involved offenders (Marlowe et al., 2011). The RANT™ contains an antisocial personality disorder diagnostic module (APD-DM). The APD-DM is a 32-item structured interview that assesses DSM-IV diagnostic criteria for APD. A dichotomous diagnosis of APD was used as one of the two risk-assessment variables in our prior studies and was used in the identical manner in the current study. In previous inter-rater reliability scoring trials, there was greater than 90 percent exact agreement for dichotomous diagnoses of APD among our research assistants. The RANT™ also contains an item inquiring whether participants attended prior drug abuse treatment episodes excluding self-help groups. Inter-rater and test-retest reliability for this item were consistently above 90 percent in prior studies.

Outcome Measures

Re-arrest rates were designated as the primary outcome variable for the study because they are measured objectively (i.e., not derived from self-report), were examined over the longest follow-up interval (18 months) and were available on the entire cohort of participants who did not withdraw from the study (N = 118). Re-arrest data were collected from the Delaware Justice Information System (DELJIS), a state-wide database containing criminal arrest, charge and conviction records. Records were examined to determine whether participants had been arrested for a new crime (excluding the original arrest that brought them into the drug court) within 18 months of entering the drug court. Although participants could be charged with more than one offense per arrest episode, this was rarely the case. Among

those who were arrested for at least one new offense, the average was 1.62 new arrests (SD = 0.85, range = 1 to 4) and 1.85 new charges (SD = 1.12, range = 1 to 6). The results were virtually identical regardless of whether new arrests or new charges were examined as the outcome measure; therefore, data are reported on new arrests because they are more likely to reflect distinct factual events.

In addition to examining the percentages of any new arrests, offenses were sub-categorized as involving misdemeanor, felony, or drug-related charges. Drug-related charges could be either felonies or misdemeanors and included simple drug possession, possession with the intent to distribute drugs, drug dealing, drug manufacturing, possession of drug paraphernalia, theft of a prescription form, driving under the influence (DUI), underage drinking, loitering for drug activity, and possession of an open alcohol container on a public highway.

For purposes of the present analyses, results are not reported for new convictions. Because conviction data can take months or years to be entered, many conviction records were not up to date for the current cohort. Future analyses will examine new convictions after sufficient time has elapsed to be confident the data are current for the study cohort.

Participants were scheduled to complete follow-up assessments at 6 and 12 months post-admission to the drug court. The follow-up assessments included collection of a urine specimen and administration of the Addiction Severity Index (ASI) (McLellan et al., 1992). Participants received a $50 check for completing the 6-month assessment and a $75 check for completing the 12-month assessment.

Urine collection was observed directly by same-gender research assistants. The urine drug tests were performed using a hand-held device, the Roche Test-Cup 5©, for cannabis, opiates, amphetamines, cocaine, and PCP. The ASI is a structured interview that assesses current (past 30 days) drug problems, alcohol problems, legal problems, medical problems, family and social problems, employment problems, and psychiatric problems. Composite scores are calculated for each of these domains and are global indicators of problem severity in each area. A lower composite score indicates fewer self-reported problems. The composite scores are based exclusively on events occurring during the preceding 30 days and are sensitive to clinical change over 3- to 6-month intervals (Alterman et al., 1998). Multiple examinations of ASI composite scores and items have yielded impressive evidence of inter-rater and test/rest reliability, concurrent validity, predictive validity, and discriminative utility across groups of participants characterized by age, race, gender, and primary substance of abuse (Alterman et al., 1998; McDermott et al., 1996; McLellan et al., 1980, 1985, 1992).

Follow-up Rates

Re-arrest data were available from the DELJIS on all 118 participants who remained in the study, for a follow-up rate of 100 percent on this variable. The follow-up rate was 94 percent out of the 125 participants in the baseline cohort who were at least partially exposed to the experimental conditions.

Participants were strongly encouraged to complete their follow-up assessments in person at the research office or at a mutually agreeable location in the community, such as a restaurant or library. However, because many participants were unable or reluctant to return for an in-person appointment, approximately 40 percent of the ASIs were administered over the telephone after verifying the participant's identity. The ASI assessments were obtained from 105 participants at the 6-month follow-up and 101 participants at the 12-month follow-up. This represents re-contact rates of 89 and 86 percent, respectively, out of the 118 participants who remained in the study. It represents re-contact rates of 86 and 81 percent, respectively, out of the original baseline cohort of 125 participants who were at least partially exposed to the experimental conditions.

Because approximately 40 percent of the participants did not return to the research office for a face-to-face interview, urine specimens were only collected from 62 participants at the 6-month follow-up and 64 participants at the 12-month follow-up. This represents re-contact rates of 53 and 54 percent, respectively, out of the 118 participants who continuously remained in the study. It represents re-contact rates of 50 and 51 percent, respectively, out of the baseline cohort of 125 participants who were at least partially exposed to the experimental conditions. Thus, although representativeness was good for the ASIs (> 85% follow-up rates for most analyses), it is far less certain whether the urine test results can be expected to generalize to the intent-to-treat cohort (approximately 50% follow-up rates for most analyses). For this reason, analyses were performed both by treating missing urine samples as missing data and also by taking a conservative approach that imputed missing specimens to be drug-positive.

Attrition analyses confirmed that participants who completed a follow-up ASI did not differ from those who did not complete an ASI in terms of their age, gender, race, risk level, employment status, criminal charges, or the severity of their substance abuse problems (all p-values > .40). Among the participants who did not complete an ASI, there were no differences on these variables between those who had been assigned to the adaptive condition as opposed to the baseline-matching condition.

Participants who provided a follow-up urine specimen did not differ from those who did not provide a urine specimen in terms of age, gender, risk level, criminal charges, or the severity of their substance abuse problems (all p-values > .20); however, those who failed to provide a urine specimen were more likely to have been Caucasian (72% vs. 53%, $p < .05$) and employed full time (64% vs. 39%, $p < .01$). Among the participants who did not provide a urine specimen, there were no differences on these variables between those who had been assigned to the adaptive condition as opposed to the baseline-matching condition.

Data Analyses

As previously reported (Marlowe et al., 2012), participants assigned to the two study conditions did not differ at baseline by age, race, gender, employment status, the severity of their substance abuse problems or their criminal histories. However, the groups did differ by risk level, with 13 percent of the adaptive participants being classified as high risk according to study criteria compared to 30 percent of those in baseline-matching ($p < .05$). This difference was attributable to the fact that approximately six more participants in the

baseline-matching condition had a prior history of drug abuse treatment. Importantly, risk level was not significantly correlated with re-arrest rates, urine drug test results or several ASI composite scores. As was intended, the baseline-matching procedure, which was administered to participants in both conditions, apparently neutralized the influence of risk on most outcome measures. However, risk level was correlated with the ASI medical (p = .02), family/social (p = .09), drug (p = .02), and psychiatric (p = .001) composite scores; therefore, those analyses were conducted both by including risk level as a covariate and not including it as a covariate to determine whether this influenced the results. For ease of interpretation, the non-transformed means are reported in the results.

Chi-square analyses were used to compare re-arrest rates for any new offense and for misdemeanor, felony and drug-related offenses. When cell sizes fell below n = 5, a Fisher's Exact Probability Test was used in lieu of a chi-square. Risk status was not included as a covariate in the models because it was not significantly related to re-arrest rates. The 6- and 12-month ASI composite scores were compared using mixed effects models. Separate models were computed for each of the seven composite scores. The models included terms for group, time, and the group-by-time interaction, and specified a compound symmetry covariance structure. The ASI composite scores were not normally distributed; therefore, log-transformed variables were used in the analyses. The 6- and 12-month urine drug test results were compared using generalized estimating equations (GEE). Separate models were computed treating missing urine samples as missing data and imputing missing specimens to be drug-positive. The models included terms for group, time, and the group-by-time interaction, and specified a compound symmetry covariance structure. Because risk level was not related to abstinence rates using either method for handling missing data (p = .55 and .73, respectively), risk level was not included as a covariate in the models.

Results

Participants

The participants were primarily male (78%), Caucasian (59%) or African American (37%), young adults (M = 24.80 years, SD = 7.81), with a high school education (M = 12.36 years, SD = 1.63). Less than one half of the sample (47%) had been employed regularly during the year prior to their arrest and the median annual income was approximately $10,000 (range = 0 to $80,000). Approximately two thirds of the sample (66%) tested positive for at least one substance of abuse during the first month following entry into the drug court. Participants reported their primary substances of abuse were, in descending order of prevalence, cannabis, opiates, cocaine, alcohol, and hallucinogens.

Intervention Integrity

As was previously reported (Marlowe et al., 2012), participants in the adaptive condition were more than twice as likely as those in the baseline-matching condition to receive increased judicial supervision as a consequence for noncompliance with their attendance obligations in the program (64% vs. 30%, p = .03). The judge or drug court team overrode the adaptive response approximately 36 percent of the time. There was no difference in the likelihood of receiving increase clinical case-management sessions as a consequence for

continued positive drug tests ($p = .59$). This suggests the mechanism of action, if any, of the adaptive algorithm may stem from holding participants more accountable for meeting their attendance obligations in the program as opposed to enhancing clinical services in response to unmet treatment needs.

Re-arrest Rates

For the sample as a whole, 22 percent (n = 26/118) of the participants were re-arrested for at least one new offense in the 18 months following entry into the drug court. Approximately 19 percent (n = 23/118) of the participants were arrested for a new misdemeanor offense, 6 percent (n = 7/118) were arrested for a new felony offense, and 11 percent (n = 13/118) were arrested for a new drug-related offense. Because participants could be arrested for both misdemeanor and felony offenses, and because drug-related offenses included both felonies and misdemeanors, the combined percentages exceed those for any new offense.

The participants averaged 0.36 new arrests (SD = 0.78, range = 0 to 4). Among those who were arrested for at least one new offense, the average was 1.62 new arrests (SD = 0.85, range = 1 to 4). This indicates most participants were arrested once or twice if they were arrested at all.

Between-group comparisons are reported in Table 1. Re-arrest rates for any new offense were relatively lower for participants in the adaptive condition than for those in the baseline-matching condition (19% vs. 25%); however, this difference was not statistically significant and the ES was small, $X^2(1) = .79$, $p = .37$; Cramer's $v = .08$.

There was a non-significant trend ($p = 0.10$) suggesting re-arrest rates for misdemeanor offenses were relatively lower for participants in the adaptive condition than for those in the baseline-matching condition (14% vs. 25%); however, the ES was small, $X^2(1) = 2.65$, $p = .10$; Cramer's $v = .15$. Re-arrests for felony offenses were infrequent and nearly equivalent in both conditions (7% vs. 5%), Fisher's Exact Test = 0.28, $p = 1.00$; Cramer's $v = .04$. Finally, re-arrest rates for drug-related offenses were relatively lower for participants in the adaptive condition (7% vs. 15%); however, this difference was not statistically significant and was small in magnitude, $X^2(1) = 2.16$, $p = .14$; Cramer's $v = .13$.

Urine Drug Test Results

When missing urine specimens were treated as missing data, 56 percent (n = 35/62) of the participants who provided a sample tested positive for at least one drug of abuse at 6 months post-entry to the drug court, and 75 percent (n = 48/64) tested positive at 12 months post-entry. The large majority of positive drug tests were positive for cannabis (100% of the positive samples at 6 months, and 94% of the positive samples at 12 months). Small percentages of the samples were positive for cocaine (6% of the positive samples at 6 months and 8% at 12 months) or benzodiazepines (3% at 6 months and 8% at 12 months). Opiates, amphetamines and hallucinogens were detected in less than 3% of the positive samples. The combined percentages may exceed 100% because some samples tested positive for more than one drug of abuse. When missing urine specimens were imputed to be drug-positive, 77 percent (n = 91/118) of the entire sample was determined to be drug-

positive at 6 months post-entry and 86 percent (n = 102/118) was determined to be drug-positive at 12 months post-entry.

Drug test results were compared between the study conditions using GEE analyses. When missing samples were treated as missing data, the GEE analysis yielded a significant main effect for the time of assessment (i.e., 6 vs. 12 months), $X^2(1) = 6.09$, $p = .01$; OR = .45; however, there was neither a significant main effect for the study condition nor a condition-by-time interaction effect. A larger proportion of urine tests were positive for both groups at the 12-month assessment than at the 6-month assessment; however, this pattern was equivalent between conditions.

Similar results were obtained when missing data were imputed to be drug-positive. The GEE analysis yielded a significant main effect for the time of assessment, $X^2(1) = 4.78$, $p = .03$; OR = .51; however, there was neither a main effect for study condition nor a condition-by-time interaction effect. Again, the percentage of positive drug tests increased from 6 months to 12 months and this pattern was equivalent between conditions.

ASI Composite Scores

Mean ASI composite scores are reported in Table 1. As was noted earlier, log-transformed variables were used in the analyses because the composite scores were not normally distributed. The non-transformed means are reported in the table for ease of interpretation. Because the groups differed by risk level at baseline on some ASI composite scores, the results are reported with risk level as a covariate when it was significantly correlated with a composite score. The results were virtually the same regardless of whether risk level was included as a covariate in the analyses.

The mean composite scores were low in every domain of the ASI except the employment domain. Participants in both conditions generally reported few psychosocial problems apart from employment or financial concerns. Because ASI scores are not available from the time participants first entered the drug court, it is unknown whether they had few psychosocial problems to begin with, whether they were minimizing their problems, or whether their problems declined appreciably in both groups during their enrollment in the drug court. Regardless, low problem-severity scores in both conditions may have contributed to a floor effect due to restricted variability in the measures, thus making it difficult to detect between-group differences if any existed.

Discussion

This study experimentally examined the effects of an adaptive program in a misdemeanor drug court. The adaptive algorithm systematically increased participants' contacts with the judge in response to noncompliance with attendance obligations, and increased clinical case-management sessions in response to positive drug tests. Previous analyses indicated that participants assigned to the adaptive condition were more than twice as likely as those assigned to baseline-matching to be drug-negative during the first 18 weeks of enrollment, with an effect size (ES) at the high end of the moderate range (Marlowe et al., 2012). Current analyses reveal, however, that the effects may have converged during the ensuing

year. Between-group differences in new arrest rates, urine drug test results, and self-reported psychosocial problems were small and non-statistically significant at 6, 12 and 18 months post-entry to the drug court.

It is unclear whether the effects of the adaptive algorithm may have degraded over time or whether outcomes in the baseline-matching condition might have caught up with those of the adaptive intervention after extended exposure to the drug court. Although the adaptive algorithm might have prompted staff members to respond more reliably to infractions during the early months of treatment, staff may have come to respond reliably on their own over the course of time. Regardless, the results do suggest further efforts may be required to extend the effects of adaptive algorithms beyond the first 4 to 6 months of treatment in drug courts.

Importantly, these results do not suggest that the effects of the drug court degraded after 6 months. Participants in both conditions were in drug court and the study compared the effects of two different service-matching approaches. Lacking a non-drug-court control condition, there is no way from this research design to determine the long-term impacts of the drug court.

In the sample as a whole, 22 percent of the participants were re-arrested for at least one new offense within 18 months of entering the drug court. Most of the arrests were for misdemeanor offenses and about half were for drug-related offenses. This suggests recidivism in this misdemeanor sample was relatively infrequent and unlikely to have posed a substantial risk to public safety. It is difficult to place these outcomes in a broader context because representative data on recidivism rates in drug courts are sparse. Results of a recent national evaluation of 23 adult drug courts reported recidivism rates of 40 percent at 18 months and 52 percent at 24 months (Rempel et al., 2012). However, those data are not directly comparable to the present study for at least two reasons. First, the national cohort was comprised predominantly of more serious felony offenders. Second, the 18-month findings in the national study were based on self-report data rather than official arrest records. Nevertheless, recidivism in the current study appears to have been within, if not substantially below, national averages.

There was a non-significant trend ($p = .10$) suggesting re-arrest rates for misdemeanor crimes were relatively lower for participants in the adaptive condition than for those in the baseline-matching condition (14% vs. 25%). It is possible that a “signal” was still detectable from the adaptive algorithm after 18 months; however, the size of the residual effects, if any, was small (Cramer's $v = .15$). Because the drug court program is only scheduled to be 18 weeks (about 4 months) in length and most participants completed the program within 6 to 10 months, the majority of participants were no longer exposed to the adaptive intervention during most of the 18-month follow-up period. It should perhaps not be surprising that the effects may have degraded during the extended follow-up window. Future efforts should append continuing-care components to the adaptive algorithm to extend its effects beyond a few months. For example, continuing-care interventions involving brief periodic telephone calls (McKay et al., 2005, 2010) and “recovery check-ups” (Scott & Dennis, 2012) have been found to extend the benefits of an index substance abuse treatment episode or reduce recidivism following offenders' release from jail.

Rates of positive urine drug tests were disconcertingly high at 6 and 12 months post-entry to the drug court. Over one half (56%) of the participants who provided a urine sample tested positive for at least one drug of abuse at 6 months post-entry and three quarters (75%) tested positive at 12 months. Cannabis was, by far, the most commonly detected drug (100% of the positive samples at 6 months and 94% of the positive samples at 12 months). This is not surprising given that most of the participants had been arrested for misdemeanor possession of marijuana or marijuana-related paraphernalia.

It is difficult to know whether the urine test results are representative of drug use in the intent-to-treat cohort because of the low follow-up rates on this measure (approximately 50%). It is possible that participants who took longer to achieve abstinence and graduate from the drug court were more likely to have been available on the premises for in-person follow-up appointments. In contrast, those who graduated earlier may have been more reluctant to return for additional in-person visits. If follow-up urine tests were completed more often on program “stragglers”, the results are apt to have over-estimated continued drug use in the sample. This interpretation is speculative, however, and any conclusions about extended drug use in the population must await future studies with higher re-contact rates for urine specimens.

Analyses involving the ASI offered limited utility for this study. With the exception of the employment domain, the composite scores were highly skewed towards low values. This is likely to have contributed to a floor effect due to restricted variability in the measures, which would have made it exceedingly difficult to detect between-group differences assuming any existed. As was mentioned earlier, because baseline ASI scores were not available from the time participants first entered the drug court, it is unknown whether the participants had few psychosocial problems to begin with, whether they were minimizing their problems, or whether problems declined appreciably in both groups during participants' enrollment in the program. Regardless, the findings raise questions about the usefulness of the ASI for evaluating response to treatment among misdemeanor drug offenders.

Limitations

There are several important limitations to this study that must be borne in mind when interpreting the findings. First, the study was conducted in a single misdemeanor drug court located in a northeast metropolitan city. It is unknown whether the results would generalize to other offender populations such as felons or juvenile offenders, or to other geographic regions.

The consent rate for the study was 39 percent, which may have reduced the representativeness of the sample. Defendants who refused to participate in the study were significantly more likely to have been represented by private defense counsel. This might suggest that they had greater financial resources or familial support. Defendants who refused to participate may also have differed on variables that were not measured in this study, such as their motivation for change. As a result, the study sample might not have adequately reflected the target population of misdemeanor drug court participants.

A small number of participants (n = 12) withdrew from the study after random assignment and some of those participants (n = 7) were at least partially exposed to the experimental conditions. This attrition is unlikely to have confounded the results because it appears to have been distributed equivalently between the conditions. Nevertheless, it is possible that the more seriously disordered or unmotivated individuals may have withdrawn systematically from the research. If so, this could have reduced the variability in the outcomes and made it more difficult to detect between-group differences. It could also have made the outcomes appear more favorable for the sample as a whole.

The groups differed significantly at baseline by risk level, with 13 percent of the adaptive participants meeting study criteria for being high risk compared to 30 percent of those in baseline-matching ($p < .05$). Risk level was not correlated with most outcome measures and was included as a covariate in those analyses where it was indicated. This suggests baseline differences in risk level are unlikely to have influenced the findings. Nevertheless, because the interventions were targeted specifically to participants' risk level, the imbalance between cells on this variable could have impacted the results in unanticipated ways. Future studies should employ an urn randomization procedure to ensure participants' risk level is distributed equivalently between the conditions.

Although follow-up rates were good to excellent for the re-arrest and ASI outcomes, the follow-up rates hovered around 50 percent for the urine drug screens. As has already been discussed at length, this raises serious concerns about whether the urine drug test results are representative of drug-use outcomes for the original study cohort.

Re-arrest rates were assessed using a statewide database that did not include offenses occurring in other jurisdictions or in the federal system. This is unlikely to have biased the results because most criminal arrests occur within the same state as the offender's residence and any under-detection of arrests should have been distributed equally between the two study conditions. Nevertheless, there is the possibility that re-arrest rates were underestimated for the sample as a whole. Future analyses will examine national criminal justice databases to gain a more complete picture of new arrest events.

There is nothing sacrosanct about the adaptive algorithm employed in this study. This algorithm was developed through a collaborative process involving the drug court team and research staff. There are undoubtedly numerous ways to improve upon the algorithm to elicit more consistent and robust effects. For example, the algorithm made no effort to standardize or influence what transpired during the court hearings or case-management sessions. Training judges or case managers on effective interactional techniques (e.g., motivational interviewing) might elicit greater benefits.

Finally, the adaptive algorithm did not ratchet services downward in response to good performance in the program. Scaling down services relates to the best way to move offenders along a continuum of care from an intensive index treatment episode to less intensive continuing aftercare. Failing to address this critical transition could explain why the effects of the adaptive algorithm were not sustained beyond the first several months of the program. Future research should evaluate adaptive algorithms that progressively taper

down the provision of services and employ evidence-based continuing-care strategies in an effort to prepare offenders for long-term maintenance of drug abstinence and desistence from crime.

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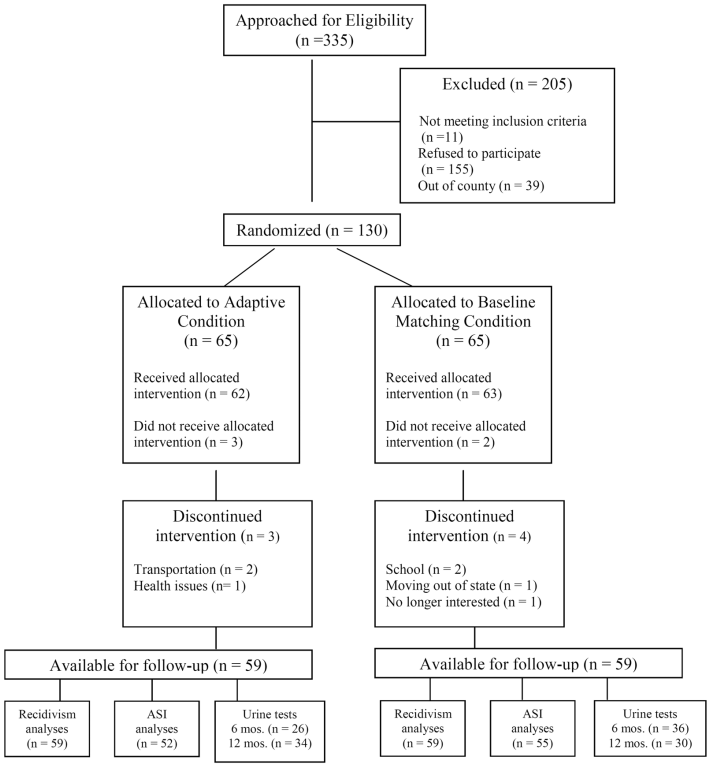

Figure 1.
CONSORT Chart.

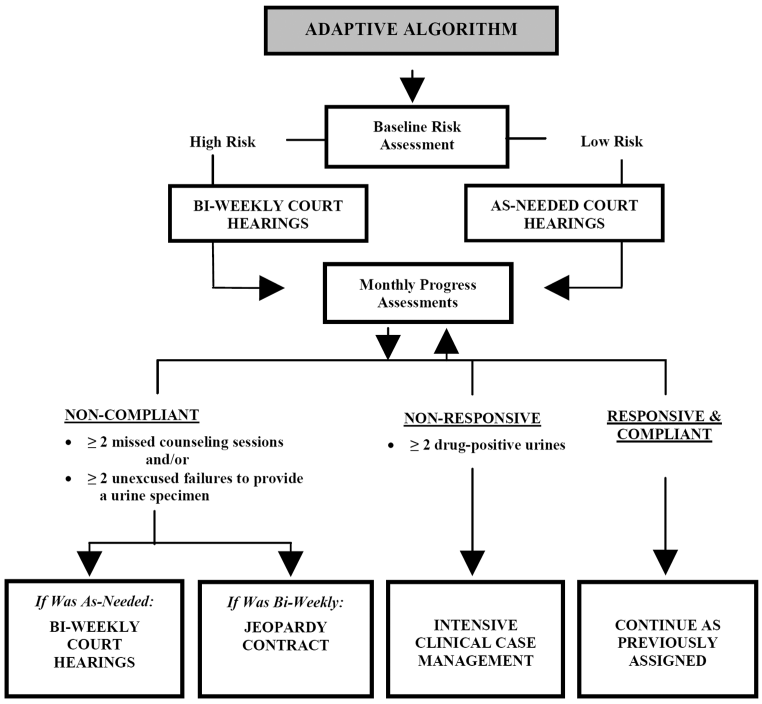

Figure 2.

Adaptive algorithm. High risk = meets DSM-IV diagnostic criteria for antisocial personality disorder (APD) or has a history of drug abuse treatment, excluding self-help groups. Low risk = does not meet diagnostic criteria for APD and has no history of drug abuse treatment.

Table 1

Outcomes by Condition: % or Mean (SD)

Outcome Measure	Follow-up interval post-entry	Adaptive Condition	Baseline-Matching Condition
Re-arrest for any new offense	18 months	19%	25%
Re-arrest for new misdemeanor offense	18 months	14%†	25%
Re-arrest for new felony offense	18 months	7%	5%
Re-arrest for new drug-related offense	18 months	7%	15%
Positive urine drug test (missing sample = missing data)	6 months	46%	64%
	12 months	71%	80%
Positive urine drug test (missing sample = drug-positive)	6 months	76%	78%
	12 months	83%	90%
ASI Composite Scores			
Alcohol	6 months	0.06 (0.09)	0.05 (0.07)
	12 months	0.05 (0.07)	0.07 (0.08)
Drug	6 months	0.04 (0.07)	0.06 (0.09)
	12 months	0.04 (0.06)	0.05 (0.06)
Legal	6 months	0.04 (0.11)	0.08 (0.15)
	12 months	0.04 (0.11)	0.04 (0.12)
Psychiatric	6 months	0.10 (0.17)	0.10 (0.16)
	12 months	0.09 (0.16)	0.14 (0.19)
Employment	6 months	0.43 (0.29)	0.44 (0.29)
	12 months	0.45 (0.34)	0.47 (0.34)
Family/Social	6 months	0.07 (0.11)	0.07 (0.14)
	12 months	0.07 (0.14)	0.07 (0.14)
Medical	6 months	0.10 (0.24)	0.14 (0.28)
	12 months	0.07 (0.24)	0.15 (0.30)

Notes:

ASI = Addiction Severity Index. Because some participants were arrested for both misdemeanor and felony offenses, the combined percentages may exceed those for any new offense. Drug-related offenses include both felonies and misdemeanors.

† $p = .10$.