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What is This?

ADAPTIVE PROGRAMMING IMPROVES OUTCOMES IN DRUG COURT

An Experimental Trial

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Prior studies in drug courts have reported improved outcomes when participants were matched to schedules of judicial status hearings based on their criminological risk level. The current experiment determined whether incremental efficacy could be gained by periodically adjusting the schedule of status hearings and clinical case management sessions in response to participants' ensuing performance in the program. The adjustments were made pursuant to a priori criteria specified in an adaptive algorithm. Results confirmed that participants in the full adaptive condition ($n = 62$) were more than twice as likely as those assigned to baseline matching only ($n = 63$) to be drug abstinent during the first 18 weeks of the program; however, graduation rates and the average time to case resolution were not significantly different. The positive effects of the adaptive program appear to have stemmed from holding noncompliant participants more accountable for meeting their attendance obligations in the program. Directions for future research and practice implications are discussed.

Keywords: addiction; substance abuse; adaptive treatment; criminal justice; offenders

More than 80% of criminal offenders in the United States meet a broad definition of substance involvement; specifically, they were arrested for a drug- or alcohol-related offense, were intoxicated at the time of their offense, reported they committed their offense to support a drug habit, or have a serious history of substance abuse (National Center on Addiction & Substance Abuse, 2010). Approximately one half of offenders satisfy diagnostic criteria for substance abuse or dependence (Fazel, Bains, & Doll, 2006; Karberg & James, 2005; Zhang, 2003).

Continued substance abuse is associated with a two- to fourfold increase in the likelihood of recidivist criminal offending (Bennett, Holloway, & Farrington, 2008). Providing substance abuse treatment can reduce recidivism rates significantly (Chandler, Fletcher, &

Volkow, 2009); however, drug offenders are notorious for failing to comply with conditions to attend substance abuse treatment. Unless they are closely supervised and receive meaningful consequences for failing to attend treatment sessions, fewer than one quarter of drug offenders may be expected to complete a treatment episode (Marlowe, 2002; University of California, Los Angeles, 2007).

DRUG COURTS

Drug courts were created to enhance offenders' compliance with substance abuse treatment. Drug courts are special criminal court dockets that provide a judicially supervised regimen of substance abuse treatment and other indicated services in lieu of prosecution or incarceration (National Association of Drug Court Professionals, 1997). Participants undergo random, weekly drug testing and attend regular status hearings in court, during which the judge reviews their progress in treatment and may impose a range of consequences contingent on their performance. These consequences may include punitive sanctions (e.g., writing assignments, community service, or brief jail detention), desired rewards (e.g., verbal praise, reduced supervision requirements, or token gifts), or modifications to the participant's treatment plan (e.g., transfer to a more intensive modality of care).

The consequences are typically administered by the judge in open court, after the drug court team has met privately in a staff meeting to review the case and reach a tentative determination about the appropriate course of action. The various team members—who often include representatives of the court, prosecution, defense bar, treatment providers, case managers, and probation officers—contribute information from their perspectives about participants' progress in the program and may offer recommendations for suitable responses; however, the judge is legally and ethically required to make the final decision about what consequences to impose, after giving due consideration to all of the relevant information and discussing the matter with the participant in court.

In preadjudication drug courts, graduates have their charge or charges withdrawn and may also have an opportunity to have the offense expunged from their record. Although the record is usually not literally erased from criminal justice databases, record expungement ordinarily entitles the individual to respond truthfully on an employment application or similar document that the arrest or conviction did not occur (Festinger, DeMatteo, Marlowe, & Lee, 2005). In postadjudication drug courts, graduates may avoid incarceration, reduce the conditions of their probation, or consolidate multiple probationary sentences.

Six meta-analyses conducted by independent investigators concluded that drug courts significantly reduced criminal recidivism (typically measured by rearrest rates) by an average of 8 to 26 percentage points (Aos, Miller, & Drake, 2006; Downey & Roman, 2010; Latimer, Morton-Bourgon, & Chretien, 2006; Lowenkamp, Holsinger, & Latessa, 2005; Shaffer, 2010; Wilson, Mitchell, & MacKenzie, 2006). A recent cost-related meta-analysis concluded drug courts produced an average of $2.21 in direct benefits to the criminal justice system for every $1.00 invested (Bhati, Roman, & Chalfin, 2008). Yet despite their proven efficacy, drug courts serve only about 5% to 10% of the roughly 1.5 million adults arrested each year in the United States who meet criteria for substance abuse or dependence (Bhati et al., 2008). If drug courts are to extend their reach to the larger at-risk population, it may no longer be feasible for team members to meet regularly in staff meetings to review

all of the cases. It will become necessary to model how well-functioning drug courts typically respond to various presentations by participants and to routinize or standardize that process so that it may be reliably implemented with larger populations of offenders (Farole, Puffett, Rempel, & Byrne, 2004). In the treatment literature, the process of standardizing clinical or supervisory responses to participants' performance is referred to as adaptive programming.

ADAPTIVE PROGRAMMING

Adaptive programs adjust the dose or types of services that are administered in response to participants' clinical presentation or performance in treatment (McKay, 2009). The decision rules or algorithms are specified a priori, that is, before treatment has been initiated (Collins, Murphy, & Bierman, 2004; Murphy, Lynch, McKay, Oslin, & TenHave, 2007). In this way, decisions are guided primarily by the research evidence rather than by individual professional judgment, which can be negatively influenced by such factors as time pressures, insufficient expertise, and personal biases (Andrews & Bonta, 2010; Wormith & Goldstone, 1984). Treatment professionals retain authority to override or alter an indicated adaptive response; however, they are typically requested to articulate the rationale for doing so in the participant's record.

Matching services to participants' pretreatment characteristics is the simplest form of adapting treatment to the needs of the individual. For example, tailoring services to the needs of youths or racial minorities is one common approach to adapting treatment for the individual. At a more sophisticated level, the nature or intensity of services is periodically adjusted as a consequence of participants' ensuing performance in treatment. For example, if a participant misses a specified number of counseling sessions, he or she might be assigned to a motivational enhancement intervention. The term *matching* is commonly used to describe strategies that tailor treatment to participants' baseline characteristics, whereas the term *adaptive* is generally reserved for strategies that adjust the interventions over the course of treatment.

NONCOMPLIANCE VERSUS NONRESPONSIVENESS

Selecting adaptive interventions can be complicated when dealing with drug-offender populations, who are jointly supervised by the criminal justice and substance abuse treatment systems. Criminal justice professionals are primarily charged with protecting public safety and are empowered to respond to misconduct with enhanced supervision or punitive sanctions. Treatment professionals are primarily charged with improving the health of their clients and may intensify a client's treatment plan in furtherance of these goals. This requires a distinction to be drawn between *noncompliance* with supervision requirements and *nonresponsiveness* to the clinical interventions (Marlowe, 2008).

For example, if a drug court participant fails to attend counseling sessions, 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 infraction. On the other hand, if a participant is meeting his or her obligations in the program but is

not responding to the clinical 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 & Wong, 2008).

Distinguishing between noncompliance and nonresponsiveness addresses an important problem that is commonly encountered in correctional rehabilitation programs. Some judges or probation officers may increase treatment requirements as a consequence for misconduct in the program. For example, a participant who misses several counseling sessions might be "sanctioned" with a requirement to attend residential treatment. This practice not only risks wasting scarce treatment resources but also may give the inadvertent message to participants that treatment is aversive and something to be avoided. Treatment should be used to address clinical symptoms and not to punish willful misconduct.

BASELINE-MATCHING STUDIES

Beginning in 1999, our research team initiated a planned sequence of experiments aimed at matching the intensity of judicial supervision in drug courts to the risk level of participants. According to the criminological paradigm of the *risk principle*, intensive court monitoring would be expected to exert the greatest benefits for high-risk offenders who have more severe antisocial propensities or treatment-refractory drug use histories but may be unnecessary or contraindicated for low-risk offenders (Andrews & Bonta, 2010; Taxman & Marlowe, 2006). High-risk offenders often require intensive and sustained interventions to dislodge their entrenched negative behavioral patterns. Low-risk offenders, in contrast, are less likely to be on a fixed antisocial trajectory and are apt to improve their conduct following a criminal arrest. Therefore, intensive court supervision may offer few incremental benefits for these individuals but at a substantial cost (DeMatteo, Marlowe, & Festinger, 2006).

Among drug offenders, the most reliable and robust risk factors for failure in traditional rehabilitation programs include a younger age, male gender, adolescent onset of delinquency or substance abuse, prior felony convictions, a coexisting diagnosis of antisocial personality disorder (APD), previously unsuccessful attempts at drug abuse treatment, and a history of violence (Marlowe, Patapis, & DeMatteo, 2003). We hypothesized that participants with some of these risk factors would benefit most from intensive judicial monitoring.

In the first study, consenting participants in a misdemeanor drug court were randomly assigned to attend judicial status hearings on a *biweekly* basis (every 2 weeks) throughout their enrollment in the program or to be monitored by their clinical case managers who requested court hearings *as needed* in response to serious or repeated infractions. Results revealed no main effects of status hearings on counseling attendance, urine drug test results, graduation rates, or criminal activity during participants' enrollment in the drug court or at 12 months postentry (Festinger et al., 2002; Marlowe, Festinger, Dugosh, & Lee, 2005; Marlowe, Festinger, et al., 2003). As hypothesized, however, planned interaction analyses confirmed that high-risk participants who (a) met diagnostic criteria of the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*) (American Psychiatric Association, 2000) for APD or (b) had a history of drug abuse treatment, provided more drug-negative urine specimens and were more likely to graduate from the drug court, when they were assigned to biweekly court hearings (Festinger et al., 2002).

These results were replicated in felony and misdemeanor drug courts located in urban and rural communities (Marlowe, Festinger, & Lee, 2004a, 2004b). Subsequently, the findings were confirmed using a prospective-matching design, which brought the interaction effects under experimental control. Participants were randomly assigned to be *matched* or *unmatched*. Unmatched participants attended status hearings as usual in the drug court, which was every 4 to 6 weeks. Matched participants were scheduled to attend either biweekly court hearings or as-needed hearings, depending on whether they met the above criteria for being high risk or low risk. The results confirmed that high-risk participants attended significantly more counseling sessions, provided significantly more drug-negative urine specimens, and graduated at a significantly higher rate when they were matched to biweekly court hearings (Marlowe, Festinger, Lee, Dugosh, & Benasutti, 2006; Marlowe, Festinger, Dugosh, Lee, & Benasutti, 2007). On the other hand, outcomes were equivalent for the low-risk participants regardless of how often they were required to appear before the judge in court.

ADAPTIVE PILOT STUDY

The baseline-matching studies represented a first step in tailoring adaptive interventions for drug-abusing offenders. No measurement tool is perfectly valid and reliable, and there will often be an appreciable number of false positives and false negatives in any program. Some offenders with poor prognoses will be erroneously assigned to low-intensity conditions, and others with good prognoses will be assigned to high-intensity conditions. A mechanism must be established to adjust the initial placement as a consequence of their subsequent performance in treatment.

It was also noteworthy that the baseline-matching procedure elicited improvements for the high-risk participants but not for the low-risk participants, who composed nearly one half to two thirds of the samples. It is possible that some individuals were low risk from a criminological perspective but still had serious treatment needs that were not being addressed by increasing their contacts with a judge.

We pilot tested an adaptive algorithm that distinguished between noncompliance with the supervisory conditions of the drug court and nonresponsiveness to the clinical interventions. The algorithm was developed through a collaborative process between the drug court team and research staff. Interventions were chosen that are commonly used in drug courts, and criteria for noncompliance and nonresponsiveness were selected that are easily and objectively measurable (see Figure 1).

The first step in the adaptive algorithm was identical to the previous baseline-matching procedure. Subsequently, participants were assessed at monthly intervals to determine how they were progressing in the program. Those who had two or more unexcused absences from counseling sessions, or two or more unexcused failures to provide a valid urine specimen, were determined to be noncompliant with the conditions of the program. For them, the schedule of court hearings was increased. If they had previously been assigned to as-needed court hearings, they were reassigned to biweekly hearings. If they were already on a biweekly 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 termination hearing, also known as a show-cause hearing, at which the participant is terminated from the program and sentenced on the original charge or charges
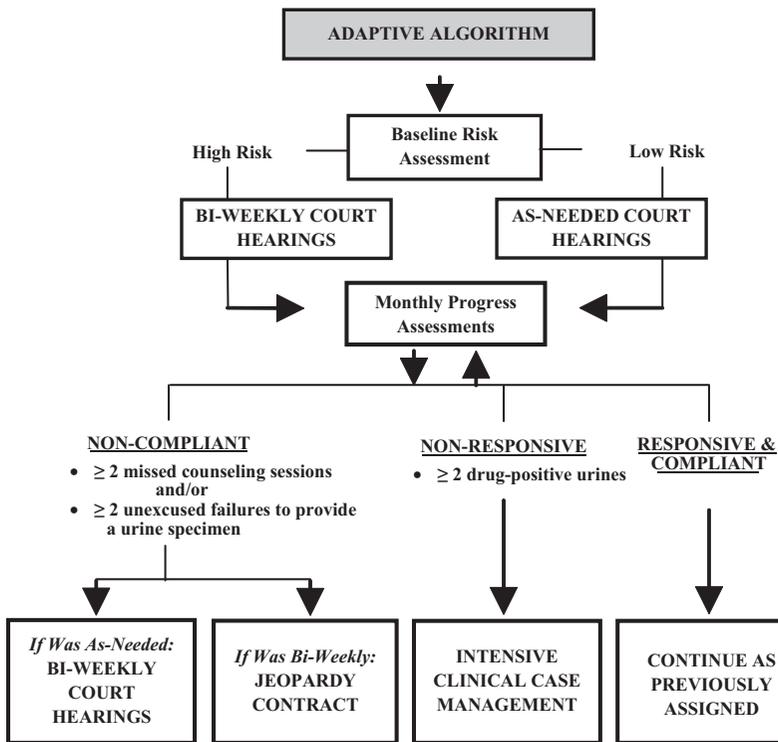
Figure 1:   Adaptive Algorithm
Note. High risk = meets *DSM-IV-TR* diagnostic criteria for antisocial personality disorder (APD) or has a history of drug abuse treatment, excluding self-help groups. Low risk = does not meet criteria for APD and has no history of drug abuse treatment.

unless he or she can provide a good-cause reason to be given another chance. The decision whether or not to permit another chance is within the discretion of the judge and is generally granted in approximately 30% of cases.

Participants who provided two or more drug-positive urine specimens were determined to be nonresponsive to the clinical interventions. Those individuals were referred to an intensive clinical case management (ICCM) program. Participants in ICCM were required to attend two additional therapeutic group sessions per week and one additional individual treatment session per month. The interventions were administered by a clinically trained case manager and focused on motivational enhancement and relapse-prevention techniques.

Consenting participants were randomly assigned at entry to drug court as usual ($n = 14$) or to the adaptive intervention ($n = 16$). This pilot trial was not intended to be statistically powered to detect modest effects. The aims were limited to determining whether the adaptive algorithm was feasible to implement in a real-world drug court and whether it showed sufficient promise to justify the cost and effort of a fully powered experimental trial. Results revealed the adaptive algorithm was acceptable to participants and staff and showed substantial promise for improving outcomes. The estimated effect sizes ranged from 0.40 to 0.60 (in the moderate to large range) across various dependent measures, including drug-negative urine specimens and on-time graduation rates (Marlowe et al., 2008).

It also took an average of approximately 4 fewer months for participants in the adaptive condition to graduate from the program or reach a final resolution of the case (Marlowe et al., 2009).

Data from the pilot study suggested a possible mechanism of action for the adaptive program. According to the same criteria for noncompliance and nonresponsiveness as for the adaptive condition, participants in the as-usual condition were much less likely to receive a consequence for inadequate performance. Consequences were imposed only 31% of the time when they were indicated for the as-usual participants, as compared to 88% for the adaptive condition. It should not be surprising that outcomes were less impressive in the as-usual condition because there was only about a one in three chance of receiving a consequence for infractions. The primary contribution of adaptive algorithms may be to increase the probability that infractions (and perhaps achievements) are recognized and addressed.

CURRENT STUDY

The current study replicated the pilot trial in a fully powered randomized experiment, with one important difference in the comparison condition. The pilot trial compared the adaptive algorithm to drug court as usual. However, it was already established from our earlier work that the baseline-matching procedure improved outcomes over drug court as usual. The important remaining question was whether the adaptive algorithm would add incremental utility beyond that attained from the matching procedure. Therefore, the current study compared the effects of the adaptive algorithm to the baseline-matching procedure rather than to drug court as usual.

METHOD

HUMAN SUBJECTS PROTECTIONS

The study was approved and monitored by the Institutional Review Boards of the Treatment Research Institute and the Delaware State Department of Health & Social Services. A National Institutes of Health 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 and Accountability Act Research Subject Authorization of Confidentiality & Privacy Rights.

RECRUITMENT PROCEDURES

The study was conducted in a misdemeanor drug court located in Wilmington, Delaware. Eligibility criteria for this drug court require defendants to (a) be at least 18 years of age; (b) be a resident of or have committed their offense in New Castle County, Delaware; (c) be charged with a misdemeanor offense including possession or consumption of cannabis, possession of drug paraphernalia, or possession of hypodermic syringes; (d) not have a history of a violent offense involving serious injury to a victim or use of a deadly weapon; and (e) meet criteria for substance abuse or dependence as determined by a clinical evaluation performed by the treatment program working in concert with the drug court.

Research staff approached consecutive admissions to the drug court from February 2009 through March 2010. Immediately following a group orientation session conducted by treatment staff, a research staff member provided a brief oral description of the study, including participation requirements, payment incentives, confidentiality protections, and the right to refuse or withdraw from the study at any time without negative repercussions. Defendants who indicated a potential interest in the study went through an individualized informed consent procedure before any research data were collected. If a defendant consented to random assignment, the research coordinator informed the court about the assigned schedule of status hearings. If the defendant declined to be in the study, he or she received the routine schedule of status hearings for the drug court, which was every 4 to 6 weeks.

A total of 335 drug court clients were approached by research staff for participation in the study. Of those, 130 (39%) provided informed consent to participate. This consent rate is comparable to those of our prior studies and 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 to participate in terms of age, gender, current criminal charges, or prior bench warrants ($p > .45$ in all analyses); however, those who refused to participate were significantly more likely to have been represented by private defense counsel (33% vs. 17%), $\chi^2(1) = 9.20$, $p = .002$. Of those who initially consented to participate, three individuals in the adaptive condition (two of whom were determined to be high risk according to study criteria) and two individuals in the baseline-matching condition (one of whom was high risk) withdrew from the study before being exposed to the experimental interventions. This left a final study sample of 125 participants (adaptive $n = 62$; baseline matching $n = 63$).

BRIEF DESCRIPTION OF THE DRUG COURT PROGRAM

In this postplea, preadjudication drug court, defendants are required to plead guilty to the initial charge or charges and the 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 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 often 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 4 months (approximately 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 at least 14 consecutive weekly drug-negative urine specimens, remaining arrest free, obeying program rules and procedures, and paying a $200 court fee. The basic group sessions are psychoeducational 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 also attend 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 with gas chromatography/mass spectrometry confirmation of positive results on a six-panel screen for cannabis, alcohol, opiates, amphetamines, cocaine, and phencyclidine, 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' treatment or supervisory obligations.

ADAPTIVE CONDITION

Participants who were randomly assigned to the adaptive condition ($n = 62$) 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 1 and described earlier for the pilot study, unless the judge elected to override a consequence. As in our prior studies, the a priori decision rule for assessing risk level was derived from two dichotomous measures employed on an either/or basis. If participants met *DSM-IV-TR* diagnostic criteria for APD or had a history of at least one prior drug abuse treatment episode, excluding self-help groups, they were determined to be high risk. If they had neither APD nor a prior drug treatment episode, they were determined to be low risk. The instruments that were used to make these assessments are described below.

Participants were subsequently assessed at monthly intervals to determine how they were progressing in the program, and status hearings or clinical case management sessions were increased pursuant to the adaptive algorithm. Attendance information and urine drug test results were entered by clinical staff or the drug court manager into a web-based management information system (MIS). The MIS issued an automated alert to the drug court staff members whenever a participant in the adaptive condition met criteria for noncompliance or nonresponsiveness and indicated the intended consequence. In addition, the research coordinator for the study alerted drug court staff when adaptations were called for. The drug court team was free to deliberate about whether to impose a particular consequence, and the judge could override an indicated response.

BASELINE-MATCHING CONDITION

Participants in the baseline-matching condition ($n = 63$) were scheduled to attend biweekly status hearings if they were determined to be high risk or as-needed hearings if they were determined to be low risk. The baseline match was performed in the same manner as in the adaptive condition. Subsequently, they were assessed on a monthly basis in the same manner as participants in the adaptive condition; however, the results were not

communicated to the drug court team. The team responded to the participants' presentation with no influence or communication from research personnel.

DATA SOURCES

Study participants provided written, informed consent granting the research team access to their treatment records from the drug court program. These records included participants' weekly urine drug-screen results, counseling attendance, and program completion status.

A baseline assessment was administered after obtaining informed consent to research participation. Participants received a $40 money order for completing the entire baseline battery. The 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-TR* (American Psychiatric Association, 2000) 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 interrater reliability scoring trials, there was greater than 90% exact agreement for dichotomous diagnoses of APD among our research assistants. The RANT™ also contains an item inquiring whether participants attended any prior drug abuse treatment episode, excluding self-help groups. Interrater and test–retest reliabilities for this item have consistently been greater than 90% in prior studies.

Finally, participants completed the following questionnaires on a monthly basis during the first 3 months of enrollment. They received a $30 money order for completing each of the monthly assessments. The purpose of the questionnaires was to determine whether the participants might have viewed the use of the adaptive algorithm as being too rigid or mechanistic or, alternatively, whether they might have perceived it as leading to more fair and even-handed decisions by the court.

Perceived deterrence. The perceived deterrence questionnaire is an eight-item Likert-type scale that measures respondents' perceptions of the likelihood that they will receive substantial sanctions for infractions and rewards for achievements in the program. Previous validation studies revealed this measure significantly predicted outcomes in several drug court programs (Marlowe, Festinger, Foltz, Lee, & Patapis, 2005).

Procedural justice. The procedural justice questionnaire is a four-item Likert-type scale that measures respondents' perceptions that they are being treated fairly and respectfully, the degree to which they understand the rules and their rights in the program, and the degree to which they are given a chance to explain their side of an issue prior to the imposition of consequences from the court.

Attitudes toward the judge and program. Two binary items examined participants' attitudes toward the judge. One item inquired whether participants believed they had a good relationship with the judge, and the second item inquired whether they felt they were being helped by the judge. A single binary item gauged participants' overall satisfaction with the drug court program. The item asked whether or not they were satisfied with the services they received in the drug court.

DATA ANALYSES

As a check on randomization, the adaptive and baseline-matching groups were compared on a range of baseline variables, including age, race, gender, employment status, severity of their drug problems, risk level, and criminal history. Any variables that were significantly different between the groups and significantly correlated with outcomes would be statistically controlled for in the outcome analyses.

The primary dependent measure for the study was the percentage of drug-negative urine specimens provided by participants during the first 18 weeks of the program. Drug test results were designated as the primary dependent variable because they are objectively measured and collected longitudinally. Because some participants could graduate within 18 weeks of entry if they readily completed all of the requirements for the program, capping the analyses at 18 weeks ensured there were equivalent data points for all participants. The analyses were performed both by counting missing or invalid urine specimens as missing data and also by taking a more conservative approach that assumed missing or invalid specimens to be drug positive. In addition, generalized estimating equations (GEEs) were used to longitudinally examine the drug test results over the course of the first 18 weeks. The GEE models included terms for group, week, and the group-by-week interaction.

Secondary dependent measures included on-time graduation rates within 18 weeks of entry into the drug court and within 12 months of entry. The average time to case resolution (either through graduation or termination) was examined using a Kaplan–Meier survival analysis. Cases were censored if they were not resolved within the first year postentry.

Finally, group differences were examined on the questionnaires assessing participants' attitudes toward the program. These analyses used *t* tests for continuous items and chi-squares for binary items. To ensure participants were sufficiently exposed to the program to provide reliable and stable responses, the analyses examined each participant's final monthly assessment.

RESULTS

PARTICIPANTS

The participants were primarily Caucasian (59%) or African American (37%), young adults ($M = 24.53$ years, $SD = 7.67$), with a high school education ($M = 12.37$ years, $SD = 1.61$). Less than one half of the sample (47%) had been regularly employed during the year prior to their arrest, and the median annual income was approximately $10,000 (range = $0 to $80,000). Nearly two thirds of the sample (64%) tested positive for at least one substance of abuse during the first month of the study. Participants self-reported that their primary substances of abuse were cannabis, heroin or other opiates, cocaine, alcohol, and hallucinogens, respectively.

Participants in the two conditions did not differ by age, race, gender, employment status, severity of their substance abuse problems, or criminal history. However, the groups did differ by risk level, with 13% of the adaptive participants classified as high risk according to the study criteria, compared to 30% of those in baseline matching ($p < .05$). This difference was accounted for by a larger number of participants in the baseline-matching condition having a prior history of drug abuse treatment. A careful review of the randomization process failed to identify a cause for the imbalance. The randomization process appeared

TABLE 1:   Outcomes by Condition

	Adaptive (n = 62)		Baseline Matching (n = 63)			Effect Size
	M or %	SD	M or %	SD	p Value	d or w
Received consequence for noncompliance (%)	64		30		.03	.33
Received consequence for nonresponsiveness (%)	46		56		.59	.10
Percentage weeks abstinent (missed urines = missing data)	0.68	0.39	0.49	0.43	.01	.46
Percentage weeks abstinent (missed urines = drug positive)	0.61	0.40	0.46	0.43	.04	.37
Graduated within 18 weeks (%)	31		23		.36	.08
Graduated within 12 months (%)	68		67		.90	.01
Days to case resolution mean and SE	193.61	11.77	200.13	12.13	.81	
Perceived deterrence scale (range = 0–24)	17.86	5.00	18.85	4.74	.28	.20
Procedural justice scale (range = 0–12)	10.86	1.54	10.30	2.15	.10	.30
Helped by judge (%)	73		73		.98	.003
Good relationship with judge (%)	62		75		.16	.14
Satisfied with drug court services (%)	86		89		.70	.03

Note. Noncompliance = two or more unexcused absences from counseling sessions within 1 month, or two or more unexcused failures to provide a valid urine specimen within 1 month. Nonresponsiveness = two or more positive urine drug tests within 1 month.

to have been implemented as planned, and there was no differential attrition from the groups. It is important that risk level was not correlated with any outcome measure ($p > .30$ in all analyses), and the results did not change when risk level was included as a covariate in the analyses. As in our prior studies, the baseline-matching procedure (which was administered to participants in both groups) apparently "neutralized" the influence of risk on outcomes. Therefore, the following analyses did not include risk as a covariate.

CONSEQUENCES FOR NONCOMPLIANCE AND NONRESPONSIVENESS

For the sample as a whole, 36% of the participants met criteria for noncompliance on at least one occasion and 23% met criteria for nonresponsiveness. Rates of noncompliance (35% vs. 37%) and nonresponsiveness (21% vs. 25%) were equivalent between the two conditions. As intended, participants in the adaptive condition were significantly more likely to receive a consequence for noncompliance than those in the baseline-matching condition, $\chi^2(1) = 4.98$, $p = .03$, $w = .33$. The adaptive participants were more than twice as likely to receive a consequence for noncompliance as those in baseline matching (64% vs. 30%). There was no significant difference in the likelihood of receiving a consequence for nonresponsiveness (46% vs. 56%), $\chi^2(1) = 0.29$, $p = .59$, $w = .10$.

URINE DRUG TEST RESULTS

Participants in the adaptive condition provided a significantly greater percentage of drug-negative urine specimens than did participants in the baseline-matching condition. When missing urine specimens were counted as missing data, the adaptive participants were drug negative an average of 68% of the weeks ($SD = 0.39$), compared to 49% for those in baseline matching ($SD = 0.43$), $t(123) = 2.55$, $p = .01$, $d = .46$. When missing specimens were imputed to be drug positive, the adaptive participants were drug negative
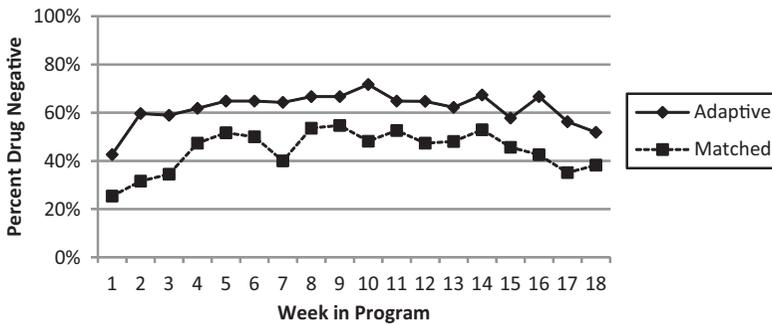
Figure 2:   Percentage of Participants Providing Drug-Negative Urine Specimens During the First 18 Weeks of Enrollment
Note. Missing and invalid urine samples were imputed to be drug positive. Group effect: p = .01, odds ratio (OR) = 2.44. Time effect: p = .03, OR = 1.03.

an average of 61% of the weeks (SD = 0.40), compared to 46% (SD = 0.43) for those in baseline matching, $t(123)$ = 2.10, p = .04, d = .37.

Longitudinal GEE analyses yielded comparable findings. When missing urine specimens were counted as missing data, the GEE analysis revealed significant main effects for group, $\chi^2(1)$ = 6.84, p = .01, and for time, $\chi^2(1)$ = 18.17, $p < .0001$. Participants in the adaptive condition were more than twice as likely to be drug negative as those in baseline matching (odds ratio [OR] = 2.34, 95% confidence interval [CI] = 1.22–4.64). The likelihood of becoming abstinent increased significantly over successive weeks in the program for participants in both conditions (OR = 1.07, 95% CI = 1.04–1.10). Likewise, when missing urines were imputed to be drug positive, the GEE analysis revealed a significant group effect, $\chi^2(1)$ = 7.12, p = .01, and time effect, $\chi^2(1)$ = 4.92, p = .03. Again, participants in the adaptive condition were more than twice as likely to be drug abstinent as those in baseline matching (OR = 2.44, 95% CI = 1.27–4.70), and the likelihood of becoming abstinent increased over successive weeks for both groups (OR = 1.03, 95% CI = 1.01–1.05). Figure 2 depicts the proportions of drug-negative urine samples for the two groups during the first 18 weeks, imputing missing samples as drug positive.

GRADUATION RATES

Approximately 31% of the participants in the adaptive condition graduated on time within 18 weeks of entry into the program, compared to 23% of those in baseline matching. This trend did not reach statistical significance, $\chi^2(1)$ = 0.83, p = .36, w = .08. Approximately 68% of participants in the adaptive condition graduated within 12 months, compared to 67% of those in baseline matching. This negligible difference did not approach significance, $\chi^2(1)$ = 0.02, p = .90, w = .01.

TIME TO CASE RESOLUTION

Approximately 85% of the cases in the adaptive condition were resolved (favorably or unfavorably) within the first 12 months after entry, compared to 87% of those in baseline matching. The mean survival time to case resolution was not significantly different between

the groups, $\chi^2(1) = 0.05$, $p = .81$, hazard ratio = 1.05, 95% CI = 0.72–1.52. The average survival interval was 193.61 days ($SE = 11.77$) for participants in the adaptive condition, compared to 200.13 days ($SE = 12.13$) for those in baseline matching.

PERCEPTIONS OF THE PROGRAM

Coefficient alpha was .86 for the perceived deterrence questionnaire and .78 for the procedural justice questionnaire. There were no statistically significant differences between the adaptive and baseline-matching groups on any of the self-report items or scales. There was a nonsignificant trend ($p = .10$) favoring greater perceptions of procedural justice in the adaptive condition; however, measures of perceived deterrence, attitudes toward the judge, and satisfaction with the drug court services did not approach significance. Perceptions of the program were generally favorable in both conditions, with a substantial proportion of all participants reporting high levels of perceived procedural justice and favorable attitudes toward the judge and the drug court services as a whole.

DISCUSSION

This study experimentally examined the effects of an adaptive program in a misdemeanor drug court. Previous research found that outcomes were significantly improved by matching participants to schedules of judicial status hearings based on their assessed criminological risk profile (Festinger et al., 2002; Marlowe et al., 2006; Marlowe et al., 2007). The current study determined whether additional incremental utility could be gained by periodically adjusting the schedule of judicial status hearings and clinical case management sessions in response to participants' ensuing performance in the program.

Results confirmed that participants randomly assigned to the adaptive condition were significantly more likely to provide drug-negative urine samples during the first 18 weeks of the program than those assigned to baseline matching only. The odds of being drug negative were more than twice the magnitude for participants in the adaptive condition than for those in baseline matching (OR = 2.34 when missing urine specimens were treated as missing data; OR = 2.44 when missing specimens were imputed to be drug positive).

The improvement in drug abstinence rates appears to have been attributable to providing more intensive supervision of recalcitrant offenders, as opposed to administering more intensive and individualized clinical services. Participants in the adaptive condition were more than twice as likely as those in baseline-matching to receive increased judicial supervision as a consequence for noncompliance in the program (64% vs. 30%, $p = .03$); however, there was no difference in the likelihood of receiving increased clinical case management as a consequence for nonresponsiveness ($p = .59$). This suggests that the mechanism of action for the adaptive algorithm may have stemmed from holding participants more accountable for meeting their attendance obligations in the program rather than enhancing clinical services in response to unmet treatment needs.

Because most commonly used risk-assessment tools rely, at least in part, on offenders' self-reports to determine risk levels, it may not take long for the more savvy individuals to discern the "right" answers that will trigger lower levels of judicial supervision. If their

subsequent behavior belies the accuracy of the assessment results, it is important to recognize the error and alter the conditions of supervision accordingly. It appears that the adaptive algorithm may have assisted staff to more readily identify mismatches and adjust the program requirements to meet the participants' demonstrated needs.

Criminal justice professionals and substance abuse treatment professionals may be capable of making comparable adjustments on their own initiative. However, in practice, many of these professionals may be too busy, distracted, or inadequately skilled to respond efficiently to distortions by offenders or rapidly changing conditions in the offenders' lives. In the current study, consequences for noncompliance were administered in less than one third of the cases for participants in the baseline-matching condition, leaving the lion's share of the infractions undetected or unaddressed. Compliance with correctional supervision is unlikely to be optimal if there is less than a one in three chance of receiving a consequence for failing to show up for treatment sessions or drug testing. A primary contribution of adaptive algorithms may be to increase the probability that such infractions (and perhaps achievements) are recognized and responded to by staff. This might allow drug courts to supervise a larger number of participants with lesser concerns that some offenders may "slip through the cracks" and continue noncompliant behavior with relative impunity.

There was no evidence from the current study that employing a structured algorithm hindered participants' perceptions of procedural fairness in the program or their attitudes toward the judge or the program as a whole. If anything, there was a nonsignificant trend ($p = .10$) favoring greater perceptions of procedural fairness by participants in the adaptive condition. It is possible that following a prespecified protocol might reduce the likelihood that some participants will receive discrepant consequences for comparable infractions and thus reduce potential perceptions of bias or inequality. Further research is needed to more closely gauge participants' perceptions of adaptive algorithms as compared to individualized discretion in the imposition of consequences from the bench.

Although there were substantial improvements in drug-abstinence rates for the adaptive program, there were no significant differences in graduation rates or in the average length of time to case resolution. On one hand, this discrepancy could suggest that the adaptive algorithm affected only substance use patterns and did not affect other outcomes, such as the payment of fines or obedience to program rules. Because the contingencies in the adaptive algorithm focused only on session attendance and drug test results, they may have had minimal effects on other behavioral outcomes. Additional efforts are needed to extend the reach of the adaptive algorithm to influence other relevant behaviors.

An alternative explanation for the apparent discrepancy between drug test results and graduation rates could be that decisions concerning graduation or termination were not assiduously based on objective indicia of success in treatment. If participants in the adaptive condition provided nearly twice the number of negative drug tests during the first 18 weeks, it is difficult to understand why they graduated at an equivalent rate during the same 18-week period. Given that urine test results are one of the primary (if not *the* primary) criteria for graduation from a drug court, one might have expected the adaptive participants to meet the requirements for graduation more readily. Perhaps graduation decisions were influenced by other subjective factors, such as participants' demeanor or the arguments of defense counsel, which may or may not predict continued desistence from crime and drug abuse. Future assessments of the current cohort will provide

additional insights into the effects of the adaptive program on objectively measured rearrest rates.

There are several important limitations to this study that must be borne in mind when interpreting the results. The study was conducted in a single misdemeanor drug court, and it is unknown whether the results will generalize to other offender populations (e.g., felony drug offenders, juvenile offenders, or mentally ill offenders) or to other geographic regions. As was noted earlier, the effects of the baseline-matching procedure were replicated in felony and misdemeanor drug courts located in urban and rural communities, and similar replication studies are needed for the adaptive program as well.

The consent rate for the study was 39%, which could 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. Moreover, outcomes might have been systematically influenced by the relative expertise of private defense counsel as compared to public defenders or their relative familiarity with drug court operations. Individuals who refused participation may also have differed on variables that were not measured in this study. For example, defendants who were relatively less motivated or more seriously drug addicted might have been more likely to refuse participation. As a result, the study sample might not have adequately reflected the characteristics of the target population of the drug court.

The groups differed by risk level, with 13% of the adaptive participants meeting study criteria for being high risk, compared to 30% of those in baseline matching ($p < .05$). Risk level was not correlated with any outcome measure, and the results did not change when risk level was included as a covariate in the analyses. This indicates that baseline differences in risk level were not responsible for the differences in outcomes. As noted previously, the baseline-matching procedure, which was administered to participants in both groups, apparently leveled the influence of risk on outcomes. Nevertheless, because the interventions were specifically targeted to participants' risk level, this imbalance between cells could have affected the results in unanticipated ways. For this reason, current studies are employing an urn-randomization procedure to ensure risk level is equivalently distributed between conditions.

The current analyses examined outcomes within the first year after entry into the drug court, when many of the participants had only recently graduated or were still enrolled in treatment. Future analyses will examine outcomes over longer follow-up intervals, when participants are no longer under the jurisdiction and control of the drug court program.

Although the perceived deterrence scale has been validated in drug courts (Marlowe, Festinger, Foltz, et al., 2005), the other attitudinal questionnaires were created for the purposes of this study and have not been examined for validity or reliability. Therefore, lesser confidence may be placed in conclusions concerning whether the adaptive algorithm influenced perceptions of procedural fairness or satisfaction with the program. More research using validated instruments is needed to confidently conclude whether and how adaptive algorithms might influence offenders' perceptions of justice and fairness in drug courts.

Finally, there is nothing sacrosanct about the adaptive algorithm employed in this study. As described earlier, this algorithm was developed through a collaborative process between

the drug court team and research staff. There are undoubtedly numerous ways to improve on the algorithm to elicit more consistent and sustained effects. For example, although there may be a logical rationale for distinguishing between noncompliance and nonresponsiveness, it may be difficult, in practice, to reliably separate out these two issues. Some participants may fail to provide urine specimens for the very reason that they expect them to be drug positive. This could blur the distinction between noncompliance and nonresponsiveness and make it difficult to determine whether an individual is engaging in willful disobedience as opposed to manifesting clinical dysfunction.

The adaptive algorithm made no effort to standardize what transpired during the court hearings or case management sessions. Research to date suggests that simply increasing the dosage of services, where needed, may be sufficient to elicit improved outcomes. This is not to suggest, however, that training judges or case managers on interactional strategies (e.g., motivational interviewing techniques) is unlikely to elicit greater benefits. For example, research suggests that hostility or a lack of readiness for change may predict negative treatment outcomes among drug offenders (e.g., Hiller, Knight, Saum, & Simpson, 2006). It may be useful to design adaptive counseling strategies to address such attitudinal risk factors.

Finally, the adaptive algorithm did not ratchet services downward in response to good performance in the program. The issue of 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 might not have been sustained beyond the first several months. Future research should evaluate adaptive algorithms that taper down the provision of services and prepare offenders for long-term maintenance of drug abstinence and desistence from crime.

SUMMARY

The results of this controlled experiment confirmed that adaptive programming has the potential to increase drug abstinence among misdemeanor drug court participants. More research is needed to replicate the findings and improve the adaptive algorithm so that it may elicit longer-term effects on a wider range of outcomes. Although it is premature to characterize adaptive programming as a best practice or evidence-based practice for drug-abusing offenders, the promising evidence emerging from this experiment is sufficient to justify further examination of adaptive interventions among offender populations.

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