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Effects of Major Depression on Crack Use and Arrests among Women in Drug Court

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Abstract

Aims—We examined whether a current major depressive episode (MDE) at baseline predicted crack use and arrests at follow-up among women enrolled in drug court.

Design—Primary analyses used zero-inflated Poisson (ZIP) and zero-inflated negative binomial (ZINB) regression analyses to predict both yes/no and number of 1) days of crack use and 2) arrests at 4-month follow-up from current (30-day) MDE. Secondary analyses addressed risk conferred by current versus past MDE.

Setting/Participants—Participants were 261 women in drug court.

Measurements—MDE was assessed using the Diagnostic Interview Schedule. Days using crack and number of arrests were assessed using the Washington University Risk Behavior Assessment for Women.

Findings—Having a current MDE predicted likelihood of crack use, but not days of crack use among those who used. Current MDE did not predict presence or number of arrests at the 4-month follow-up. Women with current MDE were more likely to be using crack at follow-up than were those with recent (31+ days to 12 months) but not current MDE (OR = 5.71); past MDE did not increase risk of crack use.

Conclusions—First, predictors of yes/no crack use and arrests were different from predictors of numbers of these behaviors, illustrating the importance of analyses that address both. Second, current (30-day) MDE, but not past MDE, increases risk of crack use among women in drug court, implying that MDE-related risk of crack use could be lessened by effective depression treatment.

Women involved in the criminal justice system are a vulnerable and growing population. More than 1,000,000 U.S. women are currently under some form of correctional supervision, including drug court, incarceration, probation, and parole [1], compared with only 400,000 in 1985 [2]. Drug courts are a relatively recent criminal justice intervention designed to relieve some of the burden on jails and prisons by providing non-violent offenders with court-supervised substance use disorder (SUD) treatment. Because several,

although not all, controlled studies of drug court outcomes have indicated positive outcomes for this approach [3,4], research has turned to efforts to identify factors that predict success in drug court, in order to identify patients who may do well in drug court or to enhance services for those at risk of poor outcome. One important predictive factor for drug court and related SUD treatment success may be mental health problems, which are reported by many women in drug court [5-7]. However, the prevalence and effects of specific psychiatric disorders in drug court are only beginning to be examined.

Findings from community and other criminal justice samples suggest that major depressive disorder (MDD) in particular is a potentially important predictor of drug court outcomes for women because it is prevalent among women with SUD [8,9], especially in the criminal justice system [10,11], and is associated with SUD relapse. Among community samples, with few exceptions, depression comorbid with SUD has been associated with premature drop-out from SUD treatment [12-14] and poorer prognosis after SUD treatment [13,15-18]. Negative mood states are among the most frequently cited precipitants of relapse [19], especially among women [20,21]. The association between MDD and cocaine relapse is particularly strong, with cocaine-dependent patients with MDD having worse outcomes [16], despite higher motivation for cocaine treatment [16,22]. Furthermore, depressive symptoms are associated with greater urges to use cocaine in high-risk situations [23,24], greater euphoria and/or higher levels of physiologic cocaine effects [25-27], more cocaine cravings [28], lower levels of confidence to abstain from cocaine [28], and more severe cocaine withdrawal symptoms [29], which may explain why depressive symptoms predict increased subsequent cocaine use [30]. In addition, the stimulant properties of cocaine may make it particularly appealing to someone who is depressed [22], with an especially strong link between depression and crack use [31,32].

MDD is also a potentially important predictor of drug court outcomes because it appears to increase women's risk of re-arrest and reincarceration in other samples. For example, a study that followed 300 female and 300 male graduates from a correctional boot camp for five years found that depressive symptoms were a strong predictor of re-arrest and for women [33]. State prison inmates with MDD were at increased risk of multiple incarcerations [34]. Psychiatric distress has also been found to predict future parole violations [35]. Furthermore, impairment in social and occupational functioning seen with MDD [36,37] can have serious consequences for a criminal justice-involved woman, interfering with her ability to address issues such as homelessness, unemployment, poverty, stigma, physical and sexual abuse, family problems, medical problems, and other psychiatric disorders [38]. In turn, these unresolved life problems may increase risk for relapse, re-arrest, and further victimization.

Based on these findings from related populations, one might expect MDD to be an important predictor of drug court outcomes for women. However, the few existing studies examining mental health variables as predictors of drug court outcomes have not assessed full MDD or outcomes other than drug court completion. One recent study of 288 adults in drug court used a single item asking if patients had experienced any depression in the prior 30 days to predict drug court drop-out [39]. The 30% of their sample who scored positively on this item were 2.73 times more likely to drop out of drug court compared to negative responders. A second study of 449 drug court participants also used the same single depression question and found that those endorsing feeling depressed were more than twice as likely to drop out of drug court than participants not endorsing feeling depressed [40]. Women were twice as likely to report feeling depressed as men (39% vs. 18%). Although these studies suggest an effect of depressive symptoms on drug court drop-out, effects on outcomes such as drug use or arrests is not known and assessment of the effects of full MDD is needed.

The first aim of the current study is to add to the literature on mental health predictors of drug court outcomes by examining whether women with a current (past 30 day) DSM-IV major depressive episode (MDE) at study baseline had poorer drug use and legal outcomes. This is the first study of which we are aware that has assessed MDE in a drug court sample larger than 15 [6]. We hypothesized that having an MDE in the current month at baseline predicted both the presence and number of days of crack use (the most common drug of dependence and the substance most associated with drug court involvement in our sample) at 4-month follow-up and arrests during the period from baseline to the 4-month follow-up.

The second aim of the study was to add to the general literature on the relationship between MDE and abuse of substances, specifically crack. This study improves on many past examinations of the effects of MDE on substance use outcomes in *any* population in two ways. First, to develop theories or relapse and design effective interventions to prevent it, it is important to understand the mechanisms of and contributors to relapse. Despite recognition that different predictive factors and processes may underlie the initiation versus the continuation of substance use or relapse [41], few analyses have been published that compare predictors of both yes/no and number of days of use in SUD populations [42,43], largely because statistical approaches typically used (i.e., logistic or ordinary least squares regression) do not make these comparisons. The ability of statistical procedures used in the current study [zero-inflated negative binomial (ZINB) and zero-inflated Poisson (ZIP) regression] to predict both yes/no use and days of use among those who used is a significant step forward for substance use and correctional outcome analyses, providing fine-grained description of MDE effects that is relevant to treatment theory while also providing a better fit to the data [42,43]. To our knowledge, this is the first examination of MDE as a potential predictor of both presence and number of days of substance use and criminal behavior in a clinical sample.

The second way in which this paper adds to the general literature on MDE and SUD is that, despite recognition that the associations between SUD and MDD are bidirectional [8,44,45] and debate about whether the high rate of SUD-MDD comorbidity is due to substance-induced depression [46,47], few studies of MDE as a predictor of substance use in clinical samples have taken timing of the MDE into account. In the current study, we address timing in two ways. First, all analyses predicting follow-up crack use and arrests from baseline MDE account for baseline levels of crack use to avoid confounding baseline crack use and mood in predictive models. Second, for any outcome predicted by current MDE, we conduct secondary analyses to determine whether this risk appears to be immediate or longer-term. Models comparing risk conferred by current (i.e., past 30-day), recent (31+ days to 12 month), or lifetime (more than 12 months ago) MDE may have implications for whether MDE confers immediate risk for crack use or arrests (for example, through negative mood) or is a marker for more long-term vulnerability. These secondary analyses are important because they inform our understanding of the causal direction of the MDE-SUD relationship.

Method

Participants

Participants were drawn from the Sisters Teaching Options for Prevention (STOP) project, a 319-participant randomized controlled HIV prevention trial for women in drug court that took place from 2005 to 2008, funded by a grant from the National Institute of Nursing Research (NINR 009180, Cottler, PI). The target population for STOP was women in drug court, at least 18 years old, under the supervision of probation or parole, with non-violent charges, who planned to remain in the sampling area for at least 12 months.

Participants in the current study were 261 female offenders from the STOP project who completed the 4-month follow-up assessment (82% of the overall sample). Using 4-month follow-up data allowed us to assess short-term effects of an index episode of MDE; longer time periods might have captured recurrence of MDE rather than a single episode [48] and made secondary analyses more difficult to interpret. Chi-square and analysis of variance tests indicated that the 261 women who completed the 4-month follow-up did not differ from the 58 women who did not complete this assessment in terms of baseline MDE, assignment to the intervention or control condition, age, being African-American, using crack in the 30 days prior to baseline, or employment (y/n). However, women who were lost to 4-month follow-up had more lifetime arrests than did those who did not (rank sum test, $Z = 2.16$, 2-sided $p = .03$).

Procedures

Women were recruited into the study by staff stationed in St. Louis area drug courts. After potentially eligible women met with the judge, study staff members explained the study and offered them transportation to and from study interviews in the study van or a later appointment to enroll in the study at the field site. At the field site, a staff member administered the Washington University Human Research Protection Office approved informed consent.

Assessments—Assessments were conducted by trained interviewers. Taped recordings of each interviewer were reviewed throughout the study period to ensure accuracy and fidelity of assessments.

Major depressive episode (MDE) was assessed using the Diagnostic Interview Schedule Screener (DIS Version-IV [49]), a fully structured interview used to ascertain the presence or absence of DSM-IV psychiatric disorders. Test-retest reliability and validity methods have resulted in kappas in the fair to good range for depression among substance users [50]. The scale establishes at least one lifetime episode of depression, and then asks “When did your last episode end, when you had been feeling depressed/lost interest and had been having some of these problems nearly every day for at least two weeks?” If a respondent indicated that their last episode of depression continued or began in the current month, they were considered to have a current (past 30-day) MDE. MDE could occur in the course of either major depressive or bipolar disorders.

The crack use outcome was self-reported days of use in the 30 days prior to each assessment (e.g., baseline or 4 month follow-up, measured using the Washington University Risk Behavior Assessment for Women (WU-RBA-W), a revision to the RBA initially developed for the NIDA HIV Cooperative Agreement studies [51]. Analyses used self-report data. To prompt provision of accurate self-report data, Quick Screen 4 panel dip cards (Phamatech) were utilized to test urine samples for amphetamine, cocaine, opiates and THC. Urine drug screen information was available for 89% of the sample. Urine drug screens for cocaine agreed with cocaine self-report at the 4-month follow-up in 83% of cases. Lifetime and 4-month follow-up number of self-reported arrests were also taken from the WU-RBA-W. Substance use diagnoses were made using the Substance Abuse Module [50,52] to characterize the sample.

Intervention conditions—Because the sample data was collected as part of an intervention study, intervention condition was included as a covariate in analyses. Participants were randomly assigned to a manualized 10-week peer-partnered case management intervention designed to reduce HIV risk by helping women complete tasks assigned by the drug court judge or to an assessment-only control. Follow-up took place 16

weeks after completion of study interventions, which was 16 weeks after randomization for control participants and 26 weeks after randomization (16 weeks after the completion of the 10-week intervention period) for the intervention participants. Intervention condition was not related to baseline number of days using crack or number of lifetime arrests (see Table 3), or current ($\chi^2 = .17$, $df = 1$, $p = .68$) or lifetime MDE ($\chi^2 = .08$, $df = 1$, $p = .77$).

Analyses

Distribution of dependent variables: rationale for ZIP and ZINB analyses—The sample included a large number of women who reported no crack use (72%) or no arrests (76%) at 4-month follow-up, meaning that the data were “zero-inflated” (had a large number of 0 responses). Because primary outcomes were zero-inflated and right-skewed, primary analyses used zero-inflated Poisson (ZIP) and zero-inflated negative binomial (ZINB) regression procedures. An additional advantage of these models is that they allow for prediction of both yes/no use and days of use among those who used. Days using crack also had an overdispersed distribution, meaning the conditional mean of crack days was less than the conditional variance of crack days (estimated parameter $\alpha = 2.41$, $SE = .46$, $t = 5.28$, $p < .0001$) [53,54]. As a result, analyses predicting days using crack used ZINB regression. Number of arrests was not overdispersed (estimated parameter $\alpha = .20$, $SE = .23$, $t = .86$, $p = .39$), so analyses predicting number of arrests used ZIP regression. ZIP and ZINB analyses were conducted using SAS PROC COUNTREG.

Primary analyses—Primary analyses used ZIP and ZINB models to examine current (30-day) MDE as a predictor of crack use and arrests. Covariates were consistent across models and were chosen based on other studies finding that lifetime number of arrests, current employment, and race, predict drug court outcomes (e.g., dropout) [40] and that age predicts re-arrest [33]. We also controlled for study intervention condition. Use of crack at baseline and incarceration status at follow-up were additional covariates in crack use analyses (incarceration reduces opportunities to use drugs). All predictors were entered in both levels (predicting yes/no and number) of both ZIP and ZINB models.

Secondary analyses—For any outcome (i.e., crack use or arrests) and level (yes / no use or of use) predicted by current MDE, secondary analyses examined whether the risk appeared to be immediate (i.e., associated only with past-30 day) or longer-term [i.e., also found with recent (31+ days to 12 months), or lifetime (more than 12 months ago) MDE]. These analyses compared crack use or arrests of individuals with 30-day MDE ($N = 41$) to 1) individuals with lifetime, but not current-month, MDE ($N = 64$); and 2) a subset of those individuals experiencing MDE in the past year, but not the current month ($N = 40$). Secondary analysis also examined whether past year MDE predicted crack use or arrests relative to never having had an MDE. These analyses took place at a single level (yes/no or days of use for those who used) at a time using logistic or ordinary least squares regression because the reduced sample size for these comparisons was less appropriate for ZIP or ZINB analysis.

Results

The sample was primarily African-American (73%), single (95%), and unemployed (57%), with a majority (61%) reporting at least one arrest for prostitution or demonstration (see Table 1). Cocaine dependence was the most common SUD diagnosis; 94% of women using cocaine in the month prior to baseline used crack. Sixteen percent reported past-month MDE; the prevalence of lifetime MDE was 40%.

Primary analyses

Table 2 shows raw crack use and arrest data for those with and without baseline MDE. Bivariate Spearman correlations (Table 3) indicated that current (30-day) MDE at baseline was *not* correlated with baseline past-30 day use of crack or with lifetime history of arrests. However, 30-day MDE at baseline was correlated with the number of days using crack at the 4-month follow-up. Findings that baseline MDE was correlated with future but not baseline crack use suggest that MDE predicted crack use rather than being a proxy for heavier previous crack use (i.e., substance-induced depression).

ZINB analyses for days using crack indicated that 30-day MDE predicted likelihood of crack use at 4-month follow-up, but not number of using days for those who used (see Table 4; log likelihood for the model = -318.9). Thus, the correlation between baseline MDE and days of crack use at 4 months was due to a difference in the number of zero responses between those with and without MDE, rather than differences in values of non-zero responses (days using among those who used).

ZIP analyses for number of arrests during the follow-up period indicated that a current MDE did not significantly predict likelihood of arrest during the 4-month follow-up or number of arrests for those who were arrested (see Table 5; log likelihood for the model = -174.7). Being African-American and older age reduced likelihood of arrest, but not number of arrests if arrested. Number of lifetime arrests and intervention condition predicted number of arrests given arrest, but not likelihood of arrest.

Secondary analyses

Logistic regression analyses indicated that women with 30-day MDE were significantly more likely to use crack at 4-month follow-up than were: (1) those with any history of MDE who were no longer in an episode of depression ($\beta = 1.35$, SE = .59, Wald $\chi^2 = 5.24$, $p = .022$; OR = 3.86, 95% CI = 1.21 - 12.35); and (2) those with even a recent (12-month) history of MDE who were no longer in an episode of depression ($\beta = 1.75$, SE = .72, Wald $\chi^2 = 5.81$, $p = .016$; OR = 5.71, 95% CI = 1.39 - 23.81). MDE that was recent (within the past year), but did not persist into the current month conferred no added risk of crack use relative to never having had an episode ($\beta = .50$, SE = .57, Wald $\chi^2 = .76$, $p = .38$). Finally, among the 41 women with current MDE, available indices of MDE chronicity (number of past episodes, length of longest episode) did not predict risk of crack use.

Discussion

These findings increase knowledge of the effects of a MDE on drug court outcomes by using analytic methods that allow for prediction of both yes/no and continuous outcomes; using a large sample of women, who are often underrepresented in corrections research; addressing issues of timing of MDE and drug use or criminal behavior; using a validated structured clinical assessment of MDE rather than a single self-report symptom item to measure depression; and using more detailed outcomes (days using crack, number of arrests) than yes/no drug court completion. Results indicated that MDE at baseline predicts likelihood of using crack at the 4-month follow-up, but not days of crack use among those who use. MDE was not a predictor of presence or number of arrests during the next four months in our sample, suggesting that depressive episodes may not predict arrests in this population on a short-term (4 month) time period.

Findings of ZIP and ZINB analyses illustrate the utility of considering that different predictive factors and processes may underlie the initiation versus the continuation of relapse. All 9 variables that were significant predictors in either the crack or arrest analyses were predictors at only one level (i.e., yes/no or number if yes; see Tables 4 and 5). This

means that the list of predictors of yes/no use or arrest was mutually exclusive from the list of predictors of numbers of these behaviors among those who engaged in them. Logistic regression alone would have missed half of the predictors and zero-inflated data such as these cannot be analyzed with ordinary least squares regression. Differences in predictors of presence and days of use have implications for tailoring intervention theories and approaches. As a result, analyses addressing both presence and days of use with ZIP/ZINB or double-hurdle models [55,56] show promise for refining treatment theories in addictive behaviors and for tailoring interventions for maximal effectiveness.

These analyses focused on crack use to limit the number of dependent variables and potential for Type I error; however, the lack of focus on other substances is a potential limitation of the paper. Even though intervention assignment was covaried in analyses, the use of a sample that was receiving different kinds of treatment (i.e., peer-partnered case management plus drug court vs. drug court alone) is another potential limitation. In addition, it is unclear how the current results generalize to other samples of female offenders (such as those who are excluded from drug court because of violent offenses or felonies) or female drug users not involved in the criminal justice system.

Women with an ongoing MDE at baseline were significantly more likely to use crack at 4-month follow-up than were those with any history of MDE or even past-year MDE who no longer reported being in an episode. Furthermore, women with recent (past-year) MDE not persisting into the month before baseline were not at any higher risk of crack use than women who had never had a MDE. Although these analyses use retrospective data, they suggest that it is a current (as in 30-day) MDE and not even recent (past-year) MDE that increases risk of crack use, and that the increased risk of using crack conferred by a past 30-day MDE could be lessened by psychotherapy or medication treatment leading to improved mood. Screening to identify current MDE along with options for effective depression treatment may be important components of drug court services and of substance abuse treatment in general, especially for crack-using women.

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Table 1

Study Participants' Demographic and Diagnostic Characteristics (Baseline)

Variable	Total (N = 261)
Age, years (M[SD])	36.4 [9.6]
Race/ethnicity (%)	
Black/African American	73%
White	23%
Latino/Hispanic	0%
Mixed/Other	4%
Married (%)	5%
Education, years (M[SD])	10.9 [2.2]
Employed	43%
Current (30-day) MDE (%)	16%
Lifetime MDE (%)	40%
Lifetime number of arrests (median[range])	5 [1-96]
Any arrest for prostitution or demonstration	61%
Past 12 month diagnosis of substance dependence (%)	
Cocaine (crack or powder)	45%
Stimulants	1%
Opioids	15%
Marijuana	9%
Alcohol	30%

Table 2

Crack use and arrests at 4-month follow-up by past 30-day MDE at baseline

	Past 30-day MDE at baseline	
	No	Yes
Percent using crack at follow-up	25%	46%
Days used crack (of past 30) at follow-up, among those who used M (SD) ^a	8.4 (7.9)	8.7 (8.9)
Percent arrested during follow-up	25%	22%
Number of arrests during follow-up, among those arrested M (SD) ^b	1.4 (.08)	1.3 (1.0)

^aRange of days of crack used among those who used was 1-30 for both groups

^bNumber of arrests among those who were arrested ranged from 1-5 for those with no MDE at baseline and 1-4 for those with MDE at baseline.

Table 3Spearman Correlations between MDE and Baseline and Follow-up Values of Outcomes ($N = 261$)

	Baseline		4-month follow-up	
	Days using crack $r_s(p)$	Lifetime arrests $r_s(p)$	Days using crack $r_s(p)$	Arrests since baseline $r_s(p)$
Baseline MDE (y/n)	.06 (.352)	-.06 (.316)	.17 (.005)	-.03 (.640)

Note: These analyses use the entire sample of 261, meaning that zero values (i.e., zero days using crack or zero arrests) are included. Significant p -values ($< .05$) are bolded.

Table 4

Prediction of days using crack in the 30 days prior to 4-month follow-up: Zero-inflated negative binomial regression ($N = 261$)

	Predictors of crack use (yes/no)				Predictors of days using (if used)			
	<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>
MDE in 30 days prior to baseline (y/n)	3.39	1.15	2.94	.003	.01	.44	.02	.987
Used crack in 30 days prior to baseline (y/n)	9.07	5.11	1.77	.076	-.27	.49	-.55	.584
Intervention (y/n)	.95	.90	1.06	.287	-.84	.33	-2.56	.011
Age	-.03	.05	-.76	.448	.03	.02	1.21	.226
Baseline number of lifetime arrests	.13	.04	2.99	.003	.01	.01	1.40	.161
African-American (y/n)	2.17	1.47	1.48	.139	1.29	.48	2.7	.007
Employed at baseline (y/n)	-1.95	.901	-2.16	.030	.60	.41	1.47	.142
Incarcerated at time of follow-up (y/n)	.80	1.22	.66	.507	-.67	.63	-1.08	.282

Note: Significant *p*-values ($< .05$) are bolded to allow easy comparison of the predictors of yes/no arrest vs. predictors of number of arrests (if arrested).

Table 5

Prediction of number of arrests during the 4-month follow-up: Zero-inflated Poisson regression ($N = 261$)

	Predictors of arrest (yes/no)				Predictors of number of arrests (if arrested)			
	<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>	<i>b</i>	<i>S.E.</i>	<i>t</i>	<i>p</i>
MDE in 30 days prior to baseline (y/n)	-.62	.91	-.68	.494	.43	.38	1.11	.267
Baseline number of lifetime arrests	-.03	.02	-1.46	.144	.02	.01	3.00	.003
Intervention (y/n)	-1.37	.88	-1.56	.120	.66	.28	2.37	.018
Age	-.17	.06	-2.57	.010	.02	.02	.93	.353
African-American (y/n)	-3.22	1.43	-2.26	.024	.26	.30	.85	.395
Employed at baseline (y/n)	-.09	.88	-.11	.915	-.24	.30	-.82	.410

Note: Significant *p*-values (< .05) are bolded to allow easy comparison of the predictors of yes/no arrest vs. predictors of number of arrests (if arrested).