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# Motivational Interviewing for Incarcerated Adolescents: Effects of Depressive Symptoms on Reducing Alcohol and Marijuana Use After Release\*

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**ABSTRACT. Objective:** Motivational interviewing to reduce alcohol and marijuana use among incarcerated adolescents was evaluated. **Method:** Adolescents ( $N = 162$ , 84% male;  $M = 17.10$  years old) were randomly assigned to receive motivational interviewing or relaxation training, with follow-up assessment 3 months after release. **Results:** Compared with those who received relaxation training, adolescents who received motivational interviewing had lower rates of alcohol and marijuana use at follow-up, with some evidence for moderating effects of depression. At low levels of depression, adolescents who received motivational interviewing had lower rates of use. Adolescents who received

relaxation training and who had high levels of depressive symptoms early in incarceration showed less use at follow-up than those low in depressive symptoms who received relaxation training. **Conclusions:** This brief motivational interviewing intervention during incarceration reduces alcohol and marijuana use after release. In addition, depressive symptoms early in incarceration should be considered in treating these adolescents, but more work is needed to extend follow-up period and account for the impact of depression on outcomes. (*J. Stud. Alcohol Drugs*, 72, 497–506, 2011)

RATES OF ALCOHOL AND MARIJUANA USE are high among youths involved in the juvenile justice system. An investigation of substance use by adolescents involved in the juvenile justice system found that those arrested in the past year were twice as likely to have used alcohol and 3.5 times more likely to have used marijuana compared with adolescents who were not arrested in the last year (National Center on Addiction and Substance Abuse at Columbia University, 2004). Rates of alcohol and marijuana use disorders among detainees are approximately 26.1% and 43.3%, respectively, and adolescent detainees show relatively high rates of depression or dysthymia (29.6%; Teplin et al., 2002). Incarcerated adolescents with negative mood (especially depression) have higher levels of alcohol use, have more consequences from alcohol and marijuana, use to regulate emotions, and use more avoidant coping than their normal-mood counterparts (Turner et al., 2005). Similarly,

incarcerated adolescents with a history of drinking problems have significantly more negative affect (including depression), have significantly more cognitive distortions typical of depression, and use less social support as a means of coping (Esposito-Smythers et al., 2008). Among juvenile detainees, prevalence of comorbid affective disorder and substance use disorder is about 21%–73% (Abram et al., 2003). Because depressive symptoms are often related to substance use, such dysphoria may have an impact on treatment outcomes for substance-involved adolescents.

Very little work has been done to evaluate substance use interventions for adolescents involved in the juvenile justice system. Stein et al. (2006a) randomly assigned substance-involved incarcerated adolescents to motivational interviewing (MI; Miller and Rollnick, 2002) or to relaxation training (RT) and found that MI resulted in better treatment engagement 2 months into standard facility care. From these same data, the investigators found that 3 months after release, for those adolescents low in depressive symptoms, persons who received MI had lower rates of risky behaviors (e.g., drinking and driving, being a passenger in a car with someone who had been drinking, having risky sex while using alcohol, and using marijuana) than those who received RT; however, at high levels of depression, effects were equivalent (Stein et al., 2006b; Rosengard et al., 2008).

MI decreases substance-related negative consequences, reduces substance use, and increases treatment engagement, with results particularly strong for those with heavier substance use patterns and/or less motivation to change

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(Tevyaw and Monti, 2004). Masterman and Kelly (2003) indicate that MI may be particularly well suited to adolescents, given their sensitivity and resistance to adult attempts to control or direct their behavior (Marlatt and Witkiewitz, 2002)—features that may be especially common among delinquent adolescents. MI (Miller and Rollnick, 2002) is ideally suited for correctional settings in that it is brief, can be used as a prelude to other treatments (Bein et al., 1993; Brown and Miller, 1993), and has also been found effective as a stand-alone treatment for substance misuse (see Burke et al., 2002; Colby et al., 1998; Monti et al., 1999). MI is well suited for settings with few resources and for persons who may be high in anger or hostility (Barrett et al., 2001; Karno and Longabaugh, 2004). As many as 40% of juveniles show significant anger when initially detained (Stein et al., 2004).

The impact of depression on substance outcomes has yielded inconsistent findings (Kranzler et al., 1996), with some studies showing it associated with treatment attrition (Curran et al., 2002) and poor substance outcomes for adolescents who received residential treatment (Subramanian et al., 2007) and others showing depression associated with longer duration of abstinence (Charney et al., 1998) and less drinking following inpatient services (Kranzler et al., 1996). Tapert et al. (2003) suggested that depressed mood may make adolescents more amenable to brief substance interventions but that for some adolescents it may be a treatment liability (perhaps by impeding the ability to attend to intervention or mobilize resources). This study evaluates the efficacy of MI versus RT in reducing substance use outcomes for incarcerated adolescents and examines the role of depressive symptoms in moderating outcomes. In this study, main findings at the conclusion of the trial are presented, and the focus is on substance use, as compared with previous work cited above, which focused on other behaviors partway through the trial.

## Method

### *Participants*

The sample was recruited at a state juvenile correctional facility in the Northeast, from April 2001 to March 2006. Immediately after adjudication, adolescents were identified as potential candidates for the study if they were between the ages of 14 and 19 years (inclusive) and were sentenced to the facility for 4–12 months (inclusive). Adolescents were included in the study if they met any of the following substance use screening criteria: (1) in the year before incarceration they (1a) used marijuana or drank regularly (at least monthly) or (1b) drank heavily (five or more standard drinks for boys, four or more standard drinks for girls) at least once, (2) they used marijuana or drank in the 4 weeks before the offense for which they were incarcerated, or (3)

they used marijuana or drank in the 4 weeks before they were incarcerated. Figure 1 illustrates screening, recruitment, and retention.

The sample ( $N = 162$ ) comprised the following racial/ethnic backgrounds: 31.5% Hispanic, 30.3% African American, and 29.6% White; 8.6% self-identified as “other.” Most were boys (84%); the average age was 17.10 years ( $SD = 1.11$ ). In the last year, 59.9% and 88.9% qualified for alcohol and marijuana use disorders, respectively. The number of times adolescents had been previously incarcerated was two (median presented because data were skewed). Most adolescents (89.5%) were enrolled in the standard-care substance use programming offered at the facility (see description below), following our initial treatment at baseline. Differences in basic demographics were explored between the study sample of 162 and the 27 excluded (19 with inadequate substance use data and 8 withdrawn or lost at follow-up; see Figure 1). More persons excluded from the study were White,  $\chi^2(1) = 5.19, p < .023$ . No significant differences were found for gender, racial/ethnic status, depressive symptoms, mother education (a marker for socioeconomic status), sentence length, substance treatment during incarceration, or treatment use after release.

### *Procedures*

Newly sentenced adolescents were screened based on record review (see above). Potential participants were then approached individually to determine eligibility based on substance use screening criteria (see above). All procedures that were used received institutional review board approval. Consent was obtained from legal guardians and assent was obtained from adolescents (adolescents 18 years and older provided consent). Adolescents and guardians provided permission for adolescent participation. Guardians and adolescents were informed that all information was confidential, except for plans to escape, hurt self or others, or reports of child abuse. Following the recruitment process, baseline assessment was conducted, followed by random assignment to treatment, which occurred within about 4 days of baseline assessment. Adolescents then enrolled in facility programming (see below), and about 2 weeks before facility discharge they received booster intervention (MI or RT). Follow-up assessment was made 3 months after release (research staff conducting assessments were blind to treatment assignment). Randomization was accomplished via random numbers table in advance and placed in an envelope by the project coordinator. Following baseline assessment, research staff opened the envelope to learn of intervention assignment. The mean time between baseline assessment and release was 185.10 days ( $SD = 78.2$ ).

*Facility program description.* The study was conducted in the state’s sole juvenile correctional facility where adolescents’ charges range from simple truancy to murder. About

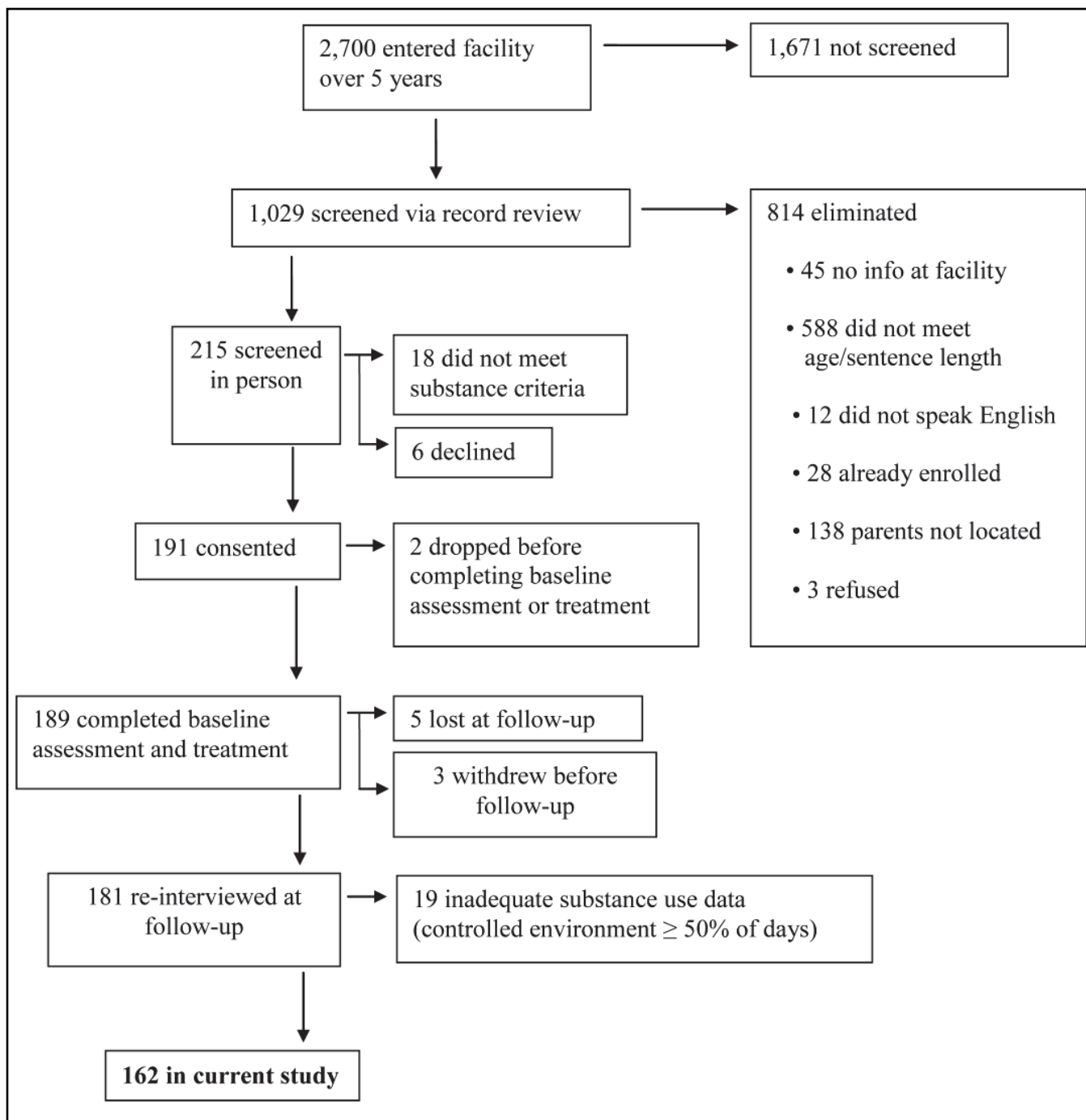


FIGURE 1. Recruitment and retention

1,000–1,200 adolescents per year are detained at the facility; 500–600 adolescents are adjudicated to the facility each year, and annual recidivism is about 35%. Adolescents receive group treatment and individualized attention (as indicated) on a variety of topics (sex offending, drug dealing, reducing crime, developing empathy, preventing violence, anger management, etc.).

The facility's standard-care substance misuse treatment is psychoeducational group treatment, which is designed to provide appropriate counseling and rehabilitative services for facility residents. Enrollment usually occurs shortly after adjudication. The program, which meets for 60 minutes twice weekly for 8 weeks (10–12 adolescents per group), is designed to provide information using didactics but also

includes interactive elements and videotapes. Topics include the physical, psychological, and social consequences of drug use; HIV risk; defense mechanisms (e.g., denial) and an introduction to Alcoholics Anonymous; overview of coping skills; and treatment resources that are available after release. As needed, groups may focus on conflict resolution, anger management, communication, gang participation, drug dealing, and independent living. Treatment goals include increased knowledge of negative effects of alcohol, tobacco, and other drugs, and accompanying change in attitude regarding use of these substances. These group treatments were available to all adolescents, regardless of their participation in the research study, and were conducted by vendors contracted with the facility.

*Assessment.* The assessments consisted of 60- to 90-minute private interviews conducted by a trained bachelor's- or master's-level research assistant. Interview format was used because of concerns about reading levels. Research assistants had about 20 hours of training with 1 hour of group and 1 hour of individual supervision per week. In vivo observations were conducted regularly by a licensed clinical psychologist. All assessment data were reviewed by a licensed clinical psychologist or master's-level project member. Record reviews were completed following completion of the assessments. Assessments occurred at baseline (shortly after adjudication) and at 3 months after release from the facility. Adolescents received a \$60 gift certificate at follow-up with \$10 bonus if they completed the interview within 1 week of the scheduled date.

*Study interventions.* Each adolescent received initial intervention (about 90 minutes at baseline) and booster session (about 60 minutes). Adolescents were randomly assigned to and received intervention (MI or RT) shortly after the baseline assessment to prepare them for the facility's standard-care treatment. For both interventions (MI and RT), research counselors had about 56 hours of manualized training with 2 hours of group and 1 hour of individual supervision per week. All study intervention files were reviewed by a licensed clinical psychologist or a master's-level project member. Research counselors were two men and two women; all were White; one had a master's degree; and three had bachelor's degrees. Each research counselor conducted both intervention types. In vivo observations were conducted by a licensed clinical psychologist to maintain intervention fidelity.

*Motivational interviewing.* The research counselors' therapeutic style and protocol were based on the principles of MI (Miller and Rollnick, 2002), with focus on empathy, not arguing, developing discrepancy, self-efficacy, and personal choice. Sections of the MI included developing rapport, exploration of motivation (pros and cons), personalized assessment feedback, imagining the future with and without change, and establishing goals. Handouts were provided (e.g., goals chosen). Focus of the intervention was

on reduction of alcohol and/or marijuana use and associated risky behaviors and consequences of use (e.g., injuries while drunk or high).

*Relaxation training.* RT, administered by research counselors, was designed to control for the effects of attending individual intervention. Participants were instructed in relaxation and use of imagery to produce a sense of calm. Adolescents received feedback and handouts in use of progressive muscle relaxation (closely observing tactile experience as muscles were tensed and relaxed). They were also instructed in imagining a peaceful scene and using the five senses to calmly observe and describe the scene in detail in the present moment as they imagined it ("I see a seagull flying overhead. . . . As it lands I hear the sand being kicked up and waves crashing. . . ."). Research counselors maintained rapport and provided generalized advice to stop risky activities involving alcohol and marijuana use. The rationale provided was that these techniques can reduce the stress that leads to use of substances such as alcohol and marijuana; therefore, using these techniques may lead to reduced substance use and the associated risky behaviors and consequences.

### Measures

*Record review.* The record review was used to enhance truthfulness of self-reported alcohol/marijuana use and illegal activity, in that adolescents were informed at the start of the study that records would be reviewed to verify self-reports. Records contained health and legal information regarding substance use history and charges. Record review was conducted at baseline only.

*Background questionnaire.* At baseline, the following sociodemographic information was recorded: age, gender, race/ethnicity, number of years of school completed, and parent/guardian educational level.

*Structured Clinical Interview for DSM-IV.* This diagnostic interview was developed by First et al. (1996) and has demonstrated reliability and validity. Modules for alcohol and marijuana abuse and dependence were administered at baseline.

*Center for Epidemiological Studies-Depression (CES-D) scale.* The CES-D (Radloff, 1991) was administered at baseline, and questions reflect distress over the last week. Coefficient  $\alpha$ 's for problematic alcohol users have ranged from .85 to .90. The CES-D has been shown to be reliable and valid for use with adolescents (Radloff, 1991). Scores of 16 or greater indicate presence of significant depressive symptomatology (Radloff, 1977); for the study sample, 69.8% had significant depressive symptoms.

*Timeline Followback (TLFB).* TLFB is a calendar-assisted approach that measures participants' recollection of their substance use over a specified period of time (Sobell and Sobell, 1992). It has been used to assess alcohol use (Bardone et al., 2000; Sobell and Sobell, 1992), drug use (Midanik et



al., 1998), smoking (Lewis-Esquerre et al., 2005), binge eating (Bardone et al., 2000), and sexual behavior (Midanik et al., 1998). TLFB has been shown to have excellent reliability ( $\alpha$ 's = .79 to .98; Sobell et al., 1979) and strong content, criterion, and construct validity. A 90-day TLFB measuring alcohol and marijuana use was collected at baseline and at follow-up after release; if adolescents were in a controlled environment for 50% of days or greater during an assessment, TLFB variables were not calculated.

### Treatment fidelity

Fidelity to treatments was maintained via manualized training, treatments manuals, regular supervision, regular treatment file reviews, and in vivo observations by a licensed psychologist. Tevyaw and Monti (2004) provide details regarding the fidelity measure. Adolescents privately completed evaluation forms assessing whether certain core components of the interventions occur. This included three items assessing the therapeutic relationship (perceived rapport, empathy, self-efficacy). Responses were rated on a scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Specific aspects of the protocols were also assessed, as were their perceived utility (0 = *topic not introduced* to 3 = *topic very useful*) across 10 items. Average relationship and usefulness ratings were obtained separately. The relationship items assess core elements of MI and should be rated more highly in MI than in RT. On the MI fidelity form, adolescents in MI rated MI-specific items as well as items specific to RT. Therefore, adolescents in MI should rate MI-specific aspects of the protocol more highly on the Likert scale than RT-specific items. On the RT fidelity form, adolescents in RT rated RT-specific items as well as items specific to MI. Therefore, adolescents in RT should rate RT-specific aspects of the protocols more highly than MI-specific items. MI-specific items include a discussion of likes and dislikes regarding substance use, whereas RT-specific items include practicing tensing and relaxing muscle groups. Research counselors independently completed similar forms.

### Analyses

Alcohol and marijuana use variables were log transformed so that these data would conform to distributional assumptions (no transformations were needed for number of days used marijuana and percentage of days used marijuana). Analysis of covariance (ANCOVA) was performed to determine the impact of depressed mood on treatment to reduce alcohol and marijuana use. Dependent variables at 3-month post-release assessment were number of drinks per drinking day, average number of drinks per day, percentage of heavy drinking days, percentage of days drank more than five drinks, number of joints smoked per day, and percentage of days used marijuana. Heavy drinking was defined as four or more drinks for girls and five or more drinks for boys. For each ANCOVA, the covariate was the corresponding baseline measure of the dependent variables, and the independent variables were intervention condition and depressive symptoms (CES-D score > 15). Significant main effects are detailed below only in the event of nonsignificant interaction effects. See Tables 2 and 3 for effect sizes for main effects, interactions, and follow-up tests.

### Results

No significant differences were found between treatment groups on relevant baseline variables including gender, age, ethnicity/race, depressive symptoms, participation in facility or post-release substance treatment, mother's education level, or sentence length. Manualized fidelity procedures indicated that (a) adolescents and research counselors in MI rated elements of RT as less useful than elements of MI, adolescents:  $t(85) = 24.34, p < .0005$ ; counselors:  $t(85) = 43.04, p < .0005$ ; (b) adolescents and research counselors in RT rated elements of MI as less useful than elements of RT, adolescents:  $t(75) = 26.96, p < .0005$ ; counselors:  $t(75) = 40.06, p < .0005$ ; and (c) adolescents and research counselors rated the therapeutic relationship better (warmth, ease of discussion, instilling

TABLE 1. Means and standard deviations for covariates at baseline

Variable	Depressive symptoms											
	Motivational interviewing						Relaxation therapy					
	High			Low			High			Low		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
DPDD	10.52	8.31	34	8.94	7.50	16	10.09	6.25	33	12.35	12.68	16
ADPD	2.01	4.60	60	1.66	3.05	26	1.98	3.70	53	1.71	1.90	23
PHDD	13.00	21.26	60	13.31	25.58	26	13.76	23.35	53	12.33	13.53	23
PDD5	12.93	21.27	60	13.05	25.52	26	13.44	23.41	53	12.27	13.57	23
JPD	7.04	10.03	60	5.11	5.87	26	5.86	6.28	53	5.92	5.90	23
PDM	69.32	36.31	60	70.09	36.21	26	67.26	40.36	53	70.15	39.78	23

Notes: Data shown are not log transformed. DPDD = drinks per drinking day; ADPD = average drinks per day; PHDD = percentage of heavy drinking days; PDD5 = percentage of days drank more than five drinks; JPD = joints per day; PDM = percentage of days used marijuana.

TABLE 2. Main effects and interaction effects for treatment condition and depressive symptoms on outcomes

Variable	Dep. symptoms				Tx effects		Dep. effects		Tx by dep. effects	
	MI		RT		<i>F</i> <sup>a</sup>	$\eta^2$	<i>F</i> <sup>a</sup>	$\eta^2$	<i>F</i> <sup>a</sup>	$\eta^2$
	High	Low	High	Low						
DPDD										
<i>M</i> <sup>b</sup>	9.17	6.07	8.62	12.79	1.57 (1, 94)	.016 <sup>c</sup>	0.37 (1, 94)	.004 <sup>c</sup>	4.14 (1, 94)	.042 <sup>d</sup>
<i>SD</i> <sup>b</sup>	6.34	3.60	6.42	9.03	<i>p</i> > .200		<i>p</i> > .500		<i>p</i> < .045	
<i>n</i>	34	16	33	16						
ADPD										
<i>M</i> <sup>b</sup>	0.88	0.55	0.71	2.12	4.34 (1, 157)	.027 <sup>c</sup>	2.78 (1, 157)	.017 <sup>c</sup>	3.54 (1, 157)	.022 <sup>c</sup>
<i>SD</i> <sup>b</sup>	2.16	1.36	1.38	3.74	<i>p</i> < .039		<i>p</i> < .098		<i>p</i> < .062	
<i>n</i>	60	26	53	23						
PHDD										
<i>M</i> <sup>b</sup>	5.15	4.23	5.86	14.54	4.63 (1, 157)	.029 <sup>c</sup>	2.78 (1,157)	.017 <sup>c</sup>	0.45 (1, 157)	.003 <sup>c</sup>
<i>SD</i> <sup>b</sup>	13.09	9.11	11.33	22.27	<i>p</i> < .033		<i>p</i> < .098		<i>p</i> > .500	
<i>n</i>	60	26	53	23						
PDD5										
<i>M</i> <sup>b</sup>	5.04	4.06	5.86	14.49	5.30 (1, 157)	.033 <sup>c</sup>	2.79 (1,157)	.017 <sup>c</sup>	0.31 (1, 157)	.002 <sup>c</sup>
<i>SD</i> <sup>b</sup>	13.10	8.97	11.33	22.29	<i>p</i> < .023		<i>p</i> < .097		<i>p</i> > .500	
<i>n</i>	60	26	53	23						
JPD										
<i>M</i> <sup>b</sup>	4.25	5.85	2.13	6.17	1.23 (1, 157)	.008 <sup>c</sup>	1.32 (1,157)	.008 <sup>c</sup>	3.86 (1, 157)	.024 <sup>c</sup>
<i>SD</i> <sup>b</sup>	9.55	23.44	3.80	10.59	<i>p</i> > .200		<i>p</i> > .200		<i>p</i> < .051	
<i>n</i>	60	26	53	23						
PDM										
<i>M</i> <sup>b</sup>	34.86	31.35	33.80	58.33	4.18 (1, 157)	.026 <sup>c</sup>	2.28 (1,157)	.014 <sup>c</sup>	4.37 (1, 157)	.027 <sup>c</sup>
<i>SD</i> <sup>b</sup>	40.23	38.23	39.63	45.25	<i>p</i> < .042		<i>p</i> > .100		<i>p</i> < .038	
<i>n</i>	60	26	53	23						

Notes:  $\eta^2$  is partial  $\eta^2$ . MI = motivational interviewing; RT = relaxation training; tx = treatment; dep. = depressive symptoms; DPDD = drinks per drinking day; ADPD = average drinks per day; PHDD = percentage of heavy drinking days; PDD5 = percentage of days drank more than five drinks; JPD = joints per day; PDM = percentage of days used marijuana. <sup>a</sup>*F* statistic provided with degrees of freedom and associated *p* levels; <sup>b</sup>data shown are not log transformed; <sup>c</sup>small effect size (Cohen, 1988); <sup>d</sup>medium effect size; <sup>e</sup>small-medium effect size.

hope) in MI than in RT, adolescents: *t*(160) = 1.96, *p* < .052; counselors: *t*(160) = 2.93, *p* < .004.

Means and standard deviations for covariates at baseline are presented in Table 1. Main effects and the interactions are presented in Table 2. Significant main effects were found for treatment group for average drinks per day, percentage of heavy drinking days, and percentage of days drank more than five drinks. For each of these dependent variables, the MI group had more favorable outcomes.

No main effects were found for depressive symptoms. The interaction (Treatment Group × Depressive Symptoms) was significant for drinks per drinking day and percentage of days used marijuana. Table 3 presents follow-up tests for significant interactions. At low levels of depressive symptoms, the MI group had significantly fewer drinks per drinking day than the RT group. Effects for RT were marginal when comparing low and high depressive levels, with RT reducing drinks per drinking day more in the high-depressive group.

TABLE 3. Follow-up tests comparing treatments within depressive symptom levels, and depressive symptoms within treatments

Variable	MI vs. RT		Low vs. high depression	
	Low dep.	High dep.	MI	RT
DPDD				
<i>F</i> <sup>a</sup>	3.97 (1, 94), <i>p</i> < .049	0.48 (1, 94), <i>p</i> > .400	1.03 (1, 94), <i>p</i> > .300	3.50 (1, 94), <i>p</i> < .064
$\eta^2$	.041 <sup>b</sup>	.005 <sup>c</sup>	.011 <sup>c</sup>	.036 <sup>d</sup>
JPD				
<i>F</i> <sup>a</sup>	3.39 (1, 157), <i>p</i> < .067	.61 (1, 157), <i>p</i> > .400	0.36 (1, 157), <i>p</i> > .500	4.57 (1, 157), <i>p</i> < .034
$\eta^2$	.021 <sup>c</sup>	.004 <sup>c</sup>	.002 <sup>c</sup>	.028 <sup>c</sup>
PDM				
<i>F</i> <sup>a</sup>	6.13 (1, 157), <i>p</i> < .014	0.00 (1, 157), <i>p</i> > .900	0.18 (1, 157), <i>p</i> > .600	6.10 (1, 157), <i>p</i> < .015
$\eta^2$	.038 <sup>d</sup>	.000 <sup>c</sup>	.001 <sup>c</sup>	.037 <sup>d</sup>

Notes:  $\eta^2$  is partial  $\eta^2$ . MI = motivational interviewing; RT = relaxation training; dep. = depressive symptoms; DPDD = drinks per drinking day; JPD = joints per day; PDM = percentage of days used marijuana. <sup>a</sup>*F* statistic provided with degrees of freedom and associated *p* levels; <sup>b</sup>medium effect size (Cohen, 1988); <sup>c</sup>small effect size; <sup>d</sup>small-medium effect size.



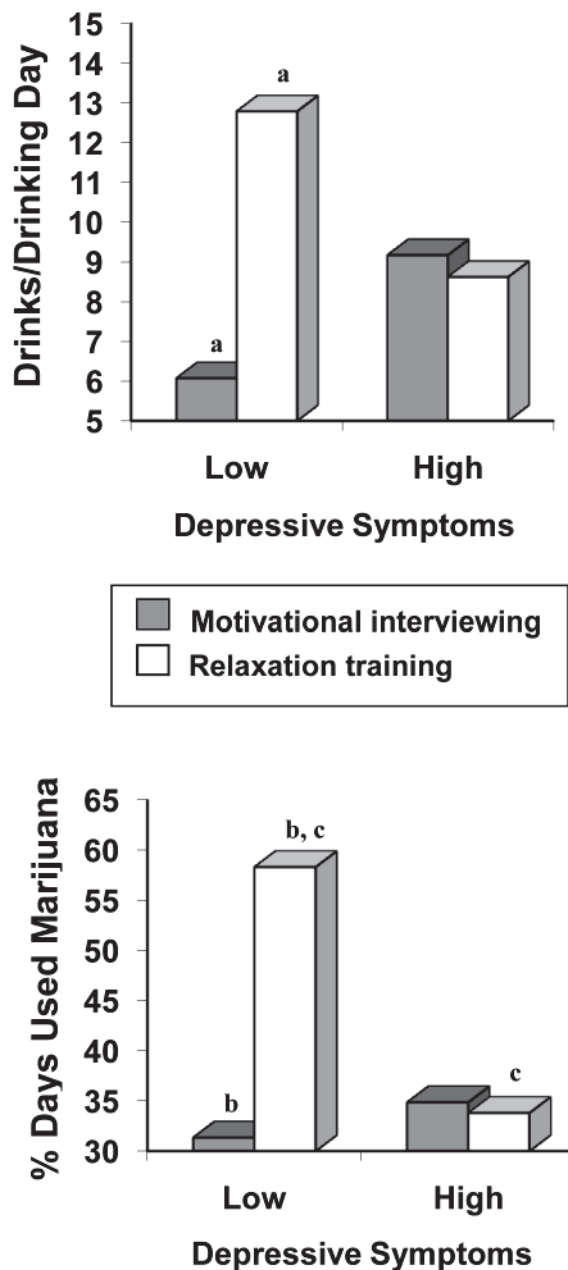


FIGURE 2. Impact of treatment on substance use by depressive symptoms: Drinks per drinking day (top panel) and percentage of days used marijuana (bottom panel). Bars with common letters are significantly different. See Table 3.

At low levels of depressive symptoms, the MI group had a significantly lower percentage of days used marijuana than the RT group. Effects for RT were significant when comparing low and high depressive levels, with RT significantly reducing percentage of days used marijuana more in the high-depressive group. Graphical display is provided in Figure 2.

Marginal interaction effects were found for joints per day, and follow-up tests are presented in Table 3. At low levels of depressive symptoms, the MI group had marginally fewer joints per day than the RT group. Effects for RT were significant when comparing low and high depressive levels, with RT significantly reducing joints per day more in the high-depressive group than in the low-depressive group.

## Discussion

Alcohol- and marijuana-involved adolescents who were recruited from a juvenile correctional facility were successfully assessed, received randomized brief intervention (MI or RT), and were retained at follow-up. Findings clearly demonstrate the acceptability and feasibility of these interventions. Main effects support the use of MI to reduce alcohol use among these adolescents. It is noteworthy that approximately 2.5 hours of MI during incarceration was significantly associated with reduced alcohol use 3 months after release, compared with 2.5 hours of RT. No main effects for depressive symptoms were found. Interaction effects indicate that, compared with RT, MI reduces alcohol and marijuana use in adolescents low in depressive symptoms at the start of incarceration. However, effects do not hold for high levels of depressive symptoms. This may be because adolescents who are low in depressive symptoms are more able to attend to the MI intervention and mobilize resources than are adolescents high in depressive symptoms, an explanation consistent with that of Tapert and colleagues (2003), who suggested that depressive symptoms may be a treatment liability.

In examining interaction effects, neither treatment outperformed the other at high levels of depression. However, it is interesting to note that for adolescents receiving RT, those high in depressive symptoms reduced marijuana use more than those low in depressive symptoms. Had RT been entirely inert, we might expect it to be associated with no effects, although absence of a no-treatment control precludes saying this with certainty. RT was designed to provide relaxation training, which has not been associated with reduction in substance use (Holroyd, 1976; Klanjer et al., 1984), although, on further inspection, this treatment provided elements of meditation and mindfulness (Bishop, 2002; Caspi and Burlinson, 2005; Jha et al., 2007; Kabat-Zinn, 1990; Perez-de-Albeniz and Holmes, 2000). In short, meditation focuses awareness on an object, image, sensation, sound, thought, or process (Caspi and Burlinson, 2005; Kabat-Zinn, 1990; Perez-de-Albeniz and Holmes, 2000) to bring about mindfulness, or complete attention to the present experience on a moment-to-moment basis (Bishop, 2002; Jha et al., 2007). Evidence is mounting for the effects of such techniques in reducing substance use, psychological distress, recidivism and aggression in prison samples (Bowen et al., 2006, 2007; Hawkins, 2003; Rainforth et al., 2003; Singh et al., 2007).

Although speculative at this time, RT may be more efficacious in reducing marijuana use for adolescents high in depressive symptoms at the start of incarceration for a number of reasons. Adolescents high in depressive symptoms may have difficulty with affect regulation, and marijuana may assist them in regulating affect. Supplying RT may assist these adolescents in modulating affect, thereby reducing use of marijuana for affect regulation. Essentially, the interaction results are consistent with the notion that, in the absence of affect regulation difficulty (i.e., low depression), adolescents may benefit from interventions (i.e., MI) aimed at motivating them to use skill sets to reduce risky behaviors, such as substance use. However, for those adolescents with affect regulation difficulty (i.e., high depression), motivating them to use skills may be moot if they do not first possess the basic tools needed to modulate affect, because it may be the lack of affect regulation that drives risky behaviors such as marijuana use. The relationship between substance use and affect regulation difficulty, and the use of less cognitively based interventions (e.g., meditation) to address this relationship has been documented elsewhere (e.g., see Hoppes, 2006). The current study parallels the work of Witkiewitz and Bowen (2010) who found that, among adults with substance use disorders, those who had higher levels of depression had the best outcomes if they were randomized to mindfulness-based treatment, compared with usual care. More work is needed to examine the potential impact of affect regulation on substance use and treatment outcome.

The clinical significance of study findings is of interest. At 3 months after release, the MI group showed a 65.0% reduction in the percentage of days they drank more than five drinks, whereas the RT group showed a 20.8% reduction. For adolescents low in depressive symptoms early in incarceration, at 3 months after release the MI group showed a 32.1% reduction in drinks per drinking day and a 55.3% reduction in percentage of days used marijuana; the RT group showed reductions of 4.6% and 33.0%, respectively. For adolescents receiving RT, at 3 months after release, those with high depressive symptoms early in incarceration showed a 49.7% reduction in percentage of days used marijuana, whereas the low depression group showed a 16.8% reduction. Clinical implications suggest that front-loading standard facility care with MI has a significant impact on substance use after release, especially for alcohol use. However, MI performs best at reducing marijuana use only for low levels of depressive symptoms as measured early in incarceration.

Findings are encouraging for intervening with substance-using incarcerated adolescents, given the prevalence of alcohol and marijuana use among this population (Lebeau-Craven et al., 2003). Given that in the previous 12 months, 59.9% and 88.9% qualified for alcohol and marijuana use disorders, respectively, these results indicate that brief intervention followed by standard facility psychoeducational

treatment is effective for a wide range of alcohol- and marijuana-involved adolescents.

These findings are similar to those of Monti et al. (1999), who found reduced alcohol-related risky behaviors after brief intervention for older adolescents. However, they are also different, in that we found evidence for moderation effects for treatment based on level of depressive symptoms as measured soon after adjudication. Findings are consistent with prior work from this data set indicating that, compared with RT, MI reduces risky sex and risky driving at low levels of depressive symptoms, yet at high levels, results from the two treatments are equivocal (Stein et al., 2006b; Rosengard et al., 2008). It appears that adolescents low in depressive symptoms may be responsive to interventions that increase their motivation to alter alcohol and, especially, marijuana use. This suggests that clinicians working in these settings may wish to consider depressive symptoms during treatment planning. For those adolescents high in depressive symptoms, results are not overwhelming; however, they do suggest that RT may be more suitable for high-depressive adolescents than it is for low-depressive adolescents.

This study is limited by its reliance on self-report methods; however, self-report is one of the most sensitive indicators of substance use. Evidence generally supports accuracy of self-reports (Babor et al., 2002). Adolescents appear to report more misbehaviors than their parents report for them and to self-report more marijuana use than is detected in urinalysis (Dennis et al., 2002). Consistent with this literature, record review contradicted adolescent reports of nonuse in 1.1% of cases for alcohol and in no cases for marijuana. Further, 21.2% and 23.8% of adolescents, respectively, reported alcohol and marijuana use that went undocumented in their records. Similarly, 4.1% of adolescents reporting no marijuana use in the previous month had a positive urine screen, whereas 7.7% that reported use in the past month tested negative. This study used various methods to enhance veridicality of self-reports including privacy during assessments and informing respondents that information would be checked against collateral information (e.g., records, facility staff, and urine screen).

Although the study is limited in its relatively brief follow-up period, it is first important to establish an effect of treatment and then to determine if it can be extended. Future investigations should include longer follow-up periods. This study was also limited in that we did not have a no-treatment control group. However, our design controlled for time spent in the intervention, which allows us to establish that the intervention effect was not a result of attention. We also reasoned that it was ethical to provide some individualized attention to each adolescent enrolled in the study. Because our measure of depressive symptoms measured affect during the past week, high scores may reflect current stressors and/or long-standing dysphoria. Future studies should consider assessing for lifetime and current major depressive disorder

and changes in depression over time that may be related to intervention efforts.

Given that this is one of the first randomized trials conducted in a juvenile correctional facility, it will be important to replicate these findings in other facilities. We selected a broad range of alcohol- and marijuana-involved adolescents, who also had diverse criminal histories. Although the racial and ethnic diversity in the sample enhances generalizability, results may vary depending on population differences in other facilities (for example, mostly aggressive offenders with substance dependence). Similarly, replication with larger sample sizes is very important because the study was relatively underpowered and some subgroup analyses comprised only about 16 participants. Although the percentage of girls recruited is consistent with facility demographics, future studies may wish to oversample girls. Finally, because the sample available for analyses excluded more Whites, findings may be somewhat more applicable to non-White adolescents.

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