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A Randomized Clinical Trial of Motivational Interviewing Plus Skills Training vs. Relaxation Plus Education and 12-Steps for Substance Using Incarcerated Youth: Effects on Alcohol, Marijuana and Crimes of Aggression

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Abstract

Background.—Motivational Interviewing plus Cognitive Behavior Therapy (MI/CBT) has been used to reduce adolescent substance use, but has rarely been applied in youth correctional settings. This trial compared MI/CBT against Relaxation Training plus Substance-Education/12-Steps (RT/SET) to reduce substance use and crime among incarcerated youth.

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Contributors

This is a report of original data, and is the first report of treatment outcomes from the dataset. All authors contributed to and approved the manuscript. Dr. Stein conceptualized the study, framed analyses, interpreted findings, drafted sections of the manuscript, and can make the protocol available upon request. Mr. Hurlbut was critical in conceptualizing study design and in implementing the protocol. Dr. Martin was responsible for statistical approach, overseeing analyses, composing results, and providing feedback on the study design and final manuscript. Drs. Clair-Michaud and Lebeau assisted with carrying out the study, its scientific integrity and drafting manuscript sections. Dr. Kahler provided input on manuscript content and presentation of data. Dr. Monti provided feedback on the manuscript in terms of framing the study and conclusions. Dr. Rohsenow provided critical scientific feedback on presentation and interpretation of results.

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https://clinicaltrials.gov/ct2/show/NCT00227890

Conflict of Interest

Authors Stein, Martin, Clair-Michaud, Lebeau, Kahler, Monti and Rohsenow received salary support during the grant. Multiple co-authors have collaborative relationships spanning multiple projects. No conflicts of interest are identified or claimed for authors, or their family members.

Methods.—Participants (*N* = 199) were incarcerated juveniles (64.8% non-White, 10.1% girls, mean age of 17.1 years). Two individual sessions of MI (or RT) were followed by 10 group sessions of CBT (or SET). Youth were randomized to condition with follow-ups at 3- and 6-months after release. Major outcomes included alcohol, marijuana and crimes involving aggression.

Results.—A marginal treatment by time interaction was found for percent heavy drinking days, with follow-up tests indicating less alcohol use in RT/SET than MI/CBT at 6 months, and increased use within MI/CBT from 3 to 6 months. A significant treatment by time interaction was found for alcohol-related predatory aggression, with follow-up tests indicating fewer youth engaged in this behavior from 3 to 6 months within RT/SET, and weak evidence favoring MI/CBT over RT/SET at 3 months. General predatory aggression decreased from 3 to 6-months for both treatments.

Conclusions.—Although weak evidence was found favoring MI/CBT with respect to alcohol-related predatory aggression, results generally support RT/SET in reducing percent heavy drinking days.

Keywords

Youth; incarcerated; substance use; treatment

1. Introduction

Rates of substance use among youth involved in the justice system are high. In a sample of detainees (*N* = 1826), 50.7% and 46.8% of males and females, respectively, had a substance use diagnosis, with just over 25% meeting criteria for alcohol disorder and over 40% meeting criteria for marijuana use disorder (Teplin et al., 2002). Within this sample, substance disorders were the 2nd most prevalent diagnosis (44.5%) behind behavioral disorders (46.3%; Abram et al., 2003). Other studies have found alarming rates of substance use among incarcerated youth in particular. A Canadian study (*N* = 205) found that 85.5% of males and 100% of females had a substance disorder (Gretton & Clift, 2011); whereas an American study (*N* = 162) found that in the last year, 59.9% and 88.9% had alcohol and marijuana use disorders, respectively (Stein, et al., 2011a).

Substance abuse is strongly related to aggression, delinquency and recidivism, and contributes to behaviors that result in juvenile crime (Doran et al., 2012). Common factors likely confer risk for substance use and aggression, which in turn reciprocally influence each other (Doran et al., 2012). Substance treatment reduces drug use and crime (Prendergast et al., 2002); and has been effective in reducing aggression and criminality in youth (Doran et al., 2012).

1.1. Interventions for incarcerated youth

Although there is great need, few studies have been conducted to evaluate efficacious interventions for substance using incarcerated youth. Extensive meta-analyses have been conducted on justice-involved youth to determine effective interventions to reduce recidivism more generally, and among the most effective are group-based and cognitive

behavioral programs (Lipsey, 2009). At the same time, of over 548 study samples, only 12% were on incarcerated/institutionalized youth (Lipsey, 2009), suggesting the need for more work in this area. A large national survey of substance services in youth correctional agencies ($N = 141$) found that psycho-education was the most frequently offered intervention (88.5%), 92.9% offered group-based intervention, and 51.2% offered cognitive behavioral programming (i.e., relapse prevention; Young et al., 2007). Although Motivational Interviewing (MI) is recommended for correctional settings (Bogue and Nandi, 2012), few controlled studies have been conducted in these settings (McMurran, 2009). A series of studies indicate MI is efficacious in substance-using incarcerated youth in terms of enhancing treatment engagement (Stein et al., 2006), and in reducing drug use (Stein et al., 2011a) and other risky behaviors after release (Stein et al., 2011b). In a review of studies on justice-involved persons, MI was found to assist treatment retention and improve motivation for change (McMurran, 2009).

Studies indicate that over 40% of incarcerated youth are unmotivated to change substance use (Slavet et al., 2006; Clair et al., 2011). Although empirical evidence indicates Cognitive Behavioral Therapy (CBT) reduces adolescent substance use (Waldron & Kaminer, 2004), skills training approaches may not be appropriate for unmotivated persons, as skills-training assumes interest and readiness to change. Therefore, combined MI-CBT has been utilized in a variety of contexts including adult smokers leaving prison (Clarke et al., 2013) and adolescent marijuana users (Dennis et al., 2004).

Although MI and CBT have been applied separately to incarcerated youth, no studies have combined MI/CBT for them (Doran et al., 2012). MI has reduced aggressive behaviors in incarcerated youth (Clair-Michaud et al., 2016). CBT has been frequently studied in youth and has demonstrated effectiveness in reducing delinquency (Doran et al., 2012). Interventions, (e.g., MI/CBT) that focus on motivation, problem-solving, communication, mental health (i.e., anger, depression) and substances may be particularly useful for incarcerated youth (Doran et al., 2012). This is because these youth may have significant mental health and substance issues, but lack motivation and skills (e.g., problem-solving, communication) to address them. CBT is generally recommended for delinquent youth with the possible addition of MI for less compliant youth (OJJDP, 2010).

1.2. Purpose

This is a randomized clinical trial (RCT) testing the hypothesis that combined MI and CBT is more efficacious than a comparison intervention in reducing substance use and crime. Given the empirical support for CBT and the importance of engagement strategies for incarcerated youth, two individual sessions of MI were combined with ten group sessions of CBT to reduce substance use in incarcerated youth. Alcohol and marijuana were targeted because they are the most frequently used substances by justice-involved youth (Lebeau-Craven et al., 2003). The comparison condition was two individual sessions of relaxation training and visualization (RT) combined with ten group sessions of treatment as usual, which was substance-education and Twelve-Step introduction (SET). As an attention control for MI, RT was utilized, as these techniques are thought to be generally ineffective in reducing substance use (see Klajner et al., 1984; Holroyd, 1976; Miller et al., 1995). Psycho-

education (Young et al., 2007) and Twelve-Step programming (Peters and Wexler, 2005) are common in correctional settings, and recommendations have been made to provide Twelve-Step programming to incarcerated youth (Sussman, 2010).

2. Methods

2.1. Participants

The study was conducted at a youth correctional facility in the northeastern United States (US). Youth are sentenced to the facility for a variety of infractions (e.g., drug dealing, sex offence). Approval to conduct the study was provided by a university Institutional Review Board and the youth facility. Informed consent was obtained for participants (youth <18 years provided assent) by study staff. Screening began 11/2005 and final follow-up was completed 3/2011. Youth meeting the following criteria were eligible: (a) ages 14–19 years; (b) sentenced for 4–12 months; and (c) in the year before incarceration they used marijuana or drank at least monthly, or they drank heavily (>5 standard drinks for boys, >4 for girls) at least once; or they used marijuana or drank in the 4 weeks before either the offense for which they were incarcerated, or before they were incarcerated.

2.2. Procedures

Immediately after adjudication, screening occurred. Screening was followed by consent, after which youth were assessed and then randomized to 2 individualized sessions of MI + 10 group sessions of CBT, or 2 individualized sessions of RT + 10 group sessions of SET. At 3 and 6 months after release, youth were assessed in the community. Assessments (60–90 min) were conducted by a trained bachelor's, master's or doctoral-level Research Assistant (RA) blind to condition. RAs had about 20 hours of training; senior level staff conducted in vivo observations to ensure proper assessment delivery. Following training, weekly supervision was provided by a PhD-level staff member; all assessment data were reviewed by a senior-level staff member. Adolescents received $230 and snacks for participation.

2.3. Interventions

Adolescents were randomized to MI/CBT or RT/SET by the Project Director, who had no contact with participants, using a random numbers table. All interventions were manualized, including fidelity procedures. Two Individual sessions (MI or RT) were 60–90 minutes each; 10 group sessions (CBT or SET) were 75 minutes each, gender segregated, used rolling admission, and occurred 1–3 times/week with a median of 3 participants/group session. Each counselor had 160 hours of manualized training, with weekly supervision. Training consisted of readings and role-plays with feedback. Intervention files were reviewed by a clinical psychologist. Counselors were 1 man and 5 women; all 6 were White; 4 had a master's, 1 had a bachelor's and 1 had a doctoral degree. Each counselor conducted both intervention types. All sessions were recorded, and fidelity coding was conducted. Any counselors falling below fidelity criteria received added individual supervision and tracking until fidelity again met acceptable levels.

MI provided feedback to clients to motivate change; emphasized personal responsibility for change; with permission, counselors provided advice and offered a menu of change-options;

and counselors sought to enhance client efficacy (see Miller & Rollnick, 2013). In session 2, pending a youth's interest, each collaborated on creating a change-plan; orientation to CBT was also provided. **CBT**, designed to be interactive, covered refusal skills; enhancing social support and communication; problem-solving; dealing with emotions; and coping with high-risk situations and urges (modeled after skills training as described in Dennis et al., 2004). Counselors in **RT** informed clients that reducing stress helps to reduce desire to use substances, and that RT will assist in reducing stress thereby mitigating substance use. Advice to stop substances was provided. Youths were instructed in progressive muscle relaxation, deep breathing, and in visualizing and describing a peaceful scene with focus on the five senses (e.g., "I *smell* popcorn," not "I *make* popcorn"). Feedback was provided on use of techniques. On session 2, youth chose the technique they liked most, practiced again, decided when they might practice it in the future, and were oriented to SET. **SET**, based on usual substance abuse intervention provided by the facility, provided an overview of physical, psychological, and social consequences of drugs; twelve-steps and defense mechanisms such as denial; types of risky situations; and resources available after release. Format was didactic as well as interactive. Video tapes were used as part of the education process. As needed, groups focused on conflict resolution, gang participation, drug dealing, and independent living.

2.4. Intervention fidelity

Procedures to track MI and RT fidelity are detailed elsewhere (Stein et al., 2011). At the end of sessions, youth and counselors completed forms. Therapeutic relationship (e.g., empathy) was assessed (1 = strongly disagree to 4 = strongly agree), as was perceived utility of specific elements of MI and RT (topic not introduced [0]; topic not useful [1] to very useful [3]). Table 1 presents relevant comparisons demonstrating fidelity to intervention. Approach to group fidelity was based on Dennis et al. (2004). At the end of group sessions supervisors completed forms assessing how much CBT or SET techniques occurred (i.e., "adherence;" rated as 1 = not at all, to 5 = extensively), and the skill used to provide the intervention techniques (i.e., "competence;" rated as 0 = not done, 1 = very poor, to 7 = excellent). Table 2 presents relevant comparisons demonstrating fidelity to intervention. SET adherence within SET was rated significantly higher than CBT adherence within CBT, although for both treatments, the level of adherence was adequate. Skill ratings did not differ across intervention; both were delivered with adequate level of skill. Of sessions observed by supervisors, a random sample of 42% was double-coded for reliability. Intra-class correlation coefficients (ICCs) indicated at least adequate agreement (Cicchetti, 1994; Cohen, 1988; Barnett, 2006) with 0.66 for CBT and 0.59 for SET on adherence; and 0.87 for CBT and 0.56 for SET on skill.

2.5. Measures

2.5.1. Baseline assessment—*Background Questionnaire* records socio-demographic information including race and ethnicity, age and gender (e.g., male or female). *Composite International Diagnostic Interview short-form* (CIDI-SF; Kessler et al., 1998) alcohol and marijuana dependence modules asks a series of questions ("What is the largest number of drinks you had in any single day during the past 12 months?" None, 1–3, 4–10, 11–20, or >20) providing an indication of substance dependence (APA, 1994). *Center for*

Epidemiological Studies Depression Scale (CES-D; Radloff, 1991; 20 items) asks a series of questions (e.g., "How often in the past week have you felt bothered by things that don't usually bother you?" 0 days, 1–2 days, 3–4 days, 5–7 days) where higher score indicates more depressive symptoms.

2.5.2. Baseline and follow-up assessments—

Delinquent Activities Scale (DAS; Reavy et al., 2014; Reavy et al., 2012) provides conduct disorder symptom count, and scales indicating crime involvement (representing primary crime outcomes) including predatory aggression, alcohol-related predatory aggression and marijuana-related drug-dealing/aggression (13, 12 and 5 items, respectively). A sample item is, "In the last 3 months, how many times were you involved in gang fights?" Three responses are requested separately for whether a behavior happened at all, if it happened while on (or behavior was done to get) alcohol, and if it happened while on/to get marijuana. Higher scores indicate more delinquent activities. *Timeline Follow-back* (TLFB; Sobell & Sobell, 1992), commonly employed to assess alcohol and marijuana use in adults (e.g., Hendricks et al., 2012) and youth (e.g., Stein et al., 2011a), was administered for the preceding 90 days. Recall of drinking patterns and deviations from patterns is assisted by providing respondents with a calendar and cuing recall by noting holidays, special events, work/school schedules and the like. Respondents are provided with examples of beverage sizes, are asked types of beverages consumed, approximate amount of alcohol consumed with each drink and so forth in order to calculate number of standard drinks consumed on a given day. TLFB assessed primary substance outcomes including average drinks/week, percent heavy drinking days, average number of joints/smoking day, average number of times smoked marijuana/week, and percent days used marijuana. Varian OnTrak Testik was utilized on-site to detect cannabinoids in urine > 50 ng/mL (Varian, 2004). Youth in a controlled environment for 100% of days during a follow-up did not have substance outcomes calculated. Youth claiming marijuana abstinence but who had positive, missing or contaminated urine screens were coded as marijuana positive for that assessment unless the reason for not providing a sample was unrelated to participant's decision (Brown et al., 2009). When youth reported marijuana use, but urine screen was negative, self-report was accepted for analyses.

2.6. Analysis

Condition effects on outcome were analyzed using Generalized Estimating Equations (GEE; Zeger & Liang, 1986), which can handle correlated observations across time for participants. Models tested the effects of intervention condition on alcohol, marijuana and crime outcomes over the 3- and 6-month follow-ups. In these models, the main effect of intervention examined whether intervention group outcomes differed over the follow-up interval. The interaction of intervention group by time examined whether the effect of intervention differed at the 3- vs. 6-month follow-up. When significant time by treatment interactions emerged, main effects were not interpreted and follow-up tests were conducted (within time, results for each treatment were compared; and within treatment, results at each time were compared). Treatment condition was dummy-coded with MI/CBT as the reference group. Outcomes that had a continuous distribution were analyzed with a GEE model and Cohen's *d* as the measure of effect size (Cohen, 1988). Dichotomous outcomes were examined using GEE models with a binomial distribution and logit link function, and

provided odds ratios (*OR*s) as a measure of effect size. Covariates were determined by examining treatment differences on important variables (Table 3); more Hispanics were in RT/SET. Age correlated significantly across alcohol, marijuana and crime outcomes ($p < .05$) and was included as a covariate. For each analysis, baseline version of the dependent variable was included as a covariate. Step 1 of each model included covariates and main effects for treatment and time; step 2 included the interaction (treatment by time). Small, medium and large *d* are represented by 0.2, 0.5 and 0.8, respectively (Cohen, 1988); whereas for *OR*, small, medium and large effects are 1.5, 3.0 and 5.0, respectively (Chen et al., 2010). Correction for multiple comparison was not used as planned comparisons were conducted.

Multiple imputation was performed for missing outcome variables using multiple linear or logistic regression plus a random component to produce the imputed values (McPherson et al., 2012; Hedeker et al., 2007). One-hundred-fifty imputed data sets were generated to yield estimates that were better than 95% efficient (Rubin, 1987; Schafer and Graham, 2002). Separate regression analyses were performed using all 150 of the imputed data sets, yielding effect sizes averaged across the 150 sets of estimates. Results did not differ in significance level from analyses without multiple imputation. Therefore, analyses with multiple imputation are not presented.

3. Results

3.1. Sample

Figure 1 shows numbers of youth enrolled and followed. Of 199 allocated to intervention, 171 (85.2%) and 163 (81.9%) completed, respectively, 3- and 6-month follow-up. Reasons for not completing 3- and 6-month follow-up were lack of interest ($n = 8$ and 16, respectively) and could not locate ($n = 20$, both times). At 3- and 6-months, $n = 1$ and 2, respectively, for disconfirmed urine; for youth in a controlled environment, $n = 4$ and 22, respectively. When youth reported they had used marijuana, but urine screen was negative, self-report was accepted for analyses: At 3-months $n = 5$ and $n = 10$, for MI/CBT and RT/SET, respectively; these figures for 6-months are $n = 1$ and $n = 3$.

Baseline sample characteristics are shown in Table 3. Those included in the study ($n = 163$) at furthest follow-up were compared to those not included ($n = 36$) on important variables (e.g., gender, ethnicity, race, age, previous detentions, days in controlled environment post-release, conduct disorder symptoms, substance disorder, depressive symptoms, treatment type, sessions attended). Youth completing furthest follow-up attended more group treatments ($M = 9.62$, $SD = 1.23$ for completers; $M = 6.86$, $SD = 3.98$ for non-completers; $t(36.49) = 4.12$, $p < .001$), and had fewer previous detentions ($M = 2.36$, $SD = 2.27$ for completers; $M = 3.28$, $SD = 2.55$ for non-completers; $t(196) = 2.14$, $p < .034$). Number of youth with data available for analyses at follow-up did not differ by treatment assignment, nor did number of treatment sessions relate to outcome or intervention assignment.

3.2. Outcomes

Analyses were completed with SPSS 24 (IBM Corp., 2016). Average drinks/week, percent heavy drinking days, average number of joints/smoking day and average number of times smoked marijuana/week were log transformed. Alcohol-related predatory aggression and marijuana-related drug-dealing/aggression were dichotomized because no transformation corrected the non-normal distributions. Table 4 shows descriptive statistics for baseline and follow-up values of outcome variables. Irrespective of intervention, problem behaviors appear to be generally lower after release from incarceration. Time from last intervention to first follow-up was unrelated to outcome or group assignment. With $a = 0.05$ and n ranging between 91 – 163 at 3- and 6-month follow-ups, power is estimated at 0.77 – 0.97 to detect small-medium effect sizes (Soper, 2016).

3.2.1. Alcohol—Table 5 presents GEE results for all analyses. For percent heavy drinking days there was a marginal treatment by time interaction. For MI/CBT, percent heavy drinking days at 3 months was 6.95%, whereas at 6 months, it was 11.10%. For RT/SET, percent heavy drinking days at 3 months was 4.52%, whereas at 6 months, it was 4.48%. Follow-up tests at each time indicate percent heavy drinking days for RT/SET was lower than that for MI/CBT at 6 months ($B = 0.22$, $SE = 0.09$, $p = 0.019$; 95% CI [−0.36, 0.41], $d = 0.40$), but not at 3 months ($B = 0.06$, $SE = 0.78$, $p = 0.44$; 95% CI [−.092, 0.212], $d = 0.11$). Furthermore, follow-up tests within RT/SET indicate no differences in percent heavy drinking days at 3 months vs. 6 months ($B = -0.009$, $SE = 0.055$, $p = 0.865$; 95% CI [−.118, 0.099], $d = 0.02$), but within MI/CBT percent heavy drinking days was significantly higher at 6 months as compared to 3 months ($B = 0.14$, $SE = 0.06$, $p = 0.033$; 95% CI [0.01, 0.27], $d = 0.25$). For average number of drinks/week, no significant main effects for treatment or time were found, nor was a significant treatment by time interaction found.

3.2.2. Marijuana—For average number of joints smoked per smoking day, average number of times smoked marijuana/week, and percent days used marijuana, no significant main effects for treatment or time were found, nor was a significant treatment by time interaction found.

3.2.3. Crime—For alcohol-related predatory aggression there was a treatment by time interaction. For MI/CBT, the percent of adolescents involved in alcohol-related predatory aggression at 3 months was 11.3%, whereas at 6 months, it was 13.0%. For RT/SET, the percent of adolescents involved in alcohol-related predatory aggression at 3 months was 18.4%, whereas at 6 months, it was 8.3%. Follow-up tests at each time indicate that the proportion engaged in alcohol-related predatory aggression for RT/SET was marginally greater than MI/CBT at 3 months ($B = -0.89$, $SE = 0.49$, $p = 0.072$; 95% CI [−1.86, 0.08], $OR = 0.41$), but not at 6 months ($B = 0.61$, $SE = 0.59$, $p = 0.300$; 95% CI [−0.54, 1.76], $OR = 1.84$). Furthermore, follow-up tests within MI/CBT indicate no differences in percent engaged in alcohol-related predatory aggression at 3 months vs. 6 months ($B = 0.14$, $SE = 0.52$, $p = 0.790$; 95% CI [−0.89, 1.17], $OR = 1.15$), but within RT/SET the proportion engaged in alcohol-related predatory aggression was significantly higher at 3 months as compared to 6 months ($B = -1.07$, $SE = 0.54$, $p = 0.045$; 95% CI [−2.13, −0.23], $OR = 0.34$).

For general predatory aggression there was a main effect for time with no treatment effect or treatment by time interaction. At 3 months, *M* was 2.02 (*SD* = 2.55); and at 6 months, *M* was 1.66 (*SD* = 2.39). For marijuana-related drug dealing and aggression, no effects were found for treatment or time, or treatment by time interaction.

4. Discussion

For percent heavy drinking days, a weak treatment by time interaction was found. Follow-up tests indicated drinking increased significantly from 3 to 6 months after MI/CBT, but at 6 months, heavy drinking was significantly lower for the RT/SET condition than for those who received MI/CBT. Therefore, for effects on heavy drinking, RT/SET may be more beneficial over the 6-month period following release. A small but significant decrease was found in predatory aggression from 3- to 6-month follow-up in both conditions. However, youth engaged in alcohol-related predatory aggression decreased significantly from 3 to 6 months only after RT/SET, not after MI/CBT. At 3 months, although weak evidence suggested fewer youth in MI/CBT engaged in alcohol-related predatory aggression as compared to youth in RT/SET, RT/SET may be beneficial in the longer term. No effects were found for marijuana or marijuana-related crime, although older youth use marijuana significantly more frequently than younger youth. Previous literature has also found it difficult to obtain treatment effects for marijuana use (Dennis et al., 2004). Given that moderate beneficial effects were found for RT/SET, this approach may be a viable, lower cost treatment to administer in correctional settings, as it requires less training for counselors to administer than MI/CBT.

Given the dangers of heavy drinking (Dawson, 2011), especially for youth (Windle, 2016), the potential for RT/SET to reduce heavy drinking at 6-month follow-up is important. Results for crime-related outcomes may be considered particularly noteworthy. There appears to be an association between alcohol and violence (Lipsey et al., 2002) with some investigators indicating alcohol facilitates violence (Raskin-White, 2002), and others observing that alcohol may cause violence (Bushman, 2002). The reductions in alcohol-related violence found in this study are salient. Costs of crime are estimated at $3,532 per theft offense to $8.98M for murder, with a median cost of $7,974 per stolen property offense (McCollister et.al, 2010). Reducing the incidence of crimes and the numbers of youth engaging in them is critical, and this is especially true for violent crimes.

4.1. Limitations

Follow-up studies should examine mechanisms of action and extend follow-up time beyond 6 months. Current results may apply more readily to youth with slightly fewer previous detentions and who attend more treatment sessions, since youth lost to assessment at furthest follow-up differed on those dimensions as compared to youth included in analyses. The influence of context cannot be eliminated in this study. For example, youth may have received a consistent message to abstain from substances from multiple sources in addition to RT/SET, including social worker, staff, probation officer and judge, whereas MI/CBT emphasized harm-reduction, a message that may have been inconsistent with the general philosophy of the judicial system. It is possible that in part, it was the consistency in

message that produced effects for RT/SET. It is possible that youth had difficulty attending to MI/CBT as compared to RT/SET. However, a meta-analysis (Tanner-Smith et al., 2013), including youth with arrest history, found MI/CBT is generally effective in reducing substance use, and that youth delinquency and comorbidity were not associated with effects. The MI/CBT manual also provided guidance on how to assist youth with delays or impairment, and staff were trained and supervised accordingly. Youth likely could attend appropriately to intervention.

5. Conclusions

Results are encouraging for use of RT/SET in reducing heavy drinking days and alcohol related predatory crime over time. At the same time, there is a need to enhance treatment effects, especially for marijuana. Among youth, there is a preponderance of support for CBT, and growing support for MI. However, there is also growing support for 12-Step approaches (see Kelly et al., 2011). In addition, RT as utilized in this study can be viewed a mindfulness approach (see Stein et al., 2011a), and as such may have contributed to intervention effects (Himelstein, 2011). Given better outcomes for RT/SET and that less training is required to administer it, further study of RT/SET is warranted in this setting.

This study has a number of strengths that may increase generalizability, including a racially and ethnically diverse sample of incarcerated youth, although future studies may wish to over-sample girls. Self-report was verified with biological sample for marijuana, retention rate at follow-up was over 80%, blinding and randomization were used, and fidelity to intervention was more than adequate. It is critical to reduce substance use and crime in incarcerated youth using methods that are relatively easily disseminated. Relaxation Training plus Substance Education/12-Steps appears to be a viable option. More work is needed to increase treatment effects.

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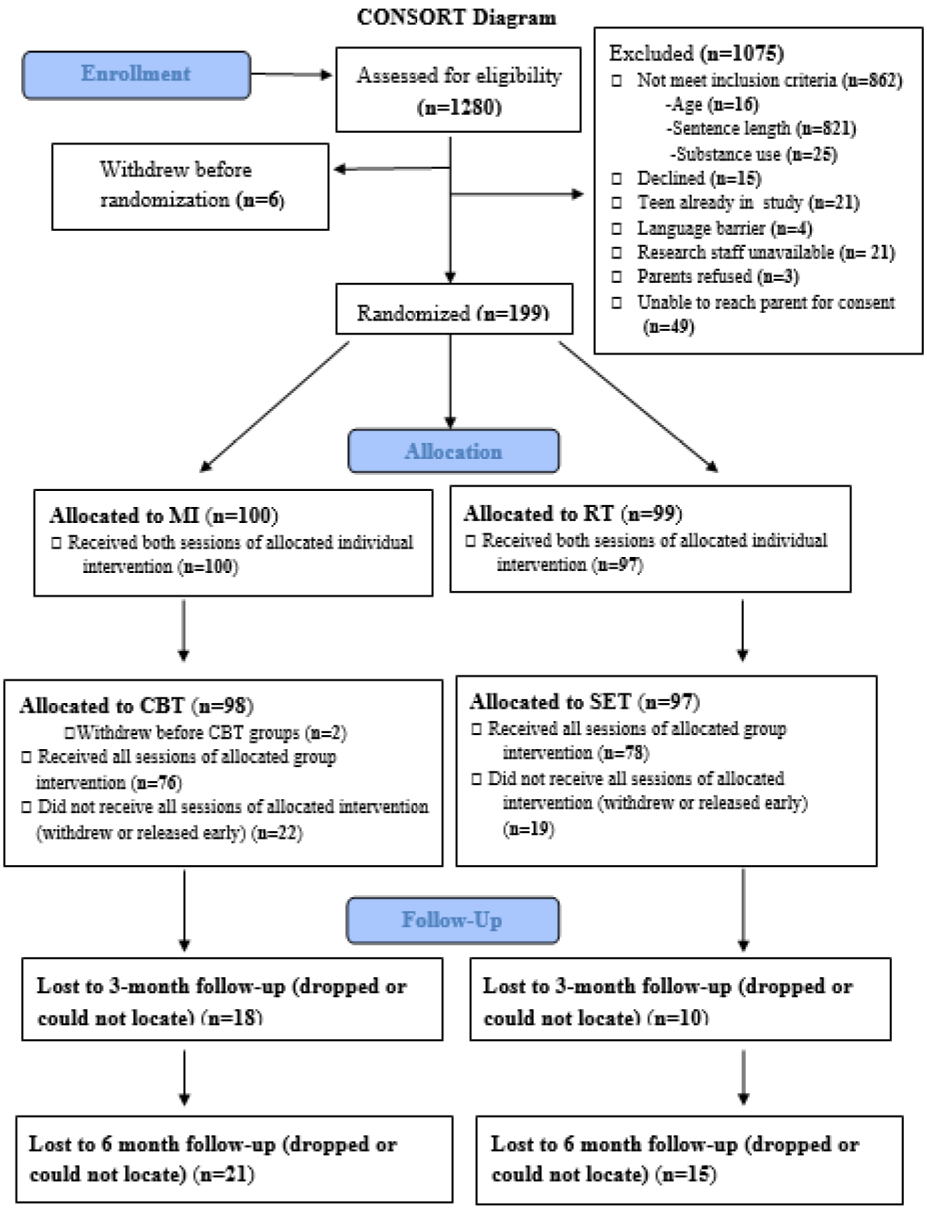
Highlights

- Compared to MI/CBT, RT/SET useful in reducing alcohol use in youth after release
- Both RT/SET and MI/CBT reduced predatory aggression
- Compared to MI/CBT, RT/SET helpful in reducing alcohol-related predatory aggression



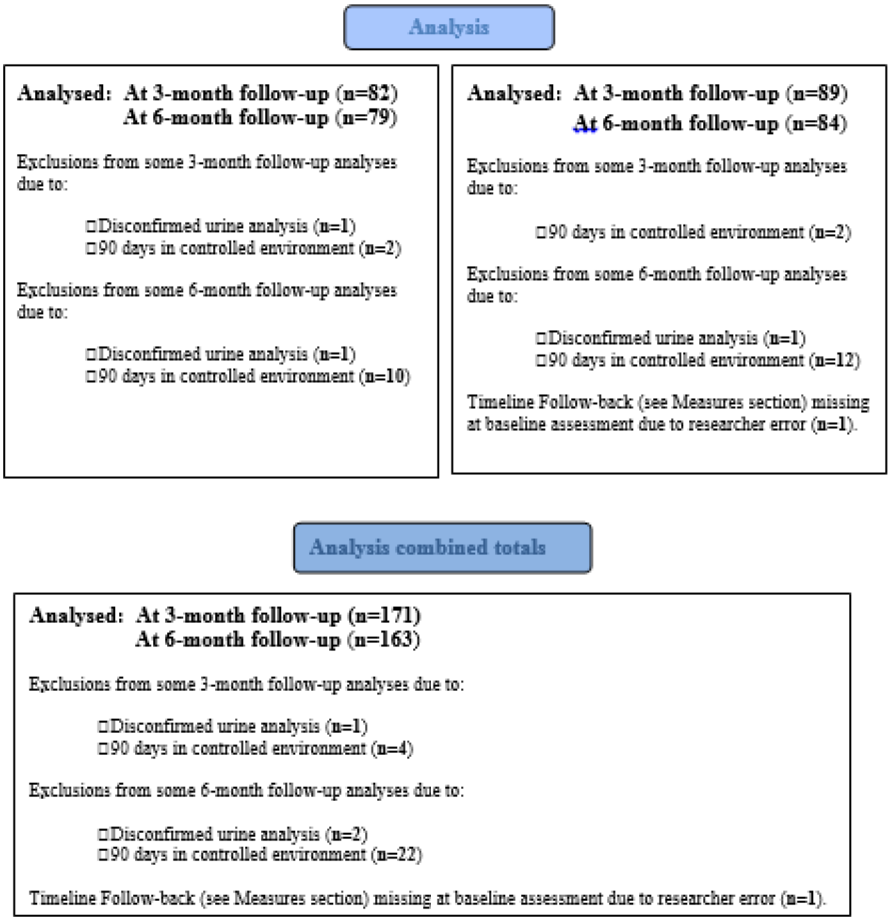


Figure 1.

Consort Diagram.

MI = Motivational Interviewing; CBT = Cognitive Behavioral Therapy; RT = Relaxation Therapy; SET = Substance Education/Twelve Step Introduction. N for analyses is equivalent to subtracting N lost at follow-up from N allocated to individual treatment. Example: N allocated to RT is 99, N lost at 3-month follow-up in the RT/SET condition is 10, so that 99 – 10 = 89 for N Analyzed at 3-month follow-up.

Table 1.

Fidelity to Individual Treatment Assignment.

	Comparison		t(df)	p
Adolescent Ratings				
	Relationship in MI Sessions	Relationship in RT Sessions		
M (SD)	3.55 (0.41)	3.52 (0.45)	0.44 (195)	=0.663
	RT Elements in MI Sessions	RT Elements in RT Sessions		
M (SD)	0.40 (0.79)	2.40 (0.51)	21.00 (167.79)	<0.001
	MI Elements in MI Sessions	RT Elements in MI Sessions		
M (SD)	2.39 (0.41)	0.40 (0.79)	22.83 (98)	<0.001
	MI Elements in MI Sessions	RT Elements in RT Sessions		
M (SD)	2.39 (0.41)	2.40 (0.51)	0.17 (184.62)	=0.865
	MI Elements in MI Sessions	MI Elements in RT Sessions		
M (SD)	2.39 (0.41)	0.36 (0.68)	25.28 (158.03)	<0.001
	RT Elements in RT Sessions	MI Elements in RT Sessions		
M (SD)	2.40 (0.51)	0.36 (0.68)	25.97 (96)	<0.001
Counselor Ratings				
	Relationship in MI Sessions	Relationship in RT Sessions		
M (SD)	3.43 (0.45)	3.34 (0.48)	1.33 (195)	=0.184
	RT Elements in MI Sessions	RT Elements in RT Sessions		
M (SD)	0.01 (0.05) [a]	2.39 (0.43)	54.52 (98.54)	<0.001
	MI Elements in MI Sessions	RT Elements in MI Sessions		
M (SD)	2.31 (0.42)	0.01 (0.05) [a]	55.49 (99)	<0.001
	MI Elements in MI Sessions	RT Elements in RT Sessions		
M (SD)	2.31 (0.42)	2.39 (0.43)	1.29 (195)	=0.199
	MI Elements in MI Sessions	MI Elements in RT Sessions		
M (SD)	2.31 (0.42)	0.00 (0.00) [a]	54.91 (99)	<0.001
	RT Elements in RT Sessions	MI Elements in RT Sessions		
M (SD)	2.39 (0.43)	0.00 (0.00) [a]	54.99 (96)	<0.001

MI = Motivational Interviewing, RT = Relaxation Training, REL = relationship rating, M = mean, SD = standard deviation, df = degrees of freedom; n (number of youth assigned to MI) = 100; n = 99 for RT;

[a] data did not conform to distributional assumptions, however, mean comparisons illustrate fidelity expectations were met (e.g., counselor ratings of MI elements in MI sessions were greater than counselor rating of RT elements in MI sessions).

Table 2.

Supervisor Ratings of Fidelity to Group Treatment Assignment.

	Comparison		t(df)	p
	SET Techniques in CBT Sessions	CBT Techniques in CBT Sessions		
M (SD)	1.02 (0.08)	2.36 (0.26)	42.69 (73)	<0.001
	SET Techniques in SET Sessions	CBT Techniques in SET Sessions		
M (SD)	2.48 (0.19)	1.10 (0.30)	33.70 (62)	<0.001
	SET Techniques in CBT Sessions	SET Techniques in SET Sessions		
M (SD)	1.02 (0.08)	2.48 (0.19)	60.00 (135)	<0.001
	CBT Techniques in CBT Sessions	CBT Techniques in SET Sessions		
M (SD)	2.36 (0.26)	1.10 (0.30)	26.70 (135)	<0.001
	CBT Techniques in CBT Sessions	SET Techniques in SET Sessions		
M (SD)	2.36 (0.26)	2.48 (0.19)	2.90 (132)	=0.004
	CBT Techniques in CBT Sessions[a]	SET Techniques in SET Sessions[a]		
M (SD)	4.50 (0.73)	4.50 (0.62)	0.34 (135)	=0.733

SET = Substance Education and Twelve Step Programming, CBT = Cognitive Behavior Therapy, M = mean, SD = standard deviation, df = degrees of freedom; n (number of CBT sessions rated by supervisors) = 74; n = 63 for SET;

[a]skill rating.

Table 3:

Baseline Differences on Demographics and Key Variables by Treatment Condition

Variable	Sample Summary (n=199) *N* (%) or M (SD)	MI/CBT (n=100) *N* (%) or M (SD)	RT/SET (n=99) *N* (%) or M (SD)
Demographics			
Age in years	17.08 (1.04)	17.05 (1.01)	17.12 (1.08)
Gender: Female	20 (10.1)	12 (12.0)	8 (8.1)
Ethnicity: Hispanic*	79 (39.7)	32 (32.0)	47 (47.5)
Race: Non-White	129 (64.8)	66 (66.7)	60 (61.9)
Number of previous detentions or incarcerations	2.53 (2.34)	2.83 (2.46)	2.23 (2.19)
Alcohol dependent	63 (31.7)	32.0 (32.0)	31.0 (31.3)
Marijuana dependent	123 (61.8)	56 (56.0)	67 (67.7)
Conduct disorder symptom count	7.96 (3.45)	8.05 (3.55)	7.88 (3.55)
Depressive symptoms	19.18 (10.29)	19.05 (10.24)	19.31 (10.39)
Sessions attended	9.12 (2.27)	9.11 (2.28)	9.13 (2.28)
Alcohol Use Variables			
Average drinks per week	10.89 (18.02)	11.16 (19.04)	10.62 (17.02)
% heavy drinking days	12.04 (19.31)	12.10 (19.57)	11.97 (19.15)
Marijuana Use Variables			
Average number of joints per smoking day	5.42 (4.97)	5.84 (5.57)[a]	4.98 (4.25)[b]
Average number of times smoked marijuana per week	17.86 (20.05)	20.42 (22.08)	15.26 (17.47)[c]
% days used marijuana	64.36 (39.32)	64.94 (40.44)	63.78 (38.35)[c]
Crime Variables			
Predatory aggression	6.20 (3.47)	6.35 (3.72)	6.05 (3.22)
Alcohol related predatory aggression[d]	103 (51.8)	54 (54.0)	49 (49.5)
Marijuana related drug dealing and aggression[d]	128 (64.3)	63 (63.0)	65 (65.7)

MI = Motivational Interviewing, CBT = Cognitive Behavior Therapy, RT = Relaxation Training, SET = Substance Education and Twelve Steps, M = Mean, SD = Standard Deviation, n = Number of participants, % = Percent.

[a] n = 90 because 10 youth had zero smoking days;

[b] n = 88 because 10 youth had zero smoking days and 1 youth did not complete the questionnaire;

[c] n = 98 because 1 youth did not complete the questionnaire.

[d] Dichotomized due to violations of distributional assumptions. Untransformed values presented. Significant difference by treatment condition and level of significance indicated by *p<.05.

Table 4:

Outcomes at Baseline and Follow-Up by Treatment Condition.

Variable	MI/CBT *N* (%) or M (SD)	RT/SET *N* (%) or M (SD)
Average number of drinks per week		
Baseline	11.16 (19.04)	10.62 (17.02)
3-Mo FU	5.16 (12.27)	3.86 (9.16)
6-Mo FU	7.08 (13.69)	3.57 (7.67)
% heavy drinking days		
Baseline	12.10 (19.57)	11.97 (19.15)
3-Mo FU	6.95 (18.16)	4.52 (12.90)
6-Mo FU	11.10 (23.08)	4.48 (11.08)
Average number of joints per smoking day		
Baseline	5.84 (5.57)	4.98 (4.25)
3-Mo FU	2.52 (2.37)	2.48 (2.48)
6-Mo FU	2.48 (2.16)	2.95 (3.71)
Average number of times smoked marijuana per week		
Baseline	20.42 (22.08)	15.26 (17.47)
3-Mo FU	8.03 (12.46)	5.37 (10.21)
6-Mo FU	6.78 (12.50)	6.59 (12.68)
% days used marijuana		
Baseline	64.94 (40.44)	63.78 (38.35)
3-Mo FU	36.88 (41.55)	29.13 (39.11)
6-Mo FU	35.56 (41.62)	34.78 (41.61)
Predatory aggression		
Baseline	6.35 (3.72)	6.05 (3.22)
3-Mo FU	2.13 (2.69)	1.92 (2.41)
6-Mo FU	1.89 (2.71)	1.44 (2.03)
Alcohol related predatory aggression[a]		
Baseline	54 (54.0)	49 (49.5)
3-Mo FU	9 (11.3)	16 (18.4)
6-Mo FU	9 (13.0)	6 (8.3)
Marijuana related drug dealing and aggression[a]		
Baseline	63 (63.0)	65 (65.7)
3-Mo FU	11 (13.8)	12 (13.8)
6-Mo FU	7 (10.1)	9 (12.5)

MI = Motivational Interviewing, CBT = Cognitive Behavior Therapy, RT = Relaxation Training, SET = Substance Education and Twelve Steps, M = Mean, SD = Standard Deviation, n = Number of participants, % = Percent., Mo = Month, FU = Follow-up.

[a]Dichotomized due to violations of distributional assumptions. Untransformed values presented. n's ranged from 44–100, with Mode = 100 and Median = 80 for MI/CBT; and 47–99, with Mode = 87 and Median = 87 for RT/SET.

Table 5:

Modeling Outcomes Using Generalized Estimating Equations.

Dependent Variable Predictor		B	SE	Effect Size d or OR	95% CI	*p*
Average number of drinks/week[a]						
1st step	Baseline number of drinks/week[a]	0.251	0.070	0.506	0.229, 0.782	0.000
	Hispanic (vs. Non-Hispanic)	−0.097	0.069	−0.196	−0.470, 0.078	0.161
	Age	0.047	0.032	0.095	−0.030, 0.220	0.135
	MI/CBT (vs. RT/SET)[b]	0.079	0.068	0.159	−0.112, 0.429	0.251
	Time[b]	0.047	0.034	0.095	−0.037, 0.228	0.158
2nd step	Time × MI/CBT	0.092	0.067	0.187	−0.077, 0.450	0.165
% heavy drinking days[a]						
1st step	Baseline % heavy drinking days[a]	0.231	0.066	0.419	0.185, 0.652	0.000
	Hispanic (vs. Non-Hispanic)	−0.107	0.073	−0.194	−0.453, 0.065	0.143
	Age	0.047	0.034	0.085	−0.036, 0.206	0.167
	MI/CBT (vs. RT/SET)[b]	0.126	0.074	0.229	−0.032, 0.491	0.086
	Time[b]	0.062	0.043	0.112	−0.040, 0.265	0.148
2nd step	Time × MI/CBT	0.149	0.085	0.270	−0.032, 0.573	0.080
Average number of joints/smoking day (AJSD)[a]						
1st step	Baseline # joints/smoking day[a]	0.174	0.091	0.476	0.250, −0.013	0.057
	Hispanic (vs. Non-Hispanic)	0.068	0.063	0.186	0.172,−0.151	0.279
	Age	−0.007	0.041	−0.019	0.114, −0.243	0.865
	MI/CBT (vs. RT/SET)[b]	0.045	0.063	0.124	0.171, −0.212	0.469
	Time[b]	−0.014	0.034	−0.037	0.930, −0.219	0.690
2nd step	Time × MI/CBT	0.010	0.682	0.027	0.187,−0.339	0.885
Average number of times smoked marijuana/week[a]						
1st step	Baseline # times marijuana/week[a]	0.271	0.064	0.497	0.268, 0.726	0.000
	Hispanic (vs. Non-Hispanic)	0.001	0.076	0.002	−0.273, 0.276	0.990
	Age	0.085	0.035	0.155	0.030, 0.281	0.015
	MI/CBT (vs. RT/SET)[b]	0.070	0.075	0.128	−0.140, 0.396	0.349
	Time[b]	0.009	0.038	0.017	−0.120, 0.153	0.808
step	Time × MI/CBT	−0.115	0.075	−0.212	−0.481, 0.058	0.124
% days used marijuana						

Dependent Variable Predictor		B	SE	Effect Size d or OR	95% CI	*p*
1st step	Baseline % days used marijuana	0.214	0.067	0.005	0.002, 0.008	0.001
	Hispanic (vs. Non-Hispanic)	2.382	5.864	0.058	−0.223, 0.340	0.685
	Age	5.754	2.618	0.141	0.015, 0.267	0.028
	MI/CBT (vs. RT/SET)[b]	5.418	5.712	0.133	−0.142, 0.407	0.343
	Time[b]	3.431	3.025	0.084	−0.061, 0.229	0.257
2nd step	Time × MI/CBT	−7.136	5.988	−0.175	−0.462, 0.113	0.233
Predatory Aggression						
1st step	Baseline predatory aggression	0.281	0.047	0.114	0.077, 0.151	0.000
	Hispanic (vs. Non-Hispanic)	0.124	0.282	0.050	−0.174, 0.274	0.661
	Age	0.044	0.148	0.018	−0.099, 0.135	0.766
	MI/CBT (vs. RT/SET)[b]	0.206	0.286	0.083	−0.144, 0.310	0.472
	Time[b]	−0.393	0.192	−0.159	−0.311, −0.007	0.040
2nd step	Time × MI/CBT	0.234	0.388	0.095	−0.213, 0.402	0.547
Alcohol related predatory aggression[c]						
1st step	Baseline alcohol aggression[c]	2.469	0.688	11.808	3.065, 45.494	0.000
	Hispanic (vs. Non-Hispanic)	0.378	0.423	1.459	0.636, 3.347	0.372
	Age	0.099	0.183	1.104	0.772, 1.579	0.588
	MI/CBT (vs. RT/SET)[b]	−0.258	0.417	0.773	0.341, 1.750	0.537
	Time[b]	−0.429	0.286	0.651	0.372, 1.141	0.134
2nd step	Time × MI/CBT	1.473	0.551	4.363	1.483, 12.833	0.007
Marijuana related drug dealing and aggression[c]						
1st step	Baseline[c]	1.122	0.515	3.070	1.120, 8.417	0.029
	Hispanic (vs. Non-Hispanic)	0.511	0.411	1.668	0.745, 3.734	0.214
	Age	0.306	0.171	1.358	0.971, 1.898	0.073
	MI/CBT (vs. RT/SET)[b]	0.009	0.415	1.009	0.447, 2.276	0.982
	Time[b]	−0.220	0.270	0.802	0.473, 1.362	0.415
2nd step	Time × MI/CBT	−0.235	0.548	0.790	0.270, 2.313	0.668

[a] Logged; analyzed as normally distributed; effect size is in standardized units of the dependent variable (d; Cohen, 1988).

[b] Dummy coded (0 = 3-month follow-up, 1 = 6-month follow-up; MI/CBT = 1; RT/SET = 0).

[c] Dichotomous; analyzed using binomial distribution; effect size is expressed as an odds ratio (OR). SE = Standard Error, % = percent, CI = Confidence Interval, MI = Motivational Interviewing, CBT = Cognitive Behavior Therapy, RT = Relaxation Therapy, SET = Substance Education and Twelve Step Programming.