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A Pilot Randomized Clinical Trial Testing Integrated Twelve-Step Facilitation (iTsf) Treatment for Adolescent Substance Use Disorder

John F. Kelly,

Recovery Research Institute Massachusetts General Hospital and Harvard Medical School, 151 Merrimac Street, 6th Floor, Boston, MA 02114 USA

Yifrah Kaminer,

University of Connecticut Health Sciences Center, Farmington CT, USA

Christopher W. Kahler,

Brown University, Department of Public Health, Providence, RI USA

Bettina Hoepfner,

Recovery Research Institute Massachusetts General Hospital and Harvard Medical School, 151 Merrimac Street, 6th Floor, Boston, MA 02114 USA

Julie Yeterian,

Recovery Research Institute Massachusetts General Hospital and Harvard Medical School, 151 Merrimac Street, 6th Floor, Boston, MA 02114 USA

Julie V. Cristello, and

Recovery Research Institute Massachusetts General Hospital and Harvard Medical School, 151 Merrimac Street, 6th Floor, Boston, MA 02114 USA

Christine Timko

VA Palo Alto Health Care System and Stanford University Medical School, Menlo Park, CA USA

Abstract

Background and Aims—Integration of 12-step philosophy and practices is common in adolescent substance use disorder (SUD) treatment programs, particularly in North America. However, although numerous experimental studies have tested 12-step facilitation (TSF) treatments among adults, no studies have tested TSF-specific treatments for adolescents. We tested the efficacy of a novel integrated TSF.

Design—Explanatory, parallel-group, randomized clinical trial comparing 10 sessions of either motivational enhancement therapy/cognitive-behavioral therapy (MET/CBT; n=30) or a novel integrated TSF (iTsf; n=29) with follow-up assessments at 3-, 6-, and 9-months following treatment entry.

Corresponding author: John F. Kelly, Recovery Research Institute, 151 Merrimac Street, 6th Floor, Boston, MA 02114, jkelly11@mgh.harvard.edu.

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Conflicts of Interest: None.

Setting—Outpatient addiction clinic in the USA.

Participants—Adolescents (N=59; M age=16.8 [1.7]; range 14-21; 27% female; 78% White).

Intervention and comparator—The iTSF integrated 12-step with motivational and cognitive-behavioral strategies, and was compared with state-of-the-art MET/CBT for SUD.

Measurements—Primary outcome: percent days abstinent (PDA); Secondary outcomes: 12-step attendance, substance-related consequences, longest period of abstinence, proportion abstinent/mostly abstinent, psychiatric symptoms.

Findings—Primary Outcome: PDA was not significantly different across treatments ($b=0.08$, CI95% -0.08 to 0.24, $p=.33$; Bayes Factor=0.28). Secondary Outcomes: During treatment, iTSF patients had substantially greater 12-step attendance, but this advantage declined thereafter ($b=-0.87$; CI95% -1.67 to 0.07, $p=.03$). iTSF did show a significant advantage at all follow-up points for substance-related consequences ($b=-0.42$; CI95% -0.80 to -0.04, $ps <.05$; effect size range $d=0.26$ to 0.71). Other secondary outcomes did not differ significantly between treatments but effect sizes tended to favor iTSF. Across the entire sample, greater 12-step meeting attendance was associated significantly with longer abstinence during ($r=0.39$, $p=.008$), and early following ($r=0.30$, $p=.049$), treatment.

Conclusion—Compared with motivational enhancement therapy/cognitive-behavioral therapy (MET/CBT), in terms of abstinence, a novel integrated 12-step facilitation treatment for adolescent substance use disorder (iTSF) showed no greater benefits, but did show benefits in terms of 12-step attendance and consequences. Given widespread use of combinations of 12-step, MET, and CBT in adolescent community outpatient settings in North America, iTSF may provide an integrated evidence-based option that is compatible with existing practices.

Introduction

Substance use disorders (SUD) are among the top causes of preventable mortality and morbidity globally among adolescents, especially in middle and high income countries, such as the US and UK (1). The expansion of evidence-based treatment options for adolescent SUD has been an important advance in adolescent clinical care in recent years (e.g., 2-7), yet, notable science-practice gaps remain. For example, to help sustain and enhance treatment gains following acute care, youth treatment programs often incorporate at least some aspects of the 12-step philosophy and practices of Alcoholics Anonymous (AA), and most refer patients to related free community mutual-help organizations, such as AA, Narcotics Anonymous (NA), or Marijuana Anonymous (MA), particularly in north America. In the US, nearly half of adolescent treatment programs (47%) require participation in 12-step organizations during treatment, and 85% link adolescents with 12-step groups as a continuing care resource (8, 9). Numerous naturalistic studies suggest such 12-step participation is safe and can confer meaningful benefits for youth (10-18). An 8-year prospective study on adolescent inpatients, for example, found that AA/NA participation was associated with significantly higher abstinence across the 8-year follow-up with AA/NA attendees gaining an average of two days of abstinence for each AA/NA meeting attended, on average, independent of other factors (19). Another 3-year prospective study of adolescent outpatients and AA/NA participation found similar results (18), and a 7-year

prospective study found that AA/NA participation was associated with higher abstinence as well as reduced health care costs (16).

Such findings suggest that facilitating youth community-based 12-step meeting participation may be a cost-effective way to enhance long-term remission across the high-risk developmental period of emerging adulthood (20). Yet, despite the increase of numerous manualized psychosocial treatments for adolescents (e.g., 2), the development and testing of numerous manualized 12-step based treatments for adults (i.e., “Twelve-Step Facilitation” interventions [TSF]; 21-31), and the popularity and potential benefit of 12-step approaches to youth SUD (i.e., free, widely available peer support), no studies to date have developed and rigorously tested in a randomized clinical trial a developmentally-appropriate manualized 12-step treatment for adolescents. Given the lack of an empirically-supported option despite the widespread integration of 12-step philosophy and practices in adolescent treatment, an integrated 12-step facilitation intervention shown efficacious could help bridge the science-practice gap and be implemented relatively easily into existing programs. The primary goal of the current study was to conduct the first randomized clinical trial testing an integrated 12-step facilitation (iTSF) intervention against a gold standard outpatient treatment (motivational enhancement therapy [MET]/cognitive behavioral therapy [CBT]; (3). Specifically, the aims were to compare MET/CBT to iTSF for adolescents presenting to outpatient treatment with a broad range of SUDs on: 1. Percent days abstinent (primary outcome); and, 2. 12-step meeting attendance, substance-related consequences, longest period of abstinence, proportion of participants completely abstinent/mostly abstinent, and psychiatric symptoms (secondary outcomes).

Method

Trial Design

This was an explanatory, parallel-group, randomized clinical trial, from the Recovery from Addictions among Youth Study (RAYS; ClinicalTrials.gov Identifier: NCT01449981) designed to test the feasibility, acceptability, and efficacy of integrated Twelve-Step Facilitation (iTSF) therapy, relative to Motivational Enhancement Therapy/Cognitive-Behavioral Therapy (MET/CBT), among adolescents seeking SUD treatment. Assessments were conducted at baseline, and 3-, 6-, and 9-months following treatment entry. Randomization occurred at the patient level, using equal (1:1 ratio) randomization across the two groups. The first stage involved the development preliminary testing of the manual (see 32 for details). The study protocol was reviewed and approved by the Internal Review Board of the Partners Health Care System as providing adequate protection of human subjects.

Participants and Procedure

The study site was the Center for Addiction Medicine in the Massachusetts General Hospital in Boston, Massachusetts, USA. Participants were recruited from July 2013 until February 2014 and follow-up assessments were conducted from October 2013 until October 2015. Eligibility criteria: (a) between 14 and 21 years old, (b) have a parent or legal guardian willing to consent to their participation (for those under 18), (c) give assent to participate (or consent if 18+), (d) meet DSM-IV-TR criteria for alcohol/drug abuse or dependence, (e)

have used alcohol or drugs in the past 90 days (or 90 days prior to being in a controlled environment), (f) meet patient placement criteria (ASAM, 2001) low intensity outpatient care, (g) provide a phone number or email address, and two additional contacts in case study staff were unable to reach them, and (h) be able to speak and understand English. Exclusion criteria: (a) actively psychotic, (b) currently in another treatment program for SUD, (c) experiencing, or had a history of, severe or complicated withdrawal, or using alcohol/drugs prior to study entry at levels likely to result in severe withdrawal, or (d) taking addiction treatment medications at the time of study entry.

Potential participants came from a variety of sources including local treatment programs, probation offices/drug courts, community advertisements, and schools. Of the 203 people who expressed an interest in the study, 96 were able to be re-contacted and completed a phone screen. Of the 96 completing phone screens, 78 (81.25%) were eligible to participate in the study. Of those eligible, 59 were enrolled in the study. Of those eligible who did not enroll in the study (n=19), reasons for non-participation included (a) unable to reach patient (78.9%; n=15), (b) scheduling conflict with treatment (5.3%; n=1), (c) admitted to inpatient facility (5.3%; n=1), (d) refused to sign consent (5.3%; n=1), (e) moved (5.3%; n=1; see Figure 1. CONSORT diagram).

Interventions

Treatment Conditions—Study treatments were delivered using a rolling admission format to enhance real-world clinical validity. Each treatment condition consisted of two individual sessions and eight group sessions. iTSF individual sessions were designed to educate and motivate participants regarding treatment goals and 12-step attendance. Also parents of participants under age 18 years old were invited into the last 15 minutes of individual sessions in order to provide them with information about 12-step meetings and encourage them to transport their child to meetings during and following treatment. Parents were not formally included in treatment in the MET/CBT condition. MET/CBT individual sessions were designed to use personalized feedback and techniques to increase motivation (33). Each treatment provided eight group sessions of CBT or iTSF therapy (see 32 for details).

MET/CBT intervention (33) consisted of two consecutive weekly 60-minute individual MET sessions, followed by eight weekly, 90-minute group CBT sessions for a total of 10 weeks of treatment. Group sessions were typically attended by 2-5 participants. Each CBT group was based around teaching and practicing a CBT skill (e.g., alcohol and drug refusal, coping with urges). At the beginning of each group, participants were asked to check in about progress toward their treatment goal in the past week. At the end of each group, participants were assigned homework related to that week's topic and reported on it the following week.

iTSF intervention (see 32 for more details) consisted of one 60- to 75-minute individual session, followed by eight, weekly, 90-minute iTSF sessions. Immediately prior to the fifth group therapy session, participants completed a second 30-50 minute individual “booster” session. Thus, participants in this condition completed 10 sessions over nine weeks of treatment. Group sessions were typically attended by 2-5 participants (n = 29). Six of the iTSF groups were based around a recovery-related topic (e.g., changing social networks, 12-

step attendance, reducing relapse risk). In two of the iTSF groups, members of 12-step organizations (MA or NA) were invited into the group to share their recovery story and experience with participants. The iTSF treatment employed a “Socratic” therapeutic questioning style to promote adolescent attention, verbal engagement, and participation in discussion of topics (e.g., “Why do treatment programs talk about 12-step participation in treatment?”; “Why do people attend Marijuana Anonymous?”). Therapists also used a variety of TSF strategies, including connecting each topic to 12-step philosophy, discussing what to expect at meetings, helping participants find a meeting to attend, and introducing common 12-step slogans/sayings. At the beginning of each iTSF group, participants were asked to check in about their progress toward their treatment goal in the past week. At the end of each group, participants identified a sober activity goal for the week (e.g., doing a fun activity with a sober friend, attending a 12-step meeting) and reported on it the following week (see 32).

Therapists—The two study therapists treated patients in both treatment conditions to avoid the problem of differential therapist effects (34). Individual MET sessions were divided equally across the two therapists and therapists co-led all groups in both conditions. One therapist had a master's degree in social work and was a certified Licensed Alcohol and Drug Counselor (LADC)-I with more than 5 years of experience. The other was in a clinical psychology doctoral training program with several years of supervised clinical experience in SUD and mental health treatment. Both therapists had specific experience in CBT, 12-step philosophy and principles, and group-based interventions for individuals with SUD particularly with adolescents. Additionally, prior to beginning the study, therapists each attended five 12-step meetings to familiarize themselves with meeting format.

Treatment Adherence and Competence—Treatment adherence and competence was monitored through weekly supervision and supervisor review of audio-recorded sessions. Therapists received this ongoing supervision independently by licensed clinicians expert in MET/CBT (second author Y.K.) and iTSF (first author J.K.). In addition, a total of 8 sessions were selected at random from all conducted sessions, 4 each from CBT and iTSF (3 group sessions and 1 individual session from each) and rated by two independent doctoral level clinicians on three dimensions: adherence to protocol, skill level, and frequency and extensiveness of skills used. When raters had different ratings, the lower score was used to provide the most conservative estimate. On average, adherence was rated at 95.0% (SD=10.0%) in the CBT sessions, and 96.4% (SD=7.1%) in iTSF. The skill level was rated as 6.3 (SD=0.2) in CBT, and 6.4 (SD=0.4) in iTSF, where 6 = ‘very good’ and 7 = ‘excellent’. Frequency and extensiveness was rated as 3.7 (SD=0.1) in CBT, and 3.7 (SD=0.2) for iTSF, where 3 = “adequately” and 4 = “extensively”. These indices suggest adherence to treatment protocols was uniformly high, and that the treatment components of each intervention were delivered with high frequency and a high degree of clinical skill.

Primary Outcome Measures

Percent days abstinent—The main outcome variable was percent days abstinent (PDA) from any drugs or alcohol use (excluding nicotine) assessed at all follow-up timepoints PDA was derived using the validated Timeline Follow Back method (TLFB; 35 and Form-90; 36;

37). The TLFB and Form-90 were completed as interviews at each assessment, wherein the interviewer helped the participant recall their substance use during the past time period, using a calendar to cue participants into key dates to aid recall (e.g., holidays, school vacations). Participants marked days on which they used different substances. Days on which participants were abstinent were divided by the total number of days, yielding PDA.

Secondary Outcomes Measures

12-Step Meeting Attendance—Given a primary goal of iTSF is to stimulate community 12-step participation this was an important intermediate/proximal outcome to assess. Participants completed the Multi-Dimensional Mutual-help Activity Scale (MDM-HAS; 38) at all time points. This interview measured 12-step group attendance. Variables were calculated to represent attendance at any type of mutual-help meeting, both lifetime and recent (e.g., past 90 days).

Substance-related consequences—Participants completed the 15-item Short Inventory of Problems-Recent (SIP-2R; 39) at all timepoints. The SIP-2R assesses physical, interpersonal, intrapersonal, impulse control, and social consequences. Participants rate how often each item has happened on a scale from 0 (never) to 3 (daily/almost daily). It has established test-retest reliability (39). Internal consistency in the current sample was high ($\alpha = .91$).

Longest period of abstinence—In addition to examining PDA, we also measured participants' longest period of abstinence during each time period. This was derived from the TLFB and Form-90 by identifying the longest span of time the participant had gone without substance use (excluding nicotine) during the time window and counting the number of days.

Abstinent/mostly abstinent—This dichotomous variable was calculated from PDA and reflects whether or not a participant had abstained from substance use for the majority of the time (i.e., on at least 90% of days) during the time window being examined (0 = not abstinent or mostly abstinent, 1 = abstinent or mostly abstinent).

Psychiatric Symptoms—Participants completed the 18-item Brief Symptom Inventory (BSI-18; 41) at all timepoints, which measures past-week psychological distress in areas of somatization, anxiety, and depression. Participants rate how much they were bothered by each symptom on a scale from 0 (not at all) to 4 (extremely). The total score, the Global Severity Index (GSI), is the average of all items and ranges from 0 to 4; higher scores indicate greater distress. The BSI has good psychometrics among adolescents (42). Internal consistency in the current sample was high ($\alpha=0.93$).

Additional Descriptive Measures—Abstinence self-efficacy and recovery motivation were measured with 10-point Likert-scaled single item measures “On a scale of 1-10, how important is it for you not to use alcohol/drugs” and “On a scale of 1-10, how confident are you that you will not use alcohol/drugs”. Problem recognition was assessed by single

questions asking whether adolescents thought they had a problem with alcohol or drugs (CDDR Brown et al, 1999).

Sample size and Randomization—The primary objective of this pilot investigation was to determine effect sizes for iTSF relative to MET/CBT and also to test for statistically significant effects. MET/CBT interventions had been shown to produce small-medium effect sizes on PDA among youth (i.e., $d=.20$ to $d=.50$). Consequently, a sample size of 60 was determined adequate to allow examination of iTSF intervention effect sizes (power $1-\beta=.80$) while staying within the scope of a developmental project. Participants were allocated to treatment conditions using a computerized Urn randomization program (44, 45) by the senior research coordinator with a 1:1 allocation stratified by age and gender. The program assigned participants to conditions immediately following initial assessment.

Retention over time and Treatment Session Attendance

Of the 59 who completed a baseline assessment, four never received any treatment, two of whom actively withdrew and two of whom were unable to be contacted; by the mid-treatment assessment 3 more individuals withdrew consent (2 from MET/CBT, 1 from iTSF); by end of treatment 2 more participants in the MET/CBT condition withdrew consent. Consequently, strict intent-to-treat study retention over time was 78%, 78% and 75%, respectively for the 3-, 6- and 9-month follow-ups. Study assessment follow-up rates for those eligible to be followed (i.e., those who did not withdraw their consent) were 88.5%, 86.5%, and 84.6%, respectively for the 3-, 6-, and 9-month, follow-up assessments. The mean number of sessions attended was similar for iTSF ($M=7.3$; $SD=3.9$) and MET/CBT ($M=6.5$, $SD=3.6$; $p=.40$). None of the tested variables was significantly related to drop-out at any of the time points.

Blinding—Following randomization, the research coordinator informed each participant of their assignment to either the “Tuesday group” or the “Wednesday group,” but did not refer to the treatment conditions by name. Therapists, clinical supervisors, and research coordinators (who collected data from participants) could not be blinded to participants' group assignments.

Saliva and breathalyzer testing—Participants provided saliva samples and were given breathalyzers at all assessments completed in person (i.e., 0m, mid-treatment, 3m, 6m, 9m), as well as at their second, fourth, and seventh groups. Saliva samples were collected by study staff using Intercept® Oral Specimen and were analyzed offsite by Alere Toxicology Services, Inc. Samples were tested for the presence of 7 substances, using cutoffs: amphetamine (100 ng/mL), methamphetamine/MDMA (40 ng/mL), benzodiazepines (1 ng/mL), cannabinoids (1 ng/mL), cocaine (5 ng/mL), opiates (10 ng/mL), phencyclidine (1 ng/mL). Breathalyzer tests (BACtrack®) provided blood alcohol level (BAL).

Analytic Strategy—To test whether treatments were related to treatment outcomes, we used repeated measures mixed models for normally distributed outcomes (i.e., PDA, SIP-2R, GSI) and generalized estimating equations for non-normally distributed outcomes (i.e., binary distribution with a logit link function for “currently abstinent”, “any 12-step

attendance”; Poisson distribution for “number of meetings”, “longest period abstinent”), where the predictors were time (0 = 3-month, 1 = 6-month, 2 = 9-month, modeled linearly), group (0=CBT, 1=iTSF), and the time*group interaction term. Baseline level of the each outcome modeled was included as a covariate. We used an AR1 structure to account for temporal correlations. We interpreted significant group main effects as overall differences due to randomized group assignment, and significant interaction effects as differences in trends over time. All analyses were intent-to-treat and the maximum likelihood estimation approach was used to address missing data (46), using SAS Proc MIXED and Proc GENMOD. Effect sizes were calculated as the between-treatment mean difference on outcomes divided by the pooled standard deviation. We compared groups on demographics and baseline clinical severity, treatment readiness, 12-step attendance, substance use and substance-related problems, using t-tests for continuous and chi-square tests for categorical variables. We examined these variables as possible predictors of drop-out using univariate logistic regression (0=retained, 1=dropped out) for each follow-up assessment (3-, 6-, and 9-month), and if significant, included them as covariates in subsequent models.

Results

Baseline Characteristics

Participants were between the ages 14 and 21 (mean = 16.8 ± 1.7) diagnosed with SUD; were predominantly male (73%), non-Hispanic White (78%), less than high school educated (78%), with many still in school (68%). Nearly half had prior SUD treatment (47%), including inpatient treatment (32%). Most had previously received treatment for psychological and/or emotional problems (78%). There were no significant differences between groups on any of these or any of the other demographic, clinical, or treatment variables (table 1).

Primary Outcome

Percent Days Abstinent: Group*time interaction effects were non-significant for PDA. After removing the non-significant interaction effect, the main effect for group remained non-significant for PDA (Table 2). Given the null effect, a Bayes Factor (BF) was calculated using the online Dienes calculator (Beard et al, 2016). The alternative model was specified using the uniform distribution ranging from 0-100% (reflecting the possible range of PDA; Dienes, 2014). The BF for the main effect of treatment condition on PDA = .28, a magnitude consistent with a conclusion of support for the null hypothesis of no treatment difference.

Secondary Outcomes

12-step attendance: After adjusting for baseline values, and accounting for trends over time, results showed significant group differences on indices of 12-step attendance. Namely, significant group*time interaction effects were found for the percent of participants attending any vs. no 12-step meetings (Table 2). where a larger percentage of participants in the iTSF condition attended 12-step meetings during treatment (at the 3-month assessment), but this effect diminished over time (Figure 2). In terms of number of meetings participants attended, there were no group differences, either as an interaction effect, or as a main effect after removing the non-significant interaction effect.. We did, however, find a significant

group*time interaction effect in the number of meetings participants attended when excluding 12-step meetings only attended as a part of any inpatient treatment received. As shown in figure 2, despite not being explicitly referred to 12-step MHOs, some patients in MET/CBT did elect to attend. When examining the relation between 12-step attendance and PDA across the entire sample, there was no relationship detected between attendance and PDA; significant relationships were observed, however, between more attendance and longer abstinence at 3m ($r=0.39$, $p=.008$) and 6m ($r=0.30$, $p=.049$), but not 9m ($r=0.09$, $p=.63$).

Substance-related consequences: In terms of substance-related consequences, a main effect for group was found after removing the non-significant group*time interaction effect, indicating that participants randomized to the iTSF condition reported fewer substance use problems during treatment and over follow-up than participants randomized to MET/CBT (mean=0.51±0.54 for iTSF, M=0.80±0.61 for CBT) with standardized effect size differences growing over time (3m $d=.26$, 6m $d=.59$, 9m $d=.71$).

Psychiatric Symptoms: There were no group differences in psychiatric symptoms during follow-up either as an interaction effect, or as a main effect after removing the interaction effect.

Longest Period of Abstinence/Proportion Abstinent/Mostly Abstinent: Group*time interaction effects were non-significant for longest period of abstinence, and the proportion abstinent/mostly abstinent abstinent. After removing the non-significant interaction effect, the main effect for group remained non-significant for longest period of abstinence and proportion abstinent/mostly abstinent (Table 2).

Discussion

This is the first randomized controlled trial to test the efficacy of an integrated twelve-step facilitation (iTSF; 32) intervention for adolescents with substance use disorder. Results indicated that compared to the current gold standard treatment (MET/CBT), iTSF was associated with similar but not better percent days abstinence, greater 12-step meeting attendance during treatment, and significantly fewer substance-related consequences during and following treatment.

In keeping with numerous studies conducted with adults and youth, this study found that 12-step participation can be clinically influenced. Specifically, the proactive discussion, encouragement, and monitoring of 12-step attendance that was conducted in iTSF was associated with substantially greater attendance. This effect, however, diminished once the intervention ended. This suggests that adolescents may need a prolonged continuing care intervention to stimulate ongoing 12-step participation over the longer-term. As is typical in TSF trials completed with adults (e.g., 24), we were unable to prevent patients in the comparison condition (MET/CBT) from attending 12-step meetings, with about 27% of MET/CBT participants attending meetings during treatment. Of note, 12-step attendance across the sample overall was not associated with greater PDA, but was associated with longer periods of sustained abstinence during treatment and early post-treatment. This relationship between 12-step participation sustained abstinence has been found in many

other studies of youth and adults (e.g., 23, 24, 47), suggesting ongoing 12-step facilitation and participation could help maintain adolescent's willingness and capacity to achieve prolonged abstinence and perhaps SUD remission.

In terms of the primary outcome (PDA), iTSF and MET/CBT treatments produced similar levels of improvement that did not differ significantly during treatment or over the 6 month follow-up. In terms of secondary substance-related outcomes, similarly there were no significant differences, although the effect size differences (e.g., for iTSF vs MET/CBT on proportion abstinent/mostly abstinent) suggest potentially meaningful benefits may be accrued for iTSF. Specifically, there were twice as many patients in iTSF relative to MET/CBT who were abstinent/mostly abstinent during treatment. Patients assigned to iTSF did have significantly lower substance-related consequences throughout treatment and across the entire follow-up period. It is currently unclear why iTSF would produce fewer substance-related consequences relative to MET/CBT, but it could be that adolescents in iTSF could have reduced the intensity of use thereby reducing associated harms. Similar to experimental treatment comparisons between different active SUD treatments for adults (48) and adolescents (2), these two treatments showed largely similar benefits, with the exception that iTSF was associated with fewer substance-related consequences. Overall, it is noteworthy that the pattern of results, though not always statistically significant, tended to consistently favor the iTSF condition (figure 2). In a larger trial it is possible that such differences would have produced statistical significance. A larger trial should be conducted to test this.

Limitations

Results from the current investigation should be considered in light of important limitations. Although the first RCT of its kind among youth, the study nonetheless is a small scale investigation and preliminary in its findings. Also, we examined 12-step attendance but not active involvement. Future research should examine this. Data collection at follow-up should ideally have been collected by research staff blinded to study assignment. The iTSF treatment, while promising, should be tested in larger and more diverse samples.

Conclusions

Relative to state-of-the-art MET/CBT, the novel iTSF treatment is able to stimulate greater 12-step community mutual-help organization participation among adolescent outpatients and produce lower substance-related consequences during and following intervention. On other substance-related outcomes, iTSF is at least as beneficial in reducing substance use frequency and prolonging abstinence over time, and was associated with larger effect sizes on some measures of abstinence during treatment despite not quite reaching statistical significance.

iTSF shows promise as a replicable, manualized outpatient treatment that may be helpful in stimulating adolescent community-based 12-step attendance, and may produce outcomes similar to, or possibly better than, existing state of the art interventions. Given the widespread use of various aspects of 12-step, MET, and CBT approaches in community adolescent outpatient settings, iTSF may provide an integrated evidence-based option that is

compatible with existing practices. The results here are promising enough to warrant further investigation. Given the ability of iTSF to substantially increase free community 12-step participation during, but not following, the intervention, and that 12-step participation showed significant associations with longer periods of abstinence, findings suggest potential promise also for a clinical continuing care iTSF treatment that could simulate free 12-step participation over the longer-term. Given also that adolescents with more severe SUD are more likely to need and benefit from 12-step participation, further research should examine severity as a moderator of 12-step-related benefit.

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Figure 1. Study CONSORT Diagram

Figure 2. Proportion attending 12-step Meetings and Average Meetings attended

Figure 3. Treatment Outcomes by Intervention Condition

Table 1
Sample Characteristics

	MET/CBT (n=30)		iTsf (n=29)	
Variable	mean % (n)	SD	mean % (n)	SD
<u>Demographics</u>				
Age	16.9	2.0	16.8	1.6
Gender (% female)	26.7 (8)		27.6 (8)	
Hispanic (% yes)	10.0 (3)		6.9 (2)	
Race (%)				
African American	10.7 (3)		7.1 (2)	
Asian/Pacific Islander	7.1 (2)		3.6 (1)	
White	67.9 (20)		82.1 (24)	
More than 1 race reported	14.3 (4)		7.1 (2)	
Education (% high school graduate)	23.3 (7)		20.7 (6)	
Student (% yes)	66.7 (20)		69.0 (20)	
<u>Clinical Severity</u>				
Prior SUD treatment	36.7 (11)		58.6 (17)	
Prior inpatient SUD treatment	26.7 (8)		37.9 (11)	
Prior non-inpatient SUD treatment	23.3 (7)		34.5 (10)	
Prior psychological treatment	76.7 (23)		79.3 (23)	
Family history of SUD	40.0 (12)		57.1 (16)	
<u>Treatment Readiness and Self-Efficacy</u>				
Acknowledges having alcohol problem	23.3 (7)		20.7 (7)	
Acknowledges having drug problem	56.7 (16)		48.3 (14)	
Motivation (1-10): Stop alcohol	4.4	2.7	4.4	3.4
Motivation (1-10): Stop using other drugs	5.2	3.2	4.5	2.9
Confidence (1-10): Remain abstinent	4.7	3.5	6.1	3.5
<u>Baseline values of targeted outcomes</u>				
12-step attendance				
12-step attendance (% any)	16.7 (5)		17.2 (5)	
12-step attendance excluding inpatient mtgs (% any)	3.3 (1)		13.8 (4)	
Substance Use				
Currently abstinent or mostly abstinent (% yes)	3.3 (1)		13.8 (4)	
Percent Days Abstinent or Mostly Abstinent	30.1	30.3	42.3	32.6
Longest Period of Abstinence (in days, past 90 days)	14.0	17.3	22.3	23.8
Other Outcomes				
Substance-related consequences (SIP-2R)	1.0	0.6	0.9	0.7
Psychiatric symptoms (GSI)	1.0	0.8	0.7	0.7

Note: There were no significant differences between treatment conditions among any of these variables

Table 2

Primary and Secondary outcomes

Outcome	BL cov			Treatment Condition			Time			Treatment Condition*Time		
	b	SE	p	b	SE	p	b	SE	p	b	SE	p
Primary outcome												
PDA	0.01	0.00	<.0001**	0.08	0.08	0.33	-0.02	0.05	0.73			
Secondary Outcomes												
12-step attendance												
% any [‡]	2.19	0.79	0.01**	2.64	0.97	0.0**1	0.16	0.23	0.48	-1.38	0.47	0.00**
# of meetings [‡]	0.20	0.08	0.01**	1.29	1.03	0.21	0.49	0.20	0.02*	-0.87	0.40	0.03*
Substance consequences [‡]	0.52	0.16	0.00**	-0.42	0.19	0.03*	-0.11	0.07	0.09			
LPA	0.01	0.00	0.09	0.29	0.27	0.27	0.14	0.09	0.14			
% abstinent/mostly abstinent [‡]	1.64	0.58	0.00**	0.58	0.56	0.30	0.15	0.22	0.50			
Psychiatric symptoms [‡]	0.47	0.13	0.00**	-0.20	0.22	0.38	-0.12	0.07	0.07			

Note: BL cov: baseline level of that variable is included in the model; PDA: Percent Days Abstinent; LPA: Longest Period of Abstinence (in days);

[‡]logistic model used;

[‡]Poisson model used;

[‡]normal distribution used, after arcsine transformation; for Treatment Condition, CBT is used as reference category