



Examining the effect of the Life Enhancement Treatment for Substance Use (LETS ACT) on residential substance abuse treatment retention

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ARTICLE INFO

Keywords:

Behavioral activation
Substance use
Depression
Treatment retention
Reinforcement

ABSTRACT

Effective, parsimonious behavioral interventions that target reinforcement are needed for substance users with depression to improve mood as well as treatment retention. The Life Enhancement Treatment for Substance Use (LETS ACT; Daughters et al., 2008) is a behavioral activation-based approach tailored to increase levels of positive reinforcement among depressed substance users while in substance abuse treatment. The current study tested the efficacy of LETS ACT compared to a contact-time matched control condition, supportive counseling (SC), examining effects on depressed mood, substance abuse treatment retention, and behavioral activation outcomes. Fifty-eight adult substance users in residential substance abuse treatment presenting with depressive symptoms ($BDI \geq 12$) were randomly assigned to LETS ACT or SC. Assessments were administered at pre- and post-treatment and included assessment of DSM-IV psychiatric diagnoses, depression severity, treatment motivation, overall activation, environmental reward, and substance abuse treatment retention. Patients in LETS ACT had significantly higher rates of substance abuse treatment retention and significantly greater increases in activation on the Behavioral Activation for Depression Scale (BADS) compared to those in SC. Both groups had decreased depression severity at post-treatment, although the group by time interaction was not significant. This study was the first to compare LETS ACT to a contact-time matched control treatment to evaluate effects on substance abuse treatment retention and two distinct measures of behavioral activation: overall activation and environmental reward. Findings suggest preliminary support for the feasibility, tolerability, and efficacy of a brief behavioral activation-based protocol that may be particularly useful to improve substance abuse treatment retention.

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1. Introduction

1.1. Depression and substance use

Depression is highly prevalent among substance users. Previous research has demonstrated over 50% of illicit drug users present to substance abuse treatment with clinically significant depressive symptoms and are in need of depression treatment (Johnson, Neal, Brems, & Fisher, 2006). Notably, the presence of depression among

substance users has been associated with increased likelihood of dropping out of substance abuse treatment (McKay et al., 2002; Tate, Brown, Unrod, & Ramo, 2004; Thase, Salloum, & Cornelius, 2001). Substance abuse treatment dropout is a significant clinical issue; treatment length is a consistent predictor of long-term psychosocial outcomes, including relapse, HIV risk, unemployment, homelessness, poverty (Hubbard, Craddock, & Anderson, 2003; Simpson, Joe, & Brown, 1997), and increased societal costs due to increased treatment utilization and re-admission (Mark, Coffey, Vandivort-Warren, Harwood, & King, 2005). Further, depression is also associated with relapse (Hasin et al., 2002; Rounsaville, Kosten, Weissman, & Kleber, 1986), shorter abstinence durations following treatment (Greenfield et al., 1998), and increased inpatient recidivism (Alterman, McLellan, & Shifman, 1993; Moos, Mertens, & Brennan, 1994). Co-occurring depression has been demonstrated to be highest among low-income, minority substance users (Huang et al., 2006; Kessler et al., 2003), which is also a group at high risk for poor psychosocial outcomes. For

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instance, regarding substance abuse treatment dropout, African Americans have been identified as less likely to complete residential substance abuse treatment compared to Whites (Jacobson, Robinson, & Bluthenthal, 2007).

1.2. Need for parsimonious behavioral interventions

Despite the clinical need, few interventions have been developed for depressed, low-income substance users (Hasin, Goodwin, Stinson, & Grant, 2005; Moneyham, Sowell, Seals, & Demi, 2000), and there are often limited resources for evidence-based mental health approaches in substance abuse treatment settings. An approach is needed that is parsimonious, cost-effective, and fits with the substance abuse treatment model, for instance emphasizing a group approach and incorporating relapse prevention strategies (Grella, Gil-Rivas, & Cooper, 2004; Timko, Lesar, Calvi, & Moos, 2003).

Given mixed pharmacological findings in treating this comorbidity (Nunes, Sullivan, & Levin, 2004), there appears to be an important role for psychosocial treatment. Torrens, Fonseca, Mateu, and Farré (2005) conducted a systematic review on the efficacy of antidepressants among individuals with a range of substance use disorders (SUDs). Their review supports the use of antidepressants for comorbid depression and nicotine dependence; however, for other types of SUDs (i.e., alcohol and cocaine dependence), efficacy findings remain mixed. Other studies have highlighted the role of environmental context as a moderator of the effect of antidepressants on depression among substance users. This work has pinpointed the need to enhance pharmacological treatment with a "behavioral intervention targeting the accessibility of reinforcement" (Carpenter, Brooks, Vosburg, & Nunes, 2004).

1.3. Behavioral activation approaches to target reinforcement

Targeting reinforcement as a means to treat this comorbidity may hold particular promise. Emerging lines of evidence suggest that depression and substance use share similar environmental contexts lacking positive reinforcement (Van Etten, Higgins, Budney, & Badger, 1998). Human and animal studies have identified a clear link between substance use and the degree of alternative substance-free reinforcement in the environment (Carroll, 1996; Higgins, Heil, & Lussier, 2004). This is consistent with behavioral economic theory suggesting that substance use is a function of the availability of reinforcing alternatives (Green & Kagel, 1996).

A reinforcement-based approach that may be particularly useful in this context is behavioral activation. Behavioral activation approaches target depressive symptoms by increasing engagement in rewarding activities as a means to increase positive reinforcement (Jacobson et al., 1996; Lejuez, Hopko, & Hopko, 2001; Lewinsohn, 1974). Numerous reviews and meta-analyses suggest the efficacy of this approach in treating depression (Cuijpers, Van Straten, & Warmerdam, 2007; Ekers, Richards, & Gilbody, 2007; Mazzuchelli, Kane, & Rees, 2009; Sturme, 2009). Further, behavioral activation has been suggested to be especially well-suited for addressing co-existent Axis I psychological disorders, such as substance abuse (Sturme, 2009).

1.4. The Life Enhancement Treatment for Substance Use (LETS ACT)

The Life Enhancement Treatment for Substance Use (LETS ACT; Daughters et al., 2008) is a group behavioral activation-based approach adapted from the empirically validated Brief Behavioral Activation Treatment for Depression (BAT-D; Lejuez et al., 2001). LETS ACT targets the link between mood, substance use, and behavior and focuses on identifying goal-driven, substance-free forms of positive reinforcement. LETS ACT was developed to complement residential substance abuse treatment; early sessions address goal-setting while in treatment, and final sessions focus on post-treatment planning. The

protocol also has the potential to be adapted for other settings (Hopko, Bell, Armento, Hunt, & Lejuez, 2005). In a previous study (Daughters et al., 2008), LETS ACT was compared to treatment as usual (TAU) at a large, urban residential substance abuse treatment center among 44 patients with mild depressive symptoms. Patients in LETS ACT had six treatment sessions and two maintenance sessions while in residential substance abuse treatment. Compared to TAU, patients in LETS ACT reported significantly higher rates of environmental reward (following the last treatment session) and significantly lower rates of depression (following the maintenance sessions). Substance abuse treatment retention was also assessed; although not a statistically significant difference, fewer individuals in LETS ACT (4.5%) dropped out of the substance abuse treatment center compared to TAU (22.7%).

Based on these promising results, there is a pressing need to further explore the efficacy and effectiveness of LETS ACT in treating depression as well as improving substance abuse treatment retention. The first step is to compare LETS ACT to a contact-time matched control condition, such as supportive counseling (SC), as opposed to TAU used in Daughters et al. (2008). A second step to increase generalizability is to streamline the original protocol to accommodate the large portion of patients with inpatient stays of less than 4 weeks (Mark & Coffey, 2003; Mark et al., 2005). Lastly, research also is needed to understand which aspects of behavioral activation LETS ACT targets. Environmental reward, one aspect of the construct of behavioral activation (Manos, Kanter, & Busch, 2010), was assessed in Daughters et al. (2008); however, this also must be distinguished from overall levels of activation (Manos et al., 2010).

1.5. Current study

In line with these objectives, the current study is a randomized clinical trial comparing LETS ACT to a contact-time matched control condition (SC) among individuals who presented to substance abuse treatment with elevated depressive symptoms. Based upon findings from Daughters et al. (2008), we hypothesized that compared to SC individuals in LETS ACT would evidence the following post-treatment: significantly lower rates of substance abuse treatment dropout and depression severity, and significantly higher rates of overall activation and environmental reward.

2. Materials and methods

2.1. Treatment setting

The study was conducted at a 136-bed residential substance abuse treatment facility in Washington, DC. Patients are required to have completed full detoxification and have a negative urine drug screen upon admission to the treatment facility. Once admitted, patients receive treatment for the use of a wide range of substances, including crack/cocaine, alcohol, heroin, PCP/hallucinogens, and marijuana. Length of treatment is determined by the funding agency providing financial support for the patient's treatment. The majority of patients are provided 30 days of treatment; for instance, in 2008–2009, approximately 72% of all residents at this center were granted 30 day contracts (as opposed to 60, 90, or 180 days). Residents are permitted to leave the center grounds only for treatment-required activities (e.g., group retreats, physician visits). Regular urinalysis drug testing is conducted, and any substance use is grounds for program dismissal. The treatment program consists of daily intervention groups, which include topics such as relapse prevention, functional analysis, stress management, anger management, and spirituality. Patients also attend twice daily AA/NA meetings. For psychiatric services, patients are referred to an off-site health center for pharmacological treatment.

2.2. Inclusion criteria

Inclusion criteria for the study were: 1) minimum of 18 years of age; 2) presence of at least mild to moderate depression as indicated on the Beck Depression Inventory (BDI-II total score of ≥ 12 ; Lasa, Ayuso-Mateos, Vazques-Barquero, Diez-Manrique, & Dowrick, 2000); 3) meet DSM-IV-TR criteria for past year Alcohol or Substance Dependence; and 4) the ability to speak and read English sufficiently to complete intervention procedures. Patients were excluded from the study if they did not meet all inclusion criteria, if they presented with psychotic symptoms (assessed using the Structured Clinical Interview for the DSM-IV; SCID; First & Gibbon, 2004), or if they were not stabilized on psychotropic medication (initiated < 3 months prior to the study screening).

A total of 246 consecutively admitted patients were administered the SCID-IV at a screening session in their first week of substance abuse treatment (see Fig. 1 for a consort diagram outlining overall recruitment and retention). Of these individuals, 60 (24.4%) patients met all inclusion and exclusion criteria; 112 (45.53%) were excluded because they did not score ≥ 12 on the BDI-II. Of the 134 individuals who had eligible BDI-II scores, 11 (8.21%) were excluded because they were subthreshold for past year Alcohol or Substance Dependence, 14 (10.45%) because they did not speak or read English sufficiently to complete study procedures, 36 (26.87%) because they had not been stabilized on psychotropic medication for ≥ 3 months, and 15 (11.19%) because they presented with symptoms of psychosis.

2.3. Participants

The majority of the sample were African American (89.7%), male (65.5%), and the mean age was 44.78 years ($SD = 9.39$). Fifteen patients in the LETS ACT group and 16 patients in the SC group were

taking antidepressant medication and had been stabilized on this medication; all but three individuals had been on the medication for > 5 months, and the other three individuals had been on the medication for approximately 3 months.

2.4. Comparison of groups

LETS ACT and SC groups were compared at baseline to ensure equivalence of groups on relevant variables such as demographics, comorbidity, treatment motivation/readiness, and levels of behavioral activation and depressive symptoms (see Tables 1 and 2). There were no significant differences between the treatment groups on any of the demographic or clinical variables at baseline.

2.5. Treatment overview

2.5.1. Life Enhancement Treatment for Substance Use (LETS ACT)

LETS ACT is a modified version of the empirically validated Behavioral Activation Treatment for Depression (BAT-D; Lejuez et al., 2001) specifically developed to treat depressed substance users in residential substance abuse treatment. The foundation of the treatment is reinforcement theory, such that depressive symptoms are alleviated by targeting increases in positive reinforcement. LETS ACT highlights the link between depression, substance use, and positive reinforcement to ultimately increase goal-driven alternative forms of positive reinforcement in one's environment. To address both the early and late stages of substance abuse treatment, earlier sessions focus on modifying behavior in treatment, while the last sessions gradually move toward post-residential treatment planning and goals. To further accommodate treatment compliance and homework completion, patients are given pocket-sized manuals that include all forms used in treatment and homework exercises.

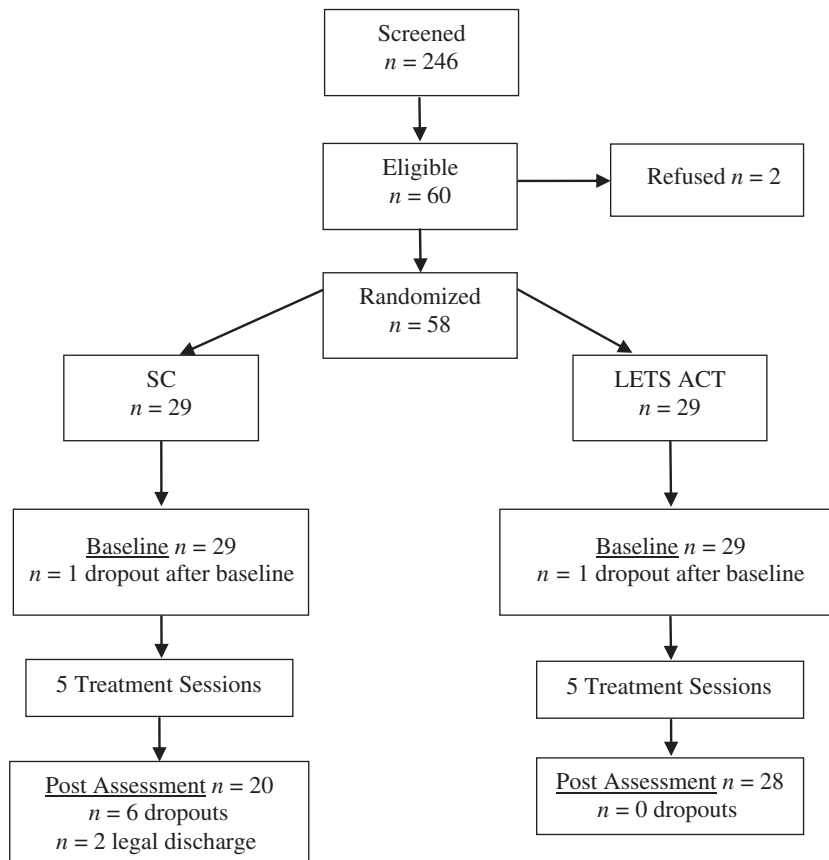


Fig. 1. Recruitment and retention consort diagram.

Table 1
Group differences: demographic information and baseline clinical variables.

	Overall (n = 58)	LA (n = 29)	SC (n = 29)	Statistic (LA vs. SC)	p
Age, mean (SD)	44.78 (9.39)	44.21 (10.59)	45.34 (8.15)	F(1, 56) = .21	.65
Gender, % male	65.5	65.5	65.5	$\chi^2(1) = 0$	1.0
Marital status				$\chi^2(3) = 1.5$	.68
Single, %	81	82.8	79.3		
Living with a partner as if married, %	5.2	3.4	6.9		
Married but separated, %	12.1	10.3	13.8		
Married, %	1.7	3.4	0		
Race				$\chi^2(3) = 1.41$	.71
White, %	5.2	3.4	6.9		
Black, %	89.7	93.1	86.2		
Hispanic, %	3.4	3.4	3.4		
Other, %	1.7	0	3.4		
Education				$\chi^2(2) = 3.44$	.18
<High school/GED, %	41.4	34.5	48.3		
High School/GED, %	34.5	31.0	37.9		
>High school/GED, %	24.1	34.5	13.8		
Total annual income				$\chi^2(1) = .49$	.49
<\$10,000, %	82.1	78.6	85.7		
>\$10,000, %	17.9	21.4	14.3		
Unemployed, %	84	82.8	82.8	$\chi^2(4) = 3.32$	.51
Court mandated, % yes	46.6	55.2	37.9	$\chi^2(1) = .28$	.60
CMR (Total), mean (SD)	74.81 (9.33)	74.62 (10.70)	75 (7.9)	F(1, 56) = .02	.88
Depression					
Current MDD, %	60.3	58.6	62.1		
Recurrent MDD, %	71	61.5	75.9	$\chi^2(1) = .11$	.74
On psychotropic medication, %	53.4	51.7	58.6	$\chi^2(1) = 2.25$	.13
Current drug dependences				$\chi^2(1) = .43$	.51
Marijuana, %	8.8	10.7	6.8		
Cocaine, %	46.6	42.3	55.2	$\chi^2(1) = .26$	.61
Opioid, %	24.1	23.1	27.6	$\chi^2(1) = .86$	.35
Multiple dependencies, %	47.4	35.7	58.6	$\chi^2(1) = .29$	.59
Current anxiety disorders				$\chi^2(1) = 2.99$	.08
PTSD, %	21.8	25	18.5	$\chi^2(1) = .34$	.56
GAD, %	17.5	17.9	17.2	$\chi^2(1) = .01$	.95

Note. Only includes diagnoses for which >5% of sample met criteria; * $p < .05$, ** $p < .01$, and *** $p < .001$.

Treatment was provided in a small group format, with each group consisting of three to five patients. Treatment included five one-hour sessions that were conducted over a period of approximately two and a half weeks. The original LETS ACT protocol piloted in Daughters et al. (2008) consisted of six sessions (plus two maintenance sessions) over 6 weeks. To accommodate the large portion of patients with inpatient stays of less than 4 weeks (i.e., 72% of patients at this center, which also reflects nationwide trends; Mark & Coffey, 2003; Mark et al., 2005), a five-session protocol was implemented over two and half weeks. This protocol contained all key content but streamlined the original protocol used in Daughters et al. (2008). Specifically, the two maintenance sessions were eliminated, and the last three sessions of the initial protocol were combined into two final sessions. Details regarding the content of each treatment session for the five-session protocol can be found in Table 3. Session content for the six-session protocol with two maintenance sessions can be found in Daughters et al. (2008).

2.5.2. Supportive counseling (SC)

To control for the non-specific elements of therapist contact and additional treatment group involvement, the other half of the patients were randomized to SC. SC also consisted of five one-hour group sessions over two and a half weeks, with three to five patients per group. Patients in this condition received unconditional support and reflective listening in response to any issues brought to session; patients set discussion topics for therapy in the first session that were revisited in subsequent sessions. A similar approach has been utilized as a control condition in other treatment outcome studies for substance abuse (Azrin et al., 1994) and depression (Manne et al., 2007; Thase et al., 2000). For the purposes of this study, therapists providing SC specifically avoided behavioral activation techniques. Although no components of LETS ACT were incorporated into SC, therapist and patient manuals were utilized to control for their effects in LETS ACT. The patient manuals contained journal writing homework forms.

Table 2
Group differences: baseline levels of main outcome variables.

	Total sample (n = 58)	LA (n = 29)	SC (n = 29)	Statistic (LA vs. SC)	p
Depressive symptoms					
Clinician-rated (HAM-D), mean (SD)	5.51 (3.54)	5.96 (3.67)	5.07 (3.42)	F(1, 55) = .91	.35
Self-reported (BDI-II), mean (SD)	18.89 (9.41)	18.65 (10.91)	19.14 (7.77)	F(1, 55) = .04	.85
Behavioral activation					
BADS, mean (SD)	75.18 (24.12)	72.61 (25.19)	77.75 (23.15)	F(1, 56) = .65	.42
Activation	18.76 (9.37)	18.33 (8.58)	19.18 (10.22)	F(1, 56) = .12	.74
Avoidance/rumination	21.09 (11.37)	21.38 (10.66)	20.79 (12.21)	F(1, 56) = .04	.85
Work/school impairment	19.63 (7.10)	18.76 (7.38)	20.50 (6.84)	F(1, 56) = .87	.36
Social impairment	15.71 (7.63)	14.14 (7.56)	17.28 (7.51)	F(1, 56) = 2.52	.12
Environmental reward					
EROS (mean, SD)	24.67 (4.81)	24.66 (4.98)	24.69 (4.71)	F(1, 56) = .001	.98

Note. * $p < .05$, ** $p < .01$, and *** $p < .001$.

Table 3
Contents of 5-session LETS ACT Treatment.

Session 1	<ul style="list-style-type: none"> • Introduce treatment, group guidelines, and discuss confidentiality • Outline treatment rationale and depict cycle of the relationship between one's mood and activities (especially substance use) and how one can intervene by integrating reinforcing activities • Introduce daily monitoring forms in patient manual for homework that include monitoring all activities and providing enjoyment ratings • Finish with a planned relaxation diaphragmatic breathing exercise
Session 2	<ul style="list-style-type: none"> • Review activity monitoring homework, discussing link between enjoyment and mood • Review treatment rationale having patient volunteer to draw cycle of the relationship between one's mood and activities (especially substance use) and intervening with reinforcing activities • Introduce Life Area Goals and Activities exercise, discussing the distinction between broader goals and more specific activities that can be set across a number of life areas
Session 3	<ul style="list-style-type: none"> • Review daily monitoring homework • Review treatment rationale having another patient volunteer to draw the treatment rationale cycle • Continue with Life Area Goals and Activities exercise, continuing to add goals and activities across remaining life areas • Introduce a daily goals exercise (to replace activity monitoring for homework) in which patients specify select goals to focus on each day and specific activities one can engage in to achieve these goals • Set daily goals and activities for the next 3 days and discuss the benefits of planning activities in advance; for homework, patients indicate whether they completed the activities set each day
Session 4	<ul style="list-style-type: none"> • Review daily goals homework and discuss whether patients were able to complete the activities • Review treatment rationale having another patient volunteer to draw the treatment rationale cycle • Review Life Area Goals and Activities exercise, continuing to add goals and activities across life areas • Behavioral contracts are introduced as a means to encourage support from others for lifestyle changes • Set daily goals and activities for the next 3 days
Session 5	<ul style="list-style-type: none"> • Review daily goals homework and discuss whether patients were able to complete the activities • Review treatment rationale having another patient volunteer to draw the treatment rationale cycle • Discuss the importance of continuing to engage in new activities across multiple life areas • Review behavioral contracts and introduce post-residential treatment contracts • Discuss post-treatment plan to implement these changes after residential treatment discharge • Review overall progress and the link between activity selection and improvements in mood

Across both conditions, all five treatment sessions occurred while patients were in residential treatment. Sessions were scheduled to occur during free periods (e.g., recreational time) to prevent interference with substance abuse treatment and to ensure that involvement with the substance abuse treatment program was equivalent across groups.

2.6. Assessment measures

2.6.1. *Beck Depression Inventory (BDI-II; Beck, Steer, Ball, & Ranieri, 1996)* is a 21-item self-report measure of depressive symptoms. Sample items include "sadness" and "loss of pleasure." Higher scores suggest increased depression severity. The instrument has excellent internal consistency ($\alpha = .92$) and convergent validity (e.g., $r = .71$ with the Hamilton Rating Scale for Depression) with depressed younger and older adults (Beck et al., 1996; Nezu, Ronan, Meadows, & McClure, 2000).

2.6.2. *Behavioral Activation for Depression Scale (BADS; Kanter, Mulick, Busch, Berlin, & Martell, 2007)* is a 25-item measure of changes in activity level. The BADS was specifically designed to assess when and how patients become activated over the course of treatment in order to measure the efficacy of behavioral activation in treating depression. Sample items include "I engaged in a wide and diverse array of activities" and "I was an active person and accomplished the goals I set out to do." The BADS has been demonstrated to have strong internal consistency ($\alpha = .92$) and good test-retest reliability ($r = .74$) in depressed and non-depressed samples (Kanter, Rusch, Busch, & Sedivy, 2009; Kanter et al., 2007).

2.6.3. *Circumstances, Motivation, Readiness Scale (CMR; De Leon, Melnick, Kressel, & Jainchill, 1994)* is an 18-item factored version of the 42-item CMRS used in residential substance abuse treatment samples to assess attitudes towards remaining in treatment. The CMR specifically measures the following: circumstances (external pressures to enter or leave treatment),

motivation (intrinsic pressures regarding the need to change), and readiness (perceived need for treatment). The total CMR score assesses individuals' overall potential to enter and remain in substance abuse treatment. Items are rated on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree". Sample items include "I am sure that I would have come to treatment without the pressure of my legal involvement" and "Lately, I feel if I don't change, my life will keep getting worse." Reliability for the 18-item version of the CMR is strong ($\alpha = .84$) across substance using samples, including detoxification, methadone outpatient treatment, and short and long-term residential treatment (Melnick, 1999).

2.6.4. *Environmental Reward Observation Scale (EROS; Armento & Hopko, 2007)* is a 10-item measure of environmental reward, specifically the extent to which activities are perceived to be associated with positive affect and rewarding environmental experiences. Scores range from 10 to 40, with higher scores suggesting higher environmental reward. Sample items include "the activities I engage in usually have positive consequences" and "lots of activities in my life are pleasurable." The EROS has strong internal consistency ($\alpha = .85-.86$) and excellent test-retest reliability ($r = .85$) (Armento & Hopko, 2007).

2.6.5. *Hamilton Depression Rating Scale - 7 item version (HAM-D-7; Maier & Philipp, 1985)* is a clinician-rated measure of severity of depressive symptoms. Clinicians rate each of the 7 items on a scale of 0–4 with higher scores indicating increased depression severity. Sample items include "Have you been feeling down or depressed this past week? How often have you felt this way, and for how long?" and "In the past week, have you felt guilty about something you've done, or that you've let others down?" Previous research has shown that the measure has strong internal consistency ($\alpha = .84$) and excellent convergent validity with the Montgomery-Asberg Depression Rating Scale (MADRS) ($r = .90$; McIntyre et al., 2005).

2.7. Procedure

During all individuals' first week at the substance abuse treatment center, a screening interview was conducted by doctoral level clinical psychology graduate students and trained advanced graduate research assistants. The screening consisted of DSM-IV diagnostic evaluations using the Structured Clinical Interview for DSM-IV (SCID-IV) including all Mood, Anxiety, Psychotic and Substance Use disorder diagnoses, as well as the BDI-II, HAMD-7, and a brief demographics form that included information about types of medications taken, including dosage information and duration of use.

Potential participants who met eligibility requirements were provided with a verbal description of the study. Interested participants then provided written informed consent. The research protocol was approved by the University of Maryland Institutional Review Board. Of the individuals approached for the study (See Fig. 1), two declined to participate. The remaining 58 patients (38 male and 20 female) met all inclusion and exclusion criteria. Participants were randomized to LETS ACT or SC and then given the baseline assessment. The baseline assessment included measures of treatment motivation (CMR), environmental reward (EROS), and activation (BADs). All assessments were conducted by independent evaluators (research assistants that were separate from study therapists and blind to treatment condition and diagnostic status).

Following the final LETS ACT or SC treatment session, the post-treatment assessment was conducted, which was approximately 17 to 21 days after the baseline assessment. At this assessment, the BDI-II, EROS, and BADs were re-administered.¹ Substance abuse treatment retention was also measured during the 30-day study period (whether or not a participant dropped out of the treatment center). As with baseline, independent evaluators for the post-treatment assessment were separate from study therapists and remained blind to treatment condition and diagnostic status. Assessments were conducted at the treatment center while patients were still in residential substance abuse treatment. All aspects of the assessment schedule for LETS ACT and SC were equated across groups.

2.8. Therapist and treatment adherence/competency

A doctoral level clinician and three graduate students (different from those randomizing participants to treatment or administering study assessments) served as therapists for the LETS ACT and SC treatment sessions. We followed best practices and treatment fidelity recommendations for therapist training and monitoring outlined by the NIH Behavior Change Consortium (Bellg et al., 2004). Therapist training occurred 3 months prior to the onset of the study. Specifically, a doctoral level psychologist (S.B. Daughters) led a therapist training across 4 weeks in which the LETS ACT treatment rationale was introduced, followed by each session and role playing of all techniques. For SC, therapists watched instructional videos on reflective listening, reframing, and providing patient-centered therapy (Hill, 2004). These techniques were then role played in the training group. Anticipated difficult patient interactions in SC were also role played (e.g., what to do when someone asks for direct advice, how to avoid behavioral activation techniques). Therapists were trained in both conditions and steps were taken to ensure that cross-contamination did not occur following the best practices and treatment fidelity recommendations (Bellg et al., 2004). For each therapist's first group in each condition, Dr. Daughters observed and provided immediate supervision. Treatment manuals were used at all times in both conditions to ensure standardization of treatment and consistency of delivery. All therapy sessions were audiotaped, and the

tapes were monitored using a therapist adherence checklist to ensure accuracy and consistency across sessions and groups. There were separate adherence forms developed for SC and LETS ACT. For each session across conditions, ratings were made based on whether each component of each session was addressed. A key issue monitored for SC sessions was the avoidance of directive feedback and behavioral activation techniques.

For therapist adherence for LETS ACT, ratings were made on a 5-point Likert scale ranging from 0 (*no adherence*) to 5 (*complete adherence*) on a session-by-session basis. Ratings for each session were recorded based on whether the therapist addressed the specific components for that session. Ratings indicated high therapist adherence ($M = 4.56$; $SD = .73$) in delivering LETS ACT. For SC, ratings were also made on a 5-point Likert scale ranging from 0 (*no adherence*) to 5 (*complete adherence*) on a session-by-session basis. Ratings for SC addressed specific session components and the degree to which therapists avoided directive feedback and behavioral activation techniques. Ratings also indicated high therapist adherence ($M = 4.63$; $SD = .62$). When therapist drift from the protocol was detected for either condition, therapists were given feedback during weekly supervision.

2.9. Statistical analyses

The first step of statistical analyses included a comparison of the two groups on all baseline demographic and clinical variables (i.e., diagnostic status, comorbidity, CMR scores) to ensure baseline equivalence of groups. There were no significant differences between groups at baseline. To identify potential covariates for each analysis, the univariate relationships between relevant baseline variables and each main outcome were examined.

To compare rates of substance abuse treatment dropout by group, a chi square test was used. Two individuals dropped out of the substance abuse treatment center prior to the first treatment session ($n = 1$ in LA, and $n = 1$ in SC). Thus, all analyses were conducted using both intent-to-treat and completer samples. No differences were found using the completer vs. intent-to-treat analyses. Only the intent-to-treat outcomes were reported here given the consideration of the intent-to-treat approach as a gold standard for RCTs over completer analyses (Little & Yau, 1996).

Lastly, changes in depression and behavioral activation were also examined from baseline to post-LETS ACT or SC treatment. The differential effects of treatment (LETS ACT vs. SC) on levels of depression severity (BDI-II) and behavioral activation (BADs, EROS) were examined utilizing repeated measure ANOVA analyses using treatment group (LETS ACT or SC) as the between subjects factor and scores on the BDI-II, BADs, and EROS as within subjects factors (in separate analyses).

3. Results

3.1. Treatment retention

Treatment retention was examined categorically (dropout status in the 30-day study period). Baseline predictors of substance abuse treatment retention were examined, including all demographic and clinical variables depicted in Tables 1 and 2. No baseline variables were related to the categorical measurement of dropout. A chi square analysis was conducted comparing the two treatment groups on rates of dropout. 3.4% of the LETS ACT group ($n = 1$) and 24.1% of the SC group ($n = 7$) dropped out of the substance abuse treatment center during the study period. This was a significant group difference ($\chi^2(1) = 5.22$, $p < .05$), demonstrating that a significantly lower percentage of individuals in LETS ACT dropped out of residential substance abuse treatment compared to SC.

¹ The SCID and the HAMD were not re-administered at the post-treatment assessment given the short timeframe (only 2.5 weeks from enrollment to final assessment for some), which precluded the ability to detect changes in diagnostic status.

3.2. Behavioral Activation and Environmental Reward

Using repeated measure ANOVAs with treatment group as the between subjects factor and scores on the BADS as the within subject factor, results indicated a significant group \times time interaction on the BADS ($F(1, 46) = 5.19, p < .05, \eta^2 = .10$). Post-hoc analyses indicated a significant increase in BADS scores from pre- to post-treatment for the LETS ACT group ($F(1, 27) = 15.66, p < .001, \eta^2 = .37$), but no change in the SC group ($F(1, 19) = .02, p = .89, \eta^2 = .001$).

The same analyses were conducted for the EROS to examine changes in environmental reward from pre- to post-treatment. Repeated measure ANOVAs were used to test the main effect of time, which was not significant ($F(1, 47) = .32, p = .32, \eta^2 = .02$), and there was no treatment condition by time interaction ($F(1, 46) = 1.06, p = .31, \eta^2 = .02$).

3.3. Depression

Repeated measure ANOVAs were used to examine changes in depression over the 30-day study period. The main effect of time was significant ($F(1, 47) = 20.103, p < .0001, \eta^2 = .299$), demonstrating a 5-point reduction in mean BDI-II score at post-treatment compared to baseline for the total sample. However, results indicated that a group \times time interaction was not evident between the two groups ($F(1, 44) = .001, p = .99, \eta^2 = 0$).

4. Discussion

4.1. Summary

The current study was the first randomized clinical trial comparing a brief LETS ACT protocol to a contact-time matched control condition to evaluate effects on substance abuse treatment retention, depression severity, and two measures of behavioral activation: overall activation and environmental reward. Findings indicated significant group differences in rates of substance abuse treatment retention, such that individuals in LETS ACT were significantly less likely to have dropped out of treatment compared to those in SC. Regarding depression outcomes, there was a main effect of time, such that the total sample demonstrated reductions depressive symptoms from pre- to post-treatment; however, a treatment by time interaction was not evident, indicating that there was no difference across groups in reductions in depressive symptoms over the course of treatment. Lastly, examining changes in behavioral activation-related outcomes, individuals in LETS ACT evidenced a significant increase in overall levels of activation compared to those in SC. There were no significant differences between groups on changes in environmental reward from baseline to post-treatment.

4.2. Retention findings

The rate of treatment dropout in the SC condition was 24.1%, which mirrors the typical rate of dropout from the substance abuse treatment center; the rate of treatment dropout from this center has been approximately 25% since 2006 ($n = 1481$) (Lejuez et al., 2008). Yet, in the current study, the rates of dropout were markedly different from this normative pattern in the LETS ACT group (3.4%). Given that both groups demonstrated similar reductions in depressive symptoms over time, further investigation is needed to understand what is accounting for this difference in treatment retention. Future research may consider exploring the construct of behavioral activation as a factor related to patterns in substance use treatment outcomes given the previously suggested link between reinforcement, substance use, and treatment retention (Marlatt, Tucker, Donovan, & Vuchinich, 1997).

4.3. Depressive symptoms

Similar improvements in depressive symptoms across groups may be explained by a number of factors, such as the effect of continued abstinence on reductions in depression (Liappas, Paparrigopoulos, Tzavellas, & Christodoulou, 2002; Satel et al., 1991) or further adjustment to the treatment setting from baseline to post-treatment (Kosten et al., 2003; Rounsaville, Kosten, & Kleber, 1986), both of which affect the sample at large. The previous findings (Daughters et al., 2008) did demonstrate significant differences in depression when comparing LETS ACT to TAU. This assessment was conducted over a longer time period (up to 6 weeks), and participants were recruited in their third week as opposed to first week of treatment in the current study. These considerations may have helped control for the aforementioned factors affecting changes in depression across the entire sample; however, the current study also balanced the need to include patients with shorter inpatient stays.

In addition to timing, another important difference to acknowledge in the current study was the type of control group utilized. SC likely had a stronger effect on depression outcomes compared to TAU. This is understood when considering the substance abuse treatment setting; patients have scarce counselor contact and free time, allowing few opportunities to express oneself and focus on individual emotional issues. Follow up assessments are needed to test effects on longer-term depression outcomes, particularly when outside the residential treatment setting.

4.4. Behavioral activation, environmental reward

Much research is still needed to understand the processes underlying behavioral activation approaches (Mazzuchelli et al., 2009). The current examination of change in overall levels of activation (BADS) and environmental reward (EROS) was an initial attempt to examine what aspects of behavioral activation are most influenced by LETS ACT. These findings suggest that activation, more so than environmental reward, is what was uniquely targeted by LETS ACT. However, it is important to again consider context—an inner-city residential substance abuse treatment setting with limited ability to diversify potentially rewarding activities. Limited activity options available for patients in the residential setting may be a potential explanation for why LETS ACT did not demonstrate an effect on reinforcement derived from activities and only on overall levels of activation. This is also typical of other residential treatment settings, suggesting generalizability to other contexts (Timko, 1995).

4.5. Conclusions

Considering these findings together, there were clear group differences for treatment retention and levels of overall activation. These measures can be considered the most "behavioral" of the outcome measures; they reflect what a patient is actually doing—referring to specific behaviors—as opposed to subjective experience. Interestingly, the BDI-II and EROS did not significantly improve in the current study, but they did in Daughters et al. (2008) with a longer period of assessment; this may have allowed for greater changes in these outcomes to be observed. It may be the case that in the current study, the latter outcomes did not have time to be altered in a shorter period of time during substance abuse treatment. This fits well with the concept of desynchrony posed by Rachman and Hodgson (1974), which suggests that behavioral changes may precede cognitive changes. According to Rachman's theory, the changes in mood would indeed be expected to follow changes in behavior. As such, additional time may have been needed to detect effects on cognitive- or mood-related changes.

4.6. Limitations/future directions

A primary limitation of the current study relates to treatment dropout as the main outcome; all individuals who dropped out of substance abuse treatment did so prior to the post-treatment assessment. This precluded an assessment of change in key potential mediators (e.g., measures of behavioral activation) to understand processes affecting dropout. Future studies should consider including a midpoint assessment and conducting assessments regardless of whether an individual has dropped out of the center. Future trials with more repeated assessments and longer-term follow ups will enable testing the effects of LETS ACT on longer-term depression and relapse outcomes, as well as potential mechanisms underlying these outcomes. It also will be important to examine longer-term changes in reinforcement and activation following residential treatment discharge when individuals have greater ability to select potentially rewarding activities.

Although initially developed to target depression, this study demonstrates that LETS ACT may also extend to substance use treatment outcomes. Future trials should examine whether LETS ACT, through increasing alternative forms of substance-free positive reinforcement, may be used to target substance use treatment outcomes regardless of depression status. This emerging line of research is consistent with the longstanding theoretical foundation of behavioral economic theory, as well as more recent related empirical research demonstrating substance use as tightly tied to diminished engagement in substance-free reinforcing activities (Murphy, Correia, & Barnett, 2007). Marlatt et al. (1997) addressed the use of behavioral-economic approaches as a means to increase treatment retention and specifically pinpointed the need to increase access to "valued alternative activities"; they suggested that enriching substance users' environment with valued, alternative substance-free activities may provide a "potentially powerful vehicle" to curtail substance use relapse and improve treatment retention. Indeed they suggested that to truly improve interventions, as well as the delivery of interventions to the "chronically underserved majority of substance users," we must understand the environmental context of these individuals (Marlatt et al., 1997).

Future research is needed to replicate the current findings and to examine the effects of LETS ACT on long-term outcomes following residential treatment, particularly relapse. However, the current study does provide initial evidence that a behavioral activation approach targeting increases in reinforcement may offer a valuable direction for future interventions aimed at improving substance abuse treatment retention.

Role of Funding Sources

This work was supported in part by the National Institute of Drug Abuse grants F31 DA026679 (PI: Magidson), R01 DA026424 (PI: Daughters), and K02 DA023200 (PI: Blanco). No funding source had any direct role in the study design; in the collection, analysis, or interpretation of the data; in the writing of the report; or in the decision to submit the report for publication. The corresponding authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Contributors

J. Magidson, S. Daughters, and C. Lejuez designed the study. J. Magidson wrote and implemented the protocol with the guidance of S. Daughters and C. Lejuez. S. Gorka was a study therapist on the project and conducted literature reviews to aid in manuscript preparation. L. MacPherson aided with statistical analysis. D. Hopko and C. Blanco consulted on study design and manuscript preparation. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors report no conflicts of interest.

Acknowledgments

We would like to thank Ms. Claudette Brooks, Ms. Adele Peeters, Ms. Raven Luckett, Mr. Wayne Garner, and Ms. Michelle Williams at the Salvation Army Harbor Light Substance Abuse Treatment Facility for their help with patient recruitment. The LETS ACT treatment manual can be accessed by contacting the corresponding authors.

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