Randomized Controlled Trial of Behavioral Activation Smoking Cessation Treatment for Smokers With Elevated Depressive Symptoms

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Objective: Depressive symptoms are associated with poor smoking cessation outcomes, and there remains continued interest in behavioral interventions that simultaneously target smoking and depressive symptomatology. In this pilot study, we examined whether a behavioral activation treatment for smoking (BATS) can enhance cessation outcomes. Method: A sample of 68 adult smokers with mildly elevated depressive symptoms (M = 43.8 years of age; 48.5% were women; 72.7% were African American) seeking smoking cessation treatment were randomized to receive either BATS paired with standard treatment (ST) smoking cessation strategies including nicotine replacement therapy (n = 35) or ST alone including nicotine replacement therapy (n = 33). BATS and ST were matched for contact time and included 8 sessions of group-based treatment. Quit date was assigned to occur at Session 4 for each treatment condition. Participants completed a baseline assessment; furthermore, measures of smoking cessation outcomes (7-day verified point-prevalence abstinence), depressive symptoms (Beck Depression Inventory–II; Beck, Steer, & Brown, 1996), and enjoyment from daily activities (Environmental Reward Observation Scale; Armento & Hopko, 2007) were obtained at 1, 4, 16, and 26 weeks post assigned quit date. Results: Across the follow-ups over 26 weeks, participants in BATS reported greater smoking abstinence (adjusted odds ratio = 3.59, 95% CI [1.22, 10.53], p = .02) than did those in ST. Participants in BATS also reported a greater reduction in depressive symptoms (B = −1.99, SE = 0.86, p = .02) than did those in ST. Conclusions: Results suggest BATS is a promising intervention that may promote smoking cessation and improve depressive symptoms among underserved smokers of diverse backgrounds.

Keywords: smoking cessation, behavioral activation, depressive symptoms, low-income and minority smokers

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Moderately elevated levels of pretreatment, current depressive symptoms are associated with poor smoking cessation outcomes (e.g., Cinciripini et al., 2003; Niaura et al., 2001). Antidepressant medications and/or mood-specific cognitive–behavioral treatments largely have not impacted depressive symptoms during quit attempts (e.g., Kahler et al., 2002), and treatment effects appear unrelated to depressive symptom change (e.g., Piper et al., 2008). Beyond the putative role of depressive symptoms in cessation failure, emerging research indicates a critical role of low positive affect in poor cessation outcomes (e.g., Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008; McCarthy et al., 2008) and in deprivation-induced withdrawal and craving (e.g., Cook, Spring, McChargue, & Hedeker, 2004). Although extant research typically has focused on the role of negative affectivity/mood on cessation failure (cf. Spring et al., 2008), it remains crucial to consider low positive affect/anhedonia (i.e., reduced positive emotions and a diminished capacity to experience pleasure; Pizzagalli, Jahn, & O’Shea, 2005), as these dimensions have also predicted smoking cessation-related changes in withdrawal symptoms and relapse beyond depression history (Leventhal et al., 2008).

Behavioral activation (BA; Jacobson, Dobson, Truax, & Addis, 1996; Lejuez, Hopko, & Hopko, 2001) strategies may be a promising adjunct to standard cessation strategies for smokers with elevated depressive symptoms, as this is a brief approach that targets greater contact with more valued environments through systematic efforts to increase rewarding experiences/enjoyment of daily activities, which may simultaneously reduce negative affect and improve positive affect through overt behavior change (Lejuez et al., 2001). We conducted a small scale randomized clinical trial of BA strategies with standard cognitive–behavioral smoking cessation strategies including transdermal nicotine patch (behavioral activation treatment for smoking; BATS). The comparison condition received standard smoking cessation treatment including transdermal nicotine patch (standard treatment; ST), matched for overall contact time. We hypothesized participants in BATS would evidence higher point-prevalence abstinence (scheduled within 2 weeks of the phone screen), participants began using the transdermal nicotine patch on the scheduled quit date (i.e., 12 and 22 weeks post end of the 8-week treatment protocol). Assessments were conducted at each treatment session, and follow-ups were conducted at 16 and 26 weeks post assigned quit date (i.e., 12 and 22 weeks post end of the 8-week treatment protocol). Assessments were conducted by research assistants blinded to treatment condition.

**ST.** ST included eight, 1-hr weekly group sessions. Participants began using the transdermal nicotine patch on the scheduled quit date with an initial dose of 21 mg for 4 weeks, followed by 2 weeks of 14 mg, and 2 weeks of 7 mg. Participants who smoked on average 10–12 cigarettes per day started with the 14-mg patch for the first 6 weeks, per manufacturer’s recommendations. Content was based on the most recent clinical practice guidelines of the U.S. Department of Health and Human Services (Fiore et al., 2000) and included self-monitoring, identifying effective and ineffective cessation strategies from prior quit attempts, relaxation, coping with triggers, identifying social support for cessation, making lifestyle changes (such as increasing physical activity and reducing stress), relapse prevention, and homework.

**BATS.** BATS also included the transdermal nicotine patch and was composed of 30 min of BA (adapted from Lejuez et al., 2001) and 30 min of core ST components and content described in the previous paragraph, excluding relaxation strategies. Relaxation strategies were not included in BATS because relaxation has been documented to be neither effective nor iatrogenic for smoking cessation (Fiore et al., 2000). Thus, removal from BATS but retention in ST was useful for equating contact time without unduly harming either condition. Specific to the BA content, Session 1 began with the therapist providing the treatment rationale focused on structuring a variety of reinforcing activities to promote a more rewarding nonsmoking lifestyle. The therapist also introduced activity monitoring that involved recording of all daily activities as well as associated mood and smoking at these times. Completion of daily activity monitoring was assigned to occur...
each day of the following week. At the start of Session 2, the
therapist led the group in a review of daily activity monitoring
completed for each day of the previous week. Next, participants
identified their values and life goals, which were used to identify
important and/or enjoyable activities. Several activities were then
planned for the coming week with the behavioral checkout form,
which allowed participants to track their activities and progress
toward achieving weekly goals. For homework, participants were
instructed to record engagement in each planned activity (Lejuez et
al., 2001). We encouraged using BA strategies for engagement in
activities as part of a nonsmoking lifestyle. In Sessions 3–8, we
focused on the behavioral checkout form starting with monitoring
of planned activities from the previous week and then planning of
activities for the coming week. In Session 3, we included a focus
on activities related to quit preparation. In Session 4, we focused
on quit-related activities. In Sessions 5–8, we focused on activities
consistent with remaining abstinent and addressing lapses in the
larger context of their specific values and life goals. Participants
were encouraged to use the monitoring and planning in BA to
incorporate activities consistent with the standard smoking cessation
strategies, including nonsmoking lifestyle and coping with triggers.

Therapists. Therapists were four women and one man; two
had clinical psychology doctoral degrees, and three were clinical
psychology doctoral students. Training for both conditions in-
cluded a 4-hr workshop, followed by scheduled practice and ob-
servation of a full group. Weekly supervision was conducted for all
therapists, which included review of therapy audiotapes. Each
therapist provided treatment in both conditions. All therapists
conducted at least one group in both conditions, and no therapist
conducted more than three groups in any condition. Sessions were
audiotaped, and independent raters rated a random 20% to assess
therapist adherence to the protocol using separate rating checklists
and scales developed for the BATS and ST protocols. Adherence
rates were over 95% for both treatment conditions.

Measures
At the baseline interview, participants provided demographic
and other background information, including age, gender, ethnic-
ity, marital status, income level, employment status, and education
level. Duration of previous quit attempts, age of onset of regular
smoking, and recent smoking behavior were assessed. Motivation
to quit was assessed via a single item on a 10-point scale ranging

Figure 1. Consolidated Standards of Reporting Trials (CONSORT) flowchart of study participants, random-
ization, treatment, follow-ups, and inclusion analyses. ST = standard treatment (i.e., standard smoking cessation
treatment including nicotine replacement therapy [NRT]); BATS = behavioral activation treatment for smoking
(i.e., ST and NRT integrating behavioral activation strategies); BDI-II = Beck Depression Inventory–II.
Note. BATS = behavioral activation treatment for smoking; ST = standard treatment; GED = General Educational Development; FTND = Fagerström Test for Nicotine Dependence; BDI-II = Beck Depression Inventory–II; EROS = Environmental Reward Observation Scale.

Table 1
Comparisons on Baseline Demographic, Smoking History, and Affective Variables Across Treatment Conditions

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>BATS (n = 35)</th>
<th></th>
<th>ST (n = 33)</th>
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<th>p</th>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>%</td>
<td>M</td>
<td>SD</td>
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<td>Demographic variables</td>
<td></td>
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<td>Age</td>
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<td>42.6</td>
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<td></td>
<td>48.5</td>
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<tr>
<td>Ethnicity (% African American)</td>
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<td></td>
<td>75.8</td>
<td></td>
<td>.34</td>
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<td>Employment status (% employed)</td>
<td>54.8</td>
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<td>58.6</td>
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<td>Education</td>
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<td>High school graduate/GED credential or lower</td>
<td>21.2</td>
<td></td>
<td>24.4</td>
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<td>.24</td>
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<td>Household income</td>
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<td>$0–$49,999</td>
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<td></td>
<td>61.5</td>
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<tr>
<td>$50,000–$99,999</td>
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<td>30.8</td>
<td></td>
<td>.39</td>
</tr>
<tr>
<td>$100,000+</td>
<td>6.7</td>
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<td>7.7</td>
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<td>.28</td>
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<td>Smoking history variables</td>
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<tr>
<td>Smoking history in years</td>
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<td>Nicotine dependence (FTND)</td>
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<td>1.8</td>
<td>6.1</td>
<td>2.1</td>
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<tr>
<td>Average cigarettes per day</td>
<td>18.8</td>
<td>7.1</td>
<td>17.3</td>
<td>8.1</td>
<td>.44</td>
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<td>No. of prior quit attempts</td>
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<td>2.4</td>
<td>4.3</td>
<td>4.1</td>
<td>.39</td>
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<tr>
<td>Motivation to quit</td>
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<td>1.7</td>
<td>8.8</td>
<td>1.3</td>
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<td>BDI-II score</td>
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<td>5.2</td>
<td>10.4</td>
<td>7.5</td>
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<td>EROS score</td>
<td>26.6</td>
<td>3.6</td>
<td>26.5</td>
<td>4.8</td>
<td>.89</td>
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</table>

Smoking outcome was point-prevalence abstinence defined as self-reported abstinence of ≥7 days prior to an assessment point. Smoking was assessed at 1 week, 4 weeks (end of behavioral treatment), 16 weeks, and 26 weeks post assigned quit date. Self-reported abstinence was verified via expired carbon monoxide analysis. In addition, saliva samples for cotinine analysis were collected at the 16- and 26-week follow-up points in which verification of abstinence required a combination of carbon monoxide ≤10 ppm and cotinine ≤15 ng/ml (SRNT Subcommittee on Biochemical Verification, 2002). Continuous abstinence was defined as the length of time from quit day until the end of follow-up period in which the participant reported no smoking. Of those who attended at least one session of treatment (n = 42), biochemically verified smoking data were obtained for 78.6%, 83.3%, 61.9%, and 64.3% of participants at 1, 4, 16, and 26 weeks post assigned quit date, respectively. Although rates are lower than typically reported in smoking cessation trials, they are consistent with rates in largely low-income and minority samples (cf. El-Khorazaty et al., 2007). The proportion of participants who completed each assessment point was unrelated to treatment condition (ps > .25). Only those individuals whose smoking status was biochemically verified were considered abstinent at each time point, whereas those with missing data were considered as having smoked (Hughes et al., 2003). No subsequent follow-up data were obtained for the 26 participants who dropped prior to treatment; therefore, all data were coded as having smoked. One participant in BATS died between 16 and 26 weeks; this death was unrelated to study participation. Unlike other missing data, this 26-week follow-up was retained as missing.

Data Analysis

Repeated measures analyses were conducted with generalized estimating equations (GEEs) to test group differences in the odds of being abstinent at 1, 4, 16, and 26 weeks post assigned quit date for both the full randomized sample (n = 68) and the subsample attending at least one treatment session (n = 42). Included covariates were gender, nicotine dependence, BDI-II symptoms, and current income—all of which are commonly linked to poor cessation outcomes (cf. Cinciripini et al., 2003). We also included a linear effect of time. Hierarchical linear modeling analyses were conducted for the subsample (n = 42) to examine treatment group differences in depressive symptoms and EROS scores, from baseline across the same time periods as the abstinence outcomes. In
In the hierarchical linear model predicting depressive symptoms, the time effect on depressive symptoms was significant (B = -1.53, SE = 0.68, p = 0.03), indicating a reduction in depressive symptoms from baseline through the 26 weeks post assigned quit date (see Table 4). However, an interaction between treatment condition and the linear effect of time (B = -1.99, SE = 0.86, p = 0.02) revealed that the reduction in depressive symptoms over time was greater for BATS than for ST participants (see Figure 2). All EROS analyses were nonsignificant.

Discussion

BATS added to standard smoking cessation resulted in greater odds of point-prevalence abstinence than ST across the 6-month follow-up period among smokers with elevated depressive symptoms. Additionally, depressive symptoms were lower throughout the follow-up period for BATS participants, whereas they slightly increased over time for ST participants. Sample size prevented testing depressive symptoms as a mediator of the time by treatment effect, but results suggest potential viability of such analyses in future work. The lack of a treatment effect on EROS score was
unexpected. Future efforts should aim to determine whether the short assessment time frame here is sufficient to capture changes in pleasure that may be slower to occur than overt behavior change as well as to include the additional assessment of actual activity engagement, which is likely to change more quickly than pleasure derived from activities.

There are several study limitations. First, our control condition did not include another psychosocial depression treatment or an antidepressant medication. Second, recruitment issues raise some concerns regarding internal validity. Specifically, the refusal rate was high, although consistent with those seen in other randomized controlled trials of combined behavioral therapy plus pharmacotherapy for smoking cessation in samples with either history or current depressive syndromes (Evins et al., 2008; Spring et al., 2007). Additionally, there was differential pretreatment attrition across the two treatment conditions. Participants were unaware of treatment assignment prior to the first session, and project staff were blinded to treatment condition during both the telephone screening and the baseline assessments. Thus, this differential attrition likely reflects random chance. The effects of treatment were significant and of similar magnitude even when examining only those participants who attended at least one session. Balancing these limitations, a strength of this work is the ethnic and socioeconomic diversity of the sample (75% ethnic minority and 37% of low income), given the historic underrepresentation of low-income and ethnic minority participants in clinical trials for smoking cessation. However, it is notable that generalizability to the larger population of smokers remains unclear.

Results indicate that BATS is a promising intervention for smoking cessation and the reduction of depression among smokers with elevated depressive symptoms. Given its brief nature, it may be a viable option for smoking cessation efforts across multiple settings and populations. This sets the stage for future work to replicate and extend these findings to quantify change in BA. It also can serve as a foundation for more comprehensive efforts to control for key variables, such as psychotropic medication utilization, as well as BA treatment acceptability, homework completion, and group cohesion. Future work would benefit from efforts to identify moderators of treatment effects, including biological variables such as stress response and reward sensitivity.

References
Evins, A. E., Cultane, M. A., Alpert, J. E., Pava, J., Liese, B. S.,


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