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Influences of Mood, Depression History, and Treatment Modality on
Outcomes in Smoking Cessation

Abstract

The relationship between depressive disorder (MDD), treatment modality, and mood was evaluated in smokers participating in cessation programs. Participants ($N = 549$, 53.7% female, 28% endorsing past MDD episodes) were randomly assigned to CBT or Health Education (HE). Participants with a history of recurrent MDD (MDD-R) had higher rates of abstinence in CBT compared to HE, even when the contribution of mood and the interaction between mood and an MDD-by-treatment variable were included in the model. Likewise, higher levels of mood disturbance were reported by MDD-R smokers compared to those reporting a single episode. The study replicated results reported by Brown et al. (2001) and expanded upon them by evaluating the differential contribution of poor mood on cessation outcomes relative to MDD history.

Influences of Mood, Depression History, and Treatment Modality on Outcomes in Smoking Cessation

Nicotine dependence and affective disorders, particularly Major Depressive Disorder (MDD), are linked (Breslau, Kilbey, & Andreski, 1991; Breslau, Kilbey, & Andreski, 1993; Hall, Muñoz, & Reus, 1994), with higher prevalence rates reported for smokers relative to nonsmokers (Anda et al., 1990; Breslau et al., 1991) and higher rates in smoking treatment samples compared to population statistics (Glassman et al., 1993; Ginsberg, Hall, Reus, & Muñoz, 1995; Hall et al., 1994). Research on negative mood states is less definitive, but MDD and poor mood are related and some believe mood may be a major factor controlling smoking behaviors.

There is evidence that the process of cessation itself produces symptoms of mood disturbance, which are more pronounced in the days immediately following cessation and generally return to baseline levels within a month of continued abstinence (USDHHS, 1988). Common affective symptoms that co-occur with cessation include depressed mood, anxiety, nervousness, restlessness, irritability, fatigue, and drowsiness (Hughes & Hagsukami, 1986). Data suggest that negative affect may be exacerbated during cessation for smokers with a history of MDD (Hughes, 1999; Hughes & Hagsukami, 1986). For example, self-reported mood disturbance is greatest for smokers with a history of depression (Covey, Glassman & Stetner, 1990; Hall et al, 1991) and remains higher over the initial days immediately following a cessation attempt (Ginsberg et al., 1995; Hall et al., 1998). Also, mood disturbance may be worse for MDD history positive smokers who quit but return to moderate levels of smoking relative to their peers who return to regular smoking (Kahler et al., 2002). Furthermore, MDD+ history smokers may have higher levels of certain negative affect (e.g., anger) relative to MDD-

smokers, which exist at baseline and continue during the cessation process (Ginsberg et al., 1995). These differences in mood disturbance appear to be related to successful cessation as well. For example, Anda et al. (1990) found that smokers reporting higher levels of negative mood and depressive symptoms were less likely to quit than smokers with less mood disturbance.

Cognitive-behavioral mood management interventions are an empirically validated technique for treating depressive symptoms (Chambless et al., 1998). This therapeutic approach has been applied in cessation programs with MDD+ history smokers, with somewhat inconsistent findings. In a series of studies using smokers recruited from the community, a cognitive-behaviorally based cessation intervention (CBT) was compared to either standard treatment or medication management (Hall et al., 1994; Hall et al., 1996; Hall et al., 1998). Results from two of the studies indicated that smokers with a history of MDD were more likely to be abstinent when treated in a cognitive-behaviorally-based intervention (CBT) than with standard treatment (e.g., psychoeducational) or a health education intervention (Hall et al., 1994; Hall et al., 1998). However, in a follow-up to the 1994 study, Hall et al. (1996) found no significant group differences for MDD+ participants based on treatment modality. Aside from this finding, the research indicates that comparable interventions designed to facilitate mood management skills have been used successfully and have been applied to other populations as well. For example, Muñoz, Marín, Posner, and Pérez-Stable (1997) developed a self-administered mood management program for Spanish-speaking Latino smokers. Results indicated that smokers with a prior history of MDD, who were not currently depressed, had higher abstinence rates when provided with the mood management cessation program in combination with a standard smoking cessation guide relative to those who received only the

standard guide. Superior rates of abstinence have also been shown with CBT-based cessation programs for recovering alcoholic smokers with a history of depression when compared to behavioral skills training that did not include a mood management component (Patten, Martin, Myers, Calfas, & Williams, 1998).

One possible explanation for the discrepant findings may be measurement related. Until recently, depression history has been categorized dichotomously in smoking cessation research (that is, prior history versus no prior history). However, there is a considerable amount of data from general psychopathology research indicating that depression is not that one-dimensional, and frequency of prior MDD occurrences is an important variable in predicting subsequent MDD incidences (APA, 1994). For example, the DSM-IV highlights that between 50-60% of individuals with a single episode of MDD will go on to subsequent episodes, with the probability of subsequent episodes increasing relative to the number of prior diagnosable episodes. Furthermore, the period between diagnosable MDD episodes is also variable, with some individuals returning to normal affective states whereas other continue to have subclinical levels of depressive symptoms – including poor mood.

This conceptualization of depression, which includes frequency of episodes, was recently applied to a randomized clinical trial for smoking cessation. Using smokers with prior episodes of DSM-III-R diagnosable major depression, Brown and colleagues (2001) assigned participants to two contact-equated psychological interventions (cognitive-behavioral mood management versus standard treatment). Preliminary results revealed equivocal rates of abstinence among the interventions. However, post hoc analyses indicated that individuals with a history of recurrent (>1 episode) diagnosable MDD episodes were more likely to abstain after completing the mood management intervention compared to the standard treatment. It should be noted, though, that

depression history was considered for analyses using a data-driven statistical procedure (backward selection of covariates prior to insertion in the GEE model). Therefore, it is uncertain whether these results are sample-specific or generalizable to other clinical samples.

The current study was designed to further this line of research, and also evaluate mood as possible mechanism for explaining the inconsistencies in prior studies evaluating abstinence rates among MDD+ smokers in different cessation interventions. Using a pooled sample from three separate randomized clinical trials for smoking cessation (Hall et al. 1994; Hall et al., 1996; Hall et al., 1998), depression history was re-coded to incorporate the frequency of past episodes. Secondary analyses were conducted using a series of models to address two main objectives. First, the study sought to replicate post-hoc findings reported by Brown et al. (2001) that MDD+ history recurrent smokers had better abstinence rates in CBT compared to standard treatment (Model 1). Second, the study expanded upon these findings by evaluating the contribution of pre-treatment mood, MDD history, and treatment modality on abstinence rates (Models 2 – 3). It was hypothesized that (a) mood disturbance will be greatest for individuals with a history of recurrent MDD, (b) greater levels of mood disturbance would be associated with lower abstinence rates for individuals with a history of recurrent depression, and (c) that MDD+ recurrent individuals receiving CBT treatment would have higher rates of abstinence than participants in a control condition given comparable levels of mood disturbance.

Method

Participants

Study participants consisted of 549 cigarette smokers (53.7% women, 46.3% men; 89.5% Caucasian) who participated in three smoking cessation research projects at the University of California, San Francisco. These studies have been reported in detail elsewhere (Hall et al.,

1994; Hall et al, 1996; Hall et al., 1998). Participants were recruited through advertisements, media announcements, and word-of-mouth. The average participant was 40 years old at time of entry into the program, had been smoking 14.78 years ($SD = 3.72$), and reported current consumption of approximately one pack per day prior to treatment ($M = 23.54$ cigarettes per day, $SD = 10.46$). Psychiatric history, as measured by the Diagnostic Interview Schedule (DIS: Robins, Helzer, Croughan, & Ratcliff, 1981), indicated that 28.23% reported prior episodes of Major Depressive Disorder (MDD) based on DSM-III-R criteria (American Psychiatric Association, 1987), with the majority of these individuals reporting more than one episode (78.1% of individuals met criteria for multiple past MDD episodes). Individuals who met criteria for MDD within three months prior to the baseline assessment, as measured by the DIS, were excluded from the study and referred for depression treatment.

Procedure

Participants were stratified on MDD history (prior episode versus no history) and number of cigarettes smoked (19 or less per day versus 20 or more) and assigned to treatment conditions using a computerized randomization program. The treatment modalities and duration of treatment will be described in subsequent sections. Irrespective of treatment condition or study, the initial quit date was set for the second week of psychological treatment. Demographic variables, depression history, current depressive symptomatology and mood, and withdrawal symptoms were assessed at baseline. Smoking status was evaluated at end-of-treatment (EOTX), 3-months following treatment (3-Month Follow-up), and one year post-treatment (12-Month Follow-up). Abstinence was verified by expired air carbon monoxide and urine cotinine tests. Self-reported mood disturbance was measured at baseline and EOTX. Longitudinal follow-up rates varied across the studies, ranging from 76% (Hall et al., 1998) to 97% (Hall et al., 1996).

Measures

Depression History and Current Symptomatology. Participants were administered the Diagnostic Interview Schedule – Depression Subscale (Robins et al, 1981) to evaluate past and present depressive symptoms. The DIS is a structured diagnostic interview resulting in diagnoses based on criteria specified in the *Diagnostic and Statistical Manual of Mental Disorders* (3rd edition, revised; DSM-III-R; American Psychiatric Association, 1987).

Participants were administered the DIS by bachelor's and master's level survey workers, trained by Ricardo F. Muñoz, with the staff member guiding the participant through the computerized interview. Psychometric studies using the interviewer-administered version reported moderate levels of test-retest reliability across diagnoses (Vandiver & Sher, 1991); validity studies indicated moderate agreement between administrations by trained professionals and lay interviewers (Robins et al., 1981).

Profile of Mood States (POMS). The POMS (McNair, Lorr, & Droppleman, 1971) is a 65-item self-report measure that evaluates six aspects of affect (depression, tension, anger, confusion, fatigue, and vigor). A Total Mood Disturbance Score (TMD) was calculated by summing across five of the scales (depression, tension, anger, confusion, and fatigue) and subtracting the vigor subscale, as specified in the manual (McNair et al, 1971), with higher scores indicative of greater mood disturbance. Prior studies indicated that the POMS had excellent reliability for measuring state affect, with internal consistency of the subscales ranging from .89 - .95 and test-retest reliability ranging from .48 - .86 (McNair et al., 1971).

Beck Depression Inventory (BDI). The BDI, a 21-item self-report measure assessing depressive symptomatology during the past week, was administered at baseline to evaluate current depressive symptomatology (Beck, Ward, Mendelsohn, & Erbaugh, 1961). Each item,

rated from 0 to 3, measures the intensity of the depressive symptom. Previous studies have reported mean scores for nonclinical samples ranging from 4.54 to 7.18, and pretreatment clinical samples mean scores of 26 (Neitzel, Russell, Hemmings, & Gretter, 1987). The BDI has been shown to have good internal consistency (ranging from .73 to .95), adequate test-retest reliability (ranging from .48 to .86), and concurrent validity with major diagnostic systems for the diagnosis of MDD (Beck, Steer, & Garbin, 1988; Neitzel et al, 1987).

Self-Report Items. Demographic data, smoking history, and current smoking behaviors were measured through a self-report questionnaire administered at baseline.

Measures for Determining Abstinence. Point prevalence abstinence was measured by self-report at three times (end-of-treatment, 3-Month Follow-up, and 12-Month Follow-up) and verified by urine and breath samples. Participants were coded as abstinent if they met the following criteria: self-report of 7-day abstinence, expired carbon monoxide levels of 10ppm or less, and urine cotinine levels less than 60 nmol/L (Jarvis, Tunstall-Pedoe, Feyerabend, Vesey, & Saloojee, 1987). Participants with missing data were coded as relapsed.

Psychological Interventions

Participants were randomly assigned to either Cognitive Behavioral or the Health Education intervention with treatment conducted by doctoral-level clinical psychologists experienced in both intervention techniques. All therapists treated patients in each of the interventions and adherence to protocols was monitored.

Cognitive-Behavioral Treatment (CBT). The CBT intervention was designed to assist smokers to develop skills to facilitate the management of affective distress associated with quitting smoking and relapse, with the central premise being that thoughts, activities, and mood interact to influence smoking behaviors. The intervention consisted of 10 group sessions

occurring over an 8-week period, with the leader aiding participants to identify and develop skills for coping with situations associated with poor mood and smoking. Participants monitored their smoking behaviors and mood on a daily basis before the quit date using diaries and pencil-and-paper measures. The sessions focused on mood management skills to manage dysphoria and maintain abstinence, including methods to increase the frequency of pleasant activities and decrease relapse-related thoughts. Detailed information regarding this intervention is described elsewhere (Hall et al., 1994; Hall et al., 1996; Hall et al., 1998). A manual is available from the authors (Muñoz, Organista, & Hall, 1988).

Health Education Condition (HE). The HE condition, also described in detail elsewhere, was designed to provide health-related information and provide a vehicle for group discussion (Hall et al., 1994; Hall et al., 1996; Hall et al., 1998). Participants attended group sessions (5-10 sessions, depending upon which cessation research project the individual participated) over eight weeks. A core element of the HE condition was the development of a plan to quit smoking and weekly modification of the plan. Methods used included paper-and-pencil exercises, informational handouts, didactic presentations, homework assignments, and smoking monitoring.

As noted above, contact time for the HE condition varied across the three studies pooled in this analysis, with two studies (Hall et al., 1994; Hall et al., 1998) having a 5-week HE intervention and one (Hall et al., 1996) having a 10-week HE intervention that was contact time equated with the CBT condition. Preliminary analyses indicated no significant differences in abstinence as a function of contact time at any time point [EOTX: $\chi^2(1, N = 263) = .50, p = .48$; 3-month follow-up: $\chi^2(1, N = 263) = .20, p = .66$; 12-month follow-up: $\chi^2(1, N = 263) = .01, p = .94$]; hence, the groups were combined in subsequent analyses.

Data Analytic Procedures

History of major depression was evaluated using the DIS (Robins et al., 1981) with participants assigned to three groups based on the frequency of self-reported discrete episodes of MDD: no history (MDD-: $n = 394$), single past episode (MDD-S: $n = 34$), and recurrent episodes (MDD-R: $n = 121$). Comparison of group differences was conducted by creating a depression history/treatment modality composite variable (DEPBYTX), with participants divided into six groups. The groups were MDD history (None vs. Single Episode vs. Recurrent) crossed with treatment (CBT vs. HE). Evaluation of MDD history differences in negative mood was performed using repeated measures ANOVA, with baseline and EOTX POMS-TMD scores used as dependent variables, and the depression history/treatment modality composite used as the independent variable. . The POMS scores were square root transformed to correct for positive skew. Post hoc Tukey HSD was used to evaluate group differences.

Evaluation of treatment, MDD history, and mood effects on abstinence rates were performed using Generalized Estimating Equations (GEE: Zeger & Liang, 1986), a statistical procedure that permits the inclusion of both categorical and continuous independent variables when outcome variables are repeated and correlated across time. Analyses were conducted in SAS using PROC GENMOD (SAS Institute Inc., 2001) using Logit link function and a binomial distribution. Comparison of group differences was conducted using the history/treatment modality composite variable described above (DEPBYTX). Planned contrasts were used to evaluate discrete differences among the groups to evaluate the treatment differences within the depression history groupings as well as differences in abstinence as a function of depression history alone. For each contrast, the CBT intervention group was specified as the reference cases for the calculation of odds ratios. Three nested models were proposed to evaluate differences in

abstinence by MDD history and treatment, as well as the contribution of negative mood on abstinence rates. In total, three GEE equations were run with an alpha level for significance set at .05. A description of the variables entered in each model is provided in Table 1. Cotinine- and CO-verified point prevalent abstinence at the three time points (end-of-treatment, 3-months post-treatment, and 12-months post-treatment) was used as the dependent variable.

Results

Evaluating Baseline Differences With Regard to MDD History

Prior to investigation of the study hypotheses, analyses were conducted to determine whether the three MDD participant groups significantly differed on a series of demographic and descriptive variables at baseline. As shown in Table 2, the three groups appeared remarkably similar on all demographic variables, including gender, ethnicity, and age. Smoking histories were also comparable, with one-way ANOVAs indicating no mean differences between the groups on age of smoking initiation or number of years smoking. Number of cigarettes smoked per day prior to treatment, a rough measure of physical dependency, was also comparable. Differences were noted with regard to pretreatment depressive symptoms, $F(2, 543) = 27.15, p = .00$. Tukey studentized range test (HSD) results indicated that MDD-R participants had significantly higher BDI scores than the MDD-, $p = .00$: however, no statistically significant differences in BDI scores were observed when comparing MDD- to MDD-S, or when comparing MDD-S to MDD-R. It should be noted that all three groups (MDD-, MDD-S, and MDD-R) reported mean BDI levels below the cut-off of 14 for mild depressive symptoms (Beck et al., 1991).

Differences in Mood Relative to MDD History and Treatment Modality

Analyses were conducted to evaluate differences in self-reported mood disturbance based on MDD history and treatment modality. A repeated measures ANOVA was conducted with baseline and end-of-treatment POMS-TMD scores used as dependent variables and the depression category by treatment composite variable used as the independent variable. Results indicated an omnibus difference between the groups with regard to mood, $F(5, 427) = 9.48, p = .00, \eta^2 = 1.00$. Post hoc Tukey HSD tests revealed that individuals with recurrent MDD histories had significantly greater levels of mood disturbance relative to those with no MDD or a single past episode (both p 's $< .001$). No treatment by depression history differences were noted. Likewise, there were no omnibus within subject differences in mood measured longitudinally, Wilks $\Lambda = .99, p = .32, \eta^2 = .002$.

Depression history group differences in POMS scores were noted at both baseline and end-of-treatment (Figure 1). At baseline, a main effect was found for MDD history, $F(2, 537) = 25.18, p = .00, \eta^2 = .09$. Post hoc Tukey HSD tests indicated that MDD history negative smokers had significantly less mood disturbance relative to MDD-recurrent ($p = .00$) and MDD-single episode smokers ($p = .04$). However, no significant difference was noted between MDD-recurrent and MDD-single episode ($p = .27$). Group differences were also observed on POMS scores obtained at end of treatment (6 weeks after the quit date), $F(2, 439) = 12.40, p = .00, \eta^2 = .05$, with MDD-recurrent participants reporting significantly more mood disturbance than individuals with no history (Tukey HSD = 1.46, $p = .00$). No other significant differences were observed.

Relationship Between History of MDD and Treatment Modality on Abstinence

A series of models using GEE were run to further evaluate the relationship between depression history, treatment modality, and mood on point prevalence abstinence rates. Results

from Model 1, with only the depression category by treatment interaction composite variable entered, indicated no overall differences in abstinence with regard to MDD history and treatment modality, $\chi^2(5, N = 1647) = 6.94, p = .23$. Follow-up analyses indicated no notable differences in abstinence with regard to MDD history alone when measured dichotomously (MDD+ vs. MDD-: $p = .65$) or differences in abstinence between individuals with recurrent and single episodes of depression (MDD-S vs. MDD-R: $p = .87$). However, planned contrasts revealed differences when evaluating treatment effects within the MDD+ history groups (see Table 3, Model 1). Analyses indicated that MDD-R participants receiving CBT had significantly higher rates of abstinence than their peers assigned to the HE condition, $\chi^2(1, N = 363) = 5.68, p = .02$, whereas no within group treatment differences were noted for MDD-S or MDD- ($p = .46$ and $.38$, respectively). Table 4 provides point prevalence abstinence rates for participants based on MDD history and treatment condition.

Evaluating Abstinence with Mood Entered in the Model

Two sequential GEE analyses were done to evaluate differences in abstinence rates when the variance accounted for by baseline mood was entered in the model. A nested model approach was used, with one model containing depression category by treatment interaction (DEPBYTX composite variable) and POMS-TMD scores (Model 2) and another model run adding a DEPBYTX*POMS-TMD interaction term (Model 3). This approach was used to evaluate the relationship between MDD history and treatment modality on abstinence when the variance contributed by baseline mood, and the interaction between baseline mood and MDD history and treatment type, were considered in the model. Results indicated that baseline mood (as measured by POMS-TMD) was a significant predictor of abstinence when entered alone (Model 2), $\chi^2(1, N = 1647) = 4.91, p = .02$, but did not predict abstinence when the interaction

term was added to the model (Model 3), $\chi^2(1, N = 1647) = 0.71, p = .49$. Likewise, the interaction between mood and the depression history/treatment variable was not significant in Model 3, $\chi^2(5, N = 1647) = 1.41, p = .92$. The depression history/treatment variable (DEPBYTX) was not significant in either model (both p 's $< .35$).

Evaluation of contrast results indicated that variance contributed by baseline mood did not markedly change the relationship between treatment modality and abstinence rates within the depression history groups. As shown in Table 3, individuals with a history of repeated prior MDD episodes continued to have superior rates of abstinence even with mood, and the interaction between mood and MDD history, included in the model. No significant treatment differences were noted in either depression group (MDD-S and MDD-).

Discussion

The current study provides further evidence implicating differences in abstinence rates for MDD history positive smokers based on history and treatment modality, and provides preliminary evidence that the level of mood disturbance also differs with regard to depression history. Consistent with the first hypothesis, mood disturbance was greatest for individuals with a history of repeated, diagnosable MDD episodes relative to those individuals with a single prior MDD episode and individuals reporting no depression history.

Consistent with the third hypothesis, results from this study replicate post hoc findings reported by Brown et al. (2001) that smokers with recurrent MDD episodes have higher rates of abstinence from participation in cognitive-behaviorally based treatment relative to standard, interventions. Treatment modality did not appear to influence outcomes for individuals reporting a single past MDD episode (MDD-S) or smokers without a history of depressive disorder. Overall, data from both studies highlight that treatment modality is a significant predictor of

abstinence outcomes for individuals at highest risk for relapse due to adverse affective states – individuals with a history of repeated, diagnosable depressive episodes.

This study sought to expand this line of research by evaluating whether self-reported negative mood is a contributory factor to relapse, in addition to depression history and treatment modality. When evaluated within two nested models that predicted abstinence for the entire sample (where a depression category by treatment interaction composite variable and self-reported mood were entered as predictors), baseline mood disturbance was found to predict point-prevalence abstinence when entered in addition to the depression history/treatment variable; however, did not predict abstinence when entered in a model accounting for the interaction between mood and the depression history/treatment modality composite variable. Likewise, the interaction variable did not predict point-prevalence abstinence across the trial based on GEE results.

Consistent with prior studies evaluating mood disturbance in MDD+ smokers during cessation (Covey et al., 1990; Ginsberg et al., 1995; Hall et al., 1991), it appeared as if history positive smokers are more susceptible to experiencing negative mood states in general, irrespective of treatment modality. History positive (MDD-Single and MDD-Recurrent) smokers reported significantly higher levels of mood disturbance at all time points relative to their MDD- counterparts, with MDD-R smokers reporting the highest levels of mood disturbance overall. Contrary to our second hypothesis, these differences in poor mood do not appear to correspond to higher rates of relapse, though, as would have been evident by findings of lower abstinence rates in the MDD-R group. In fact, the present study found that MDD-R smokers have comparable rates of abstinence at all three measured outcome times relative to MDD- and MDD-S participants despite reporting more mood symptoms and having higher levels of

depression pretreatment. This is counterintuitive, given results of prior studies documenting the relationship between smoking and related constructs like depressive symptoms (e.g., Anda et al., 1990) or findings from a recent study suggesting that increases in depressive symptoms among MDD+ smokers post cessation are related to higher incidences of relapse (Burgess et al., 2002). It should be noted that the current study was interested in mood (e.g., affective disturbance) and not symptoms of depression per se (that may include cognitive an/or more physiological complaints in addition to affective symptoms) which was why BDI scores were not used in the models tested. It should be noted, though, that the same models were run using BDI scores in place of the POMS, and identical patterns of results were found.

Results from this study, in conjunction with findings reported by Brown et al. (2001), suggest one possible explanation for the inconsistencies reported in prior studies evaluating the relationship between MDD history, smoking treatment, and outcomes (Hall et al., 1994; Hall et al., 1996; Hall et al., 1998). As noted in the introduction, prior studies measured MDD history dichotomously (MDD+ versus MDD-) and did not consider the number of prior diagnosable MDD episodes. Results from recent studies, though, suggest that smokers with recurrent MDD episodes respond differently based on the kind of treatment they receive relative to smokers with a single prior MDD episode, and that collapsing depression history (MDD-S and MDD-R) into a single group may suppress treatment differences.

Evaluation of both point prevalence abstinence rates and self-reported mood indicate that MDD-R smokers are distinctly different from MDD-S and should be considered separate groups when evaluating treatment outcomes for smoking cessation interventions. It is possible that individuals with a history of recurrent depression, and correspondingly higher levels of negative mood and/or baseline depressive symptoms, may be qualitatively different from individuals who

have experienced a single episode. For example, it is possible that individuals with a single MDD episode may in fact have symptoms more consistent with adjustment disorder or may not have as severe pathology as those with repeated MDD episodes. The MDD-recurrent, higher risk group, would potentially benefit more from cognitive-behaviorally based interventions that focus on the recognition and management of negative affect as part of the cessation treatment. Such treatment, by theory, is designed to make participants more attentive of the relationship between their smoking and coping with negative affect (Rabois & Haaga, 1997). Results from this study indicate that MDD-R participants receiving CBT-based treatment do not show a greater reduction in mood disturbance than their peers receiving a health education intervention, but do show higher point-prevalent abstinence rates. A similar counterintuitive lack of comparatively greater reduction in depressed symptoms in the mood management condition was reported by Muñoz and colleagues (1997), who also reported greater abstinence rates in this condition. We surmise that smokers receiving the mood management CBT interventions develop alternative strategies for dealing with their affect that do not involve a return to smoking. Furthermore, benefits appear to generalize past the time frame immediately following treatment, as evident by higher rates of abstinence at both the 3-month and 12-month follow-up times. This finding of greater duration of effect parallels that found in CBT studies focused on major depression (Hollon, DeRubeis, & Seligman, 1992) as well as other smoking cessation programs that utilize a mood management component (Muñoz et al., 1997).

The current study has limitations that should be addressed in follow-up work. Though the study utilized a pooled sample across three clinical trials that resulted in a relatively large sample size, the number of participants reporting a single episode of MDD is relatively small, which creates both statistical and conceptual considerations. After assignment to treatment

conditions, fewer than 20 MDD-S participants were assigned to each intervention arm, which introduces the possibility of non-significant results due to decreased power. It should be noted that the current study attempted to control for power issues by using a statistic implementing repeated measurement over three follow-up evaluations (GEE); however, these results should be interpreted with caution and replication with a larger sample of MDD-S smokers is clearly indicated. Similarly, it is possible that differences in treatment outcomes may have been attributable to some third variable (e.g., gender) not directly measured in the GEE models. Though this is a possibility, post hoc analyses indicated no gender differences within any of the MDD-by-treatment condition groupings, $\chi^2(2, N = 549) = 2.68, p = .26$ and gender was found to explain a very small amount of variance in abstinence at each of the three abstinence measurements (r^2 based on ϕ coefficients $< .01$ for each evaluation time). Furthermore, no differences were noted in gender-by-treatment condition assignment within the MDD-S group, $\chi^2(1, n = 34) = 0.06, p = .80$.

The small number of MDD-S participants introduces conceptual questions as well that were not addressed in the scope of this study. Since the majority of prevalence-based literature examining major depressive disorder in smokers has not considered historical variables (such as number of prior episodes) it is unclear whether the sample reported in this study is representative of the general smoking population or is an under-representation of single-episode MDD smokers. Additional considerations include the measurement of mood in this study. Mood was measured with a self-report based on a single scale (POMS-TMD). Future studies may want to include additional measures of negative affect and depression, administered longitudinally throughout the cessation process and follow-up, to further distinguish specific facets of negative mood (e.g., anxiety, anger, depression) and whether they differ across the clinical trial with regard to

depression history and/or treatment modality. In addition, the study is conducted using an adult, community-based sample. It is unclear how these results would translate to other age groups (e.g., adolescents or older adults) or to special populations with high rates of smoking (e.g., substance abusers or individuals diagnosed with schizophrenia).

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Table 1

Generalized Estimating Equations Used to Test Study Hypotheses

Model 1:	$DEPBYTX^a = Abstinence^b$
Model 2:	$DEPBYTX^a + POMS-Base = Abstinence^b$
Model 3:	$DEPBYTX^a + POMS-Base + DEPBYTX * POMS-Base = Abstinence^b$
Model 4:	$DEPBYTX^a + POMS-END-OF-TREATMENT = Abstinence^b$
Model 5:	$DEPBYTX^a + POMS-END-OF-TREATMENT + DEPBYTX * POMS-END-OF-TREATMENT = Abstinence^b$

Note^a: DEPBYTX corresponds to the depression category by treatment interaction composite variable.

Note^b: Abstinence as measured by repeated measurements at end of treatment, 3-Month Follow-up, and 12-Month Follow-up.

Table 2

Sample Characteristics for MDD-History Participant Groups

Variable	Participant Group		
	MDD-	MDD-S	MDD-R
<i>Gender (% Within Participant Group)</i>			
Male	48.48	35.29	43.80
Female	51.52	64.71	56.20
<i>Treatment Condition (% Within Participant Group)</i>			
Health Education	48.73	47.06	45.45
CBT-Based	51.27	52.94	54.55
<i>Ethnicity (% Within Participant Group)</i>			
Caucasian	90.23	88.24	87.50
African-American	4.11	0.00	1.67
Hispanic	1.54	0.00	3.33
Asian	1.80	2.94	2.50
Other	2.31	8.82	5.00
Age (<i>M, SD</i>)	40.60 (9.30)	37.29 (8.49)	40.26 (10.15)
Age First Smoked (<i>M, SD</i>)	14.73 (3.65)	14.41 (3.77)	15.01 (3.94)
Number of Years Smoking (<i>M, SD</i>)	22.00 (9.60)	19.59 (9.06)	21.50 (11.00)
Number of Cigarettes Smoked			
Per Day - Pretreatment (<i>M, SD</i>)	23.54 (10.62)	23.89 (10.41)	23.45 (10.02)
Baseline BDI Score (<i>M, SD</i>)**	5.93 (5.03)	8.21 (6.05)	10.36 (7.92)

Note: ** Denotes omnibus group differences, $p = .00$

Table 3

Comparison of MDD History by Treatment Condition Interactions on Abstinence in Nested Generalized Estimating Equation Models

MDD History/Treatment Condition	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
MDD-Recurrent: CBT vs. HE ^a	2.18 (1.47 – 4.13)	2.12 (1.11 – 4.06)	2.93 (1.13 – 7.67)
MDD-Single: CBT vs. HE ^a	0.68 (0.22 – 2.05)	0.70 (0.22 – 2.12)	0.73 (0.24 – 2.26)
MDD-Negative: CBT vs. HE ^a	0.90 (0.65 – 1.25)	0.92 (0.65 – 1.28)	0.85 (0.56 – 1.27)
-2 Log Likelihood for Model	-1066.39	-1039.58	-1045.33

Table 4

Point Prevalence Abstinence Rates for Participants

Participant Group	<i>n</i>	End-of-Treatment	3-Month Follow-Up	12-Month Follow-Up
No History of MDD				
CBT	192	49.01	33.66	24.75
HE	202	55.73	32.29	25.52
Single Episode MDD				
CBT	16	50.00	27.78	16.67
HE	18	56.25	37.50	25.00
Recurrent MDD				
CBT	55	57.58	37.88	34.85
HE	66	38.18	21.82	18.18

Figure 1

POMS-TMD Score Differences in MDD History Groups at Baseline and End-of-Treatment

