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The Effect of Mood, Anxiety, and Alcohol Use Disorders on Smoking Cessation in Cancer Patients

Janice A. Blalock, PhD, **Cho Lam, PhD**, **Jennifer A. Minnix, PhD**, **Maher Karam-Hage, MD**, **Ellen R. Gritz, PhD**, **Jason D. Robinson, PhD**, **Paul M. Cinciripini, PhD**

University of Texas MD Anderson Cancer Center

Abstract

Smoking is highly prevalent in individuals with psychiatric disorders. The relationship between smoking and anxiety disorders has received less attention than that of depression and substance use disorders, despite the fact that anxiety disorders are the most common of mental illnesses across the globe. In this study, we investigated the relationship between psychiatric disorders, including anxiety, depression, alcohol abuse, and comorbid combinations of these primary Axis I disorders and smoking cessation, in a cohort of 1,425 cancer patients who were participating in a smoking cessation clinical program. Patients were followed prospectively and assessed for abstinence status at the end of treatment and at 6-month posttreatment. Treatment involved six to eight behavioral smoking cessation counseling sessions over a 12- to 16-week period, and up to 12 weeks of smoking cessation pharmacotherapy. We hypothesized that patients with current anxiety disorders as well as other psychiatric disorders would have lower smoking cessation rates than those with no psychiatric disorders. There were no differences in abstinence rates between patients with anxiety disorders and those with no psychiatric disorders at end of treatment or 6 months. Patients with major depression or alcohol abuse had lower cessation rates than patients with no psychiatric disorders at 6 months. Findings suggest that both major depression and alcohol abuse may adversely affect treatment outcome in cancer patients. However, these findings should be considered within the limitations of observational studies that involve comparisons between nonrandomly assigned groups.

Keywords

smoking cessation; anxiety; depression; alcohol

Smoking is highly prevalent in individuals with psychiatric disorders. Recent epidemiologic data show that smoking prevalence was 40.1% among adults who had mental illness within the previous 12 months, compared to 21.3% in adults who reported no mental illness in the previous 12 months (Lawrence, Mitrou, & Zubrick, 2009), a level that is similar to that of the general U.S. population (Centers for Disease Control and Prevention, 2005). Among individuals with current major depression and alcohol abuse or dependence, the smoking rate is estimated to be 45% and 56%, respectively (Lasser et al., 2000). Rates of nicotine

Correspondence regarding this article should be directed to Janice A. Blalock, PhD, University of Texas MD Anderson Cancer Center, Department of Behavioral Science, Unit 1330, P.O. Box 301439, Houston, TX 77230-1439. jablaloc@mdanderson.org.

dependence are higher in smokers with depression and alcohol use disorders than those with no psychiatric disorder (Grant, Hasin, Chou, Stinson, & Dawson, 2004; Pratt & Brody, 2010), and smokers with these disorders are less likely to quit (Breslau, Peterson, Schultz, Andreski, & Chilcoat, 1996; Pratt & Brody).

The relationship between smoking and anxiety disorders has received less attention than that of depression and substance use disorders, despite the fact that anxiety disorders are the most common of mental illnesses across the globe (World Health Organization World Mental Health Survey Consortium, 2004). It has been estimated that approximately 38% of individuals with an anxiety disorder are current smokers, and that among all current adult smokers, 23% meet criteria for an anxiety disorder within the past 12 months (Lawrence et al., 2009). Smoking rates for each of the anxiety disorders are approximately double the rates of nonpsychiatrically disordered smokers (21.3%) and range from 45.2% for panic, 45.2% for generalized anxiety, 42.0% for agoraphobia, 40.0% for posttraumatic stress disorder, and 35% for social phobia (Lawrence et al.).

The presence of anxiety disorders is related to nicotine dependence, withdrawal, and history of unsuccessful quit attempts (Breslau, Kilbey, & Andreski, 1991; Cougle, Zvolensky, Fitch, & Sachs-Ericsson, 2010). Current anxiety disorders have been shown to increase the risk of transition to nicotine dependence among daily smokers (Breslau, Novak, & Kessler, 2004). The presence of anxiety disorders has also been found to increase symptoms of nicotine withdrawal in a dose-response fashion (John, Meyer, Rumpf, & Hapke, 2004). Despite evidence of substantial levels of nicotine dependence in individuals with current anxiety disorders, anxiety disorders that predated the onset of daily smoking were found in one study to be unrelated to quitting in smokers within an epidemiologic sample (Breslau et al., 2004). However, in a clinical sample that consisted of smokers participating in a pharmacotherapy-based clinical trial ($N = 1,504$), lifetime history of anxiety disorder predicted poorer abstinence outcomes at 8 weeks and 6 months following the quit date relative to no history of psychiatric disorder. Having an anxiety disorder within the past year predicted poorer outcomes at 8 weeks (Piper et al., 2010). In a sample of community-recruited smokers, individuals with current anxiety disorders were at increased risk of relapse during the first week following a self-guided quit attempt, compared to smokers without current psychiatric disorders (Zvolensky et al., 2008).

Several factors have been hypothesized to explain the relationship between smoking and anxiety disorders, including smokers' belief that tobacco use reduces anxiety, high levels of anxiety sensitivity that increase sensitivity to withdrawal symptoms, use of tobacco as a coping strategy in response to life stress, and conditioning of anxiety and trauma-related cues to trigger craving (see Feldner, Babson, & Zvolensky, 2007; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007, for reviews). These factors have also been hypothesized to increase withdrawal and potentially hinder smoking cessation efforts. However, as has been noted by researchers in the field, few studies have examined the role of anxiety in cessation attempts, and additional research is needed on how smokers with current anxiety disorders respond to smoking cessation treatments (Morissette et al.; Piper et al., 2010; Ziedonis et al., 2008).

Smoking cessation among cancer patients is an important goal. A substantial body of literature demonstrates the deleterious consequences of tobacco use on cancer treatment outcomes. Smoking increases the risk of complications and can potentially diminish the effectiveness of the major cancer treatment modalities—surgery and radiation therapy (Browman et al., 1993; Chang et al., 2000; Gritz, Dresler, & Sarna, 2005; Gritz, Lam, Vidrine, & Fingeret, 2008; Zevallos et al., 2009). Although less is known about the effects of smoking during chemotherapy, smoking has the potential to exacerbate drug toxicity and side effects, contribute to impairment of immune function, and increase incidence of infection. Overall, up to 30% to 50% of cancer patients smoking at diagnosis do not quit, or relapse following initial quit attempts (Gritz et al., 2008). The prevalence of clinically significant levels of anxiety symptoms has been found to be high in cancer patients (e.g., 24% to 34%; Grassi, Travado, Moncayo, Sabato, & Rossi, 2004; Zabora, BrintzenhofeSzoc, Curbow, Hooker, & Piantadosi, 2001), and the prevalence of moderate to severe anxiety and worry has been found to increase with increasing stage of cancer disease (i.e., from successful curative treatment to treatment no longer feasible; van den Beuken-van Everdingen, 2009). The high prevalence of anxiety symptoms in cancer patients could further contribute to barriers to cessation following a diagnosis of cancer.

In this study, we investigated smoking cessation rates in cancer patients with current anxiety, depression, and alcohol use disorders compared to those patients with no disorders following 3 months of intensive smoking cessation treatment with medication and counseling. Patients were followed prospectively and assessed for abstinence status at the end of treatment (EOT) and at 6-month posttreatment. Given evidence of the high rate at which anxiety disorders co-occur with depressive and alcohol use disorders (Grant, Stinson, et al., 2004), and evidence that co-occurring disorders affect smoking prevalence (Baker-Morissette, Gulliver, Wiegel, & Barlow, 2004; Cougle et al., 2010), we examined comorbid combinations of these *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*; American Psychiatric Association, 1994) Axis I disorders separately. We hypothesized that patients with current anxiety disorders would have lower cessation rates than those with no psychiatric disorders. In addition, we hypothesized that cessation rates would be lower in patients with other forms of psychiatric disorders compared to patients with no disorders.

Method

Participants

The sample consisted of all patients (N = 1,425) referred to the MD Anderson Cancer Center Tobacco Treatment Program (TTP) from June 2006 to August 2009. The cohort was selected over this time course to provide sufficient opportunity for all in the cohort to have reached their 6-month follow-up assessment point. The program provides counseling and medication services free of charge and is available to all current smokers being followed by an MD Anderson Cancer Center physician. Patients were referred for smoking cessation treatment by physicians, nurses, and midlevel practitioners. Patients could also enter the TTP through self-referral.

Demographic and cancer-related characteristics of participants with and without psychiatric disorders are presented in Table 1. The sample was composed of 50% males and the average

age was 53 years. Eighty-one percent of the sample was White. Average smoking rate was 19 cigarettes a day at the first visit to the TTP. As shown in Table 1, patients were referred from various cancer treatment clinics, with the highest number of referrals coming from head and neck, thoracic, and breast centers. Referrals from the Cancer Prevention Center included long-term cancer survivors and those being followed with premalignant conditions.

Procedures

The TTP consists of an initial consultation, six to eight follow-up treatment sessions conducted over a 12- to 16-week period following the initial visit, and long-term abstinence follow-up assessments conducted at 6 months following the EOT. Treatment involved smoking cessation behavioral counseling at each of the visits and up to 12 weeks of smoking cessation pharmacotherapy.

The initial consultation was conducted by PhD or masters-level counselors to whom the patient was assigned for the duration of the program. This visit was 60 to 90 minutes in duration, at which time information on smoking history, nicotine dependence, cancer treatment, psychosocial history, alcohol use, depression, anxiety, and other psychiatric disorders, as well as other factors used in treatment planning, was obtained. In addition, a medical review conducted by the program physician and/or medical staff (physician assistant) determined the appropriateness of specific smoking cessation medications. Most patients were offered 12 weeks of smoking cessation medication including varenicline, bupropion, and nicotine replacement therapy (NRT; patch, gum, lozenge, inhaler, and spray) or combined medications. The choice of medication followed a clinical protocol that took into consideration past use and success on various pharmacotherapies, presence of contraindications for certain medications, and patient preference. The distribution of medications was as follows: bupropion (4%), varenicline (41%), NRT (16%), and combination medications (27%)—most commonly bupropion and NRT or two forms of NRT. Although almost all patients were offered the opportunity to receive some type of smoking cessation medication, 12% of patients declined to use medication because of the desire to avoid treatment with medication or concerns about medication side effects.

Following the initial consultation, patients were scheduled for six to eight smoking cessation-counseling sessions over the next 12 to 16 weeks, which were approximately 30 to 45 minutes in duration. Consistent with our treatment protocol, some patients may have received additional sessions if clinically warranted (i.e., had not quit yet but continued to be motivated to do so). Sessions were conducted over the phone and/or in person, depending on the patient's location, treatment schedule, individual preferences, and level of progress. The distribution of telephone sessions to in-person sessions was approximately equal. Patients received an average of 8.2 sessions ($SD = 6.0$).

Smoking cessation counseling was based on motivational interviewing and social cognitive behavioral problem–solving-based strategies. Counseling sessions included each of the counseling components recommended by the clinical practice guideline for treating nicotine dependence (e.g., problem–solving skills training and intratreatment social support; Fiore et al., 2008), as well as the use of motivational strategies for patients who were ambivalent about making changes in their smoking behavior. In addition, counselors addressed stressors

associated with cancer treatment, family, finances, and so forth as potential barriers to abstinence by providing supportive listening and assistance with problem solving.

In addition to smoking cessation behavioral counseling, some patients (~15%) received a consultation by the program addiction psychiatrist for evaluation of acute and/or severe psychiatric symptoms (e.g., depression, sleep disturbance, heavy alcohol use, anxiety) that posed functional barriers to their continued progress toward smoking cessation, or to address medication side effects, or to make adjustments in medication. This referral was not necessarily based on the diagnosis of a psychiatric disorder but could have occurred to alter the smoking cessation pharmacotherapy regimen. In the case where these consultations were sought, patients continued to be followed by their original smoking cessation counselor for cessation counseling therapy.

Measures

Psychiatric disorders were assessed at the consultation visit with the Patient Health Questionnaire (PHQ), a self-report questionnaire derived from the Primary Care Evaluation of Mental Disorders (PRIME-MD; Spitzer et al., 1994) that assesses eight of the most common *DSM-IV* Axis I disorders seen in primary care. The PHQ has diagnostic validity comparable to the original clinician-administered PRIME-MD (Spitzer, Kroenke, & Williams, 1999; Spitzer, Williams, Kroenke, Hornyak, & McMurray, 2000). Diagnoses made with the PHQ have been found to be related to increases in health care utilization and functional impairment (Fogarty, Sharma, Chetty, & Culpepper, 2008; Olfson et al., 2000). Only the major depressive disorder, anxiety and panic disorders, and probable alcohol abuse/dependence modules were administered in this study. For ease of use, “anxiety disorders” will be used to refer to the category of other anxiety and panic disorders (16.35% of total sample met criteria for other anxiety disorder and 6.81% of the sample met criteria for panic disorder); and “alcohol abuse” will be used in reference to the probable alcohol abuse/dependence category.

Severity of nicotine dependence was measured at the consultation session with the Fagerstrom Test for Nicotine Dependence (FTND), a 6-item questionnaire that assesses various components of smoking behavior (Fagerström, 1978; Fagerström, 1982; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

Abstinence and smoking rate were assessed at consultation and throughout treatment using a Timeline Follow-Back (TLFB; Brown et al., 1998) interview. For this study, we use the TLFB data to determine 7-day point prevalence abstinence at the EOT (12–16 weeks) and 6-month posttreatment. Abstinence was defined as a self-report of no smoking (not even a puff) during the previous 7 days. An intent-to-treat model was followed, counting all individuals with missing data as nonabstinent.

Given the clinical nature of our program, the varying time course of patients’ cancer therapies, and the fact that only about one-third of our patients lived within travelling distance to the MD Anderson Cancer Center, patients could not be required to return to the TTP for a biochemical assessment of abstinence. Thus, the TLFB procedure could provide abstinence assessments at EOT and 6 months for which there were no physical visits and,

as such, biochemical verification of self-reported abstinence in this study was unavailable. Given that the study focused on a medically ill population of smokers for whom there are high social and medical demands to quit, lack of biochemical verification of self-reported abstinence could have produced a bias in estimates of abstinence. However, studies of smokers at high risk of lung cancer participating in lung cancer screening trials have found extremely high rates of agreement between self-report and biochemical assessments of abstinence (98%), as have those involving patients with coronary heart disease (96%; Cox et al., 2003; Studts et al., 2006). These studies provide support for the veridicality of self-reported abstinence in populations similar to that of the current study.

Statistical Analysis

We used Proc Logistic in SAS (version 9.2) to evaluate two separate logistic regression models to examine the effects of psychiatric disorders on 7-day point prevalence smoking abstinence (0 = no, 1 = yes) at the EOT and 6-month follow-up assessment points. In each model, we regressed abstinence status on a single predictor variable (0 = no disorder, 1 = major depressive disorder, 2 = anxiety disorders, 3 = alcohol abuse, 4 = comorbid anxiety and major depressive disorders, and 5 = comorbid anxiety or major depressive disorder and alcohol abuse). For each outcome point (e.g., 7-day smoking abstinence at EOT/6 months), we also conducted a multivariate logistic regression to study the adjusted effects of the predictor variable psychiatric disorder after controlling for age, sex, and the FTND total score reported at baseline visit. Finally, cross-tabulations were used to calculate the prevalence of abstinence for each of the six groups of patients at EOT and 6-month follow-up assessment points.

Results

No significant differences were noted between any of the psychiatric disorder and no psychiatric disorder groups for type of tobacco cessation medication (no medication, nicotine replacement, etc.), frequency of smoking cessation counseling sessions, number of cigarettes smoked per day at baseline, race, or referring clinic (see Table 1). Compared to the group of patients with no psychiatric disorders, we found a significantly higher proportion of female patients among those who met criteria for anxiety disorders, $\chi^2 = 12.5$, $p < .01$, and for comorbid anxiety and depressive disorders, $\chi^2 = 27.6$, $p < .01$. Furthermore, patients who were diagnosed with alcohol abuse were significantly more likely to be male than patients with no psychiatric diagnoses, $\chi^2 = 10.1$, $p < .01$. Analysis of variance (ANOVA) also indicated the presence of significant group differences in age $F(5, 1419) = 3.63$, $p = .003$, showing that individuals with major depressive disorder and no psychiatric disorder were approximately 3 years older than those with comorbid major depressive and anxiety disorders. Additional ANOVAs revealed group differences in level of nicotine dependence as measured by the FTND,[1] $F(5, 1226) = 3.71$, $p < .01$. Individuals with major depressive disorder or comorbid anxiety and major depressive disorder had significantly higher levels of nicotine dependence at baseline than those with no disorder.

[1]Baseline FTND score was missing from 193 patients. Because of the large number of patients with missing baseline FTND scores, all analyses reported in this article were repeated, including only patients with a baseline FTND score. Excluding patients with missing FTND scores did not significantly alter any of the reported results.

Because there were significant differences between no psychiatric disorder and psychiatric disorder groups in gender, age, and nicotine dependence, these variables were controlled for in the main analyses.

Table 2 shows the results from two separate logistic regression models that examined the association between psychiatric disorder and smoking abstinence at the EOT and 6-month posttreatment assessment points. At EOT, cancer patients who met criteria for major depressive disorder (Wald $\chi^2 = 4.55$, $p = .03$), comorbid anxiety and major depressive disorders (Wald $\chi^2 = 5.25$, $p = .02$), alcohol abuse (Wald $\chi^2 = 3.90$, $p = .05$), and comorbid anxiety and/or major depressive disorders and alcohol abuse (Wald $\chi^2 = 7.03$, $p < .01$) were significantly less likely than those with no disorder to achieve 7-day abstinence. The model was reanalyzed, this time controlling for the three variables (i.e., age, sex, and FTND score) that differed significantly among groups at baseline. When these covariates were included in the model, differences between the psychiatric disorder groups and no disorder group were no longer significant at EOT. When individual estimates were examined, results showed that the effect was greatest for FTND.

At 6-month posttreatment, compared to patients with no disorder, those with major depressive disorder (Wald $\chi^2 = 3.58$, $p = .05$), alcohol abuse (Wald $\chi^2 = 4.33$, $p = .04$), and comorbid anxiety and/or major depressive disorder and alcohol abuse (Wald $\chi^2 = 5.17$, $p = .02$) were significantly less likely to report 7-day abstinence. Using the same analytic approach that we used for the EOT assessment point, we reran the model with age, sex, and baseline FTND score as covariates. The new model revealed significant differences in 7-day abstinence between patients with alcohol abuse and patients with no disorder (Wald $\chi^2 = 4.09$, $p = .04$) and between patients with major depressive disorder and those with no disorder (Wald $\chi^2 = 3.86$, $p = .05$).

Adding the covariates age, sex, and baseline FTND score to the model eliminated the significant differences in abstinence found at EOT for each of the psychiatric disorders groups. At 6 months, differences were also eliminated between patients with comorbid anxiety and major depressive disorders, and those with no disorder, as well as between patients with comorbid anxiety or depressive disorders and alcohol abuse, and those with no disorder. To better understand the relationship among these comorbid diagnostic groups and age, sex, nicotine dependence, and smoking abstinence, we conducted two separate logistic regressions, one including patients with comorbid anxiety and major depressive disorders and patients with no disorder, and another including patients with comorbid anxiety and/or depressive disorders and alcohol abuse, in comparison to patients with no disorder. For both models, there was a significant main effect for baseline FTND only, suggesting that although patients in either diagnostic group were significantly less likely than those with no disorder to achieve abstinence at EOT and 6 months, the abstinence differences could be explained primarily by differences in level of nicotine dependence, which was higher at baseline in patients in the psychiatric diagnostic groups than in patients in the no psychiatric disorder group.

Discussion

The goal of this study was to examine whether the presence of current anxiety and other psychiatric disorders was associated with poorer abstinence outcomes in cancer patients following intensive smoking cessation treatment with counseling and medication. We hypothesized that individuals who entered treatment with current anxiety, depressive and alcohol use disorders would have lower abstinence rates at EOT and 6 months, compared to those who entered treatment without current psychiatric disorders. Given evidence of the high rate at which anxiety disorders co-occur with depressive and alcohol use disorders (Grant, Stinson, et al., 2004), and evidence that co-occurring disorders affect smoking prevalence (Baker-Morissette et al., 2004; Cougle et al., 2010), we also examined abstinence outcomes in patients with anxiety disorders, comorbid with either depression or depression and alcohol abuse, separate from that of individuals with just one disorder.

Although we did not find support for the hypothesis that individuals with anxiety disorders alone fared more poorly than individuals with no psychiatric disorder in terms of cessation success, we did note poorer cessation outcomes for those with either major depression or alcohol abuse. In the unadjusted models, the odds of quitting smoking did not differ between smokers with no current psychiatric disorder in comparison to those with anxiety disorders, at either EOT or the 6-month posttreatment assessment points, whereas those with major depression alone, alcohol abuse alone, comorbid anxiety and depression (at EOT only), and comorbid depression and/or anxiety and alcohol abuse quit significantly less often than those with no psychiatric disorder at both time points. However, this finding is qualified by the fact that in an adjusted model that controlled for age, sex, and baseline level of nicotine dependence, abstinence differences between each of the psychiatric groups and the no psychiatric group were attenuated, with the exception of major depression alone and alcohol abuse alone, which remained significant at the 6-month posttreatment assessment point. These reductions in abstinence differences were primarily attributable to the influence of nicotine dependence as a covariate. Nicotine dependence has been found to be more highly prevalent and severe in smokers with psychiatric disorders compared to smokers with no psychiatric disorders (Breslau, 1995; Grant, Hasin, et al., 2004; Lawrence et al., 2009; Schmitz, Kruse, & Kugler, 2003; Xian et al., 2007). Moreover, a dose-response relationship has been found between the number of comorbid psychiatric disorders, level of dependency, and severity of withdrawal in some (Lasser et al., 2000; John et al., 2004), but not all (Weinberger, Desai, & McKee, 2010), studies. Our findings further highlight the importance of nicotine dependence in smokers with current psychiatric disorders and the importance of providing enhanced tobacco cessation treatments that include both counseling and medication when working with this group of smokers.

The reductions in abstinence differences at EOT in the adjusted model for patients in the major depression alone and alcohol abuse alone groups were primarily attributable to the influence of nicotine dependence as a covariate. During the active treatment period, none of the groups differed in terms of the distribution of smoking cessation pharmacotherapies or in the intensity (frequency) of smoking cessation counseling sessions. Nevertheless, in a clinically based program such as ours, much of the content is individualized according to the needs of the patient. One possible explanation for these findings is that the two active

treatment components, present up to EOT, served to equalize the effects of the psychiatric disorder, given the primary focus on the smoking behavior of the individual. Perhaps some element of the counseling was calibrated to the level of dependence of the individual. However, when the active treatment phase was completed, those who entered treatment with either major depression or alcohol abuse alone relapse more often than those with no psychiatric disorder, despite any compensation for such effects during the treatment period. Our program, although manualized, does provide latitude to program counselors, allowing for individualized tailoring of counseling content. However, it is not possible in our setting to quantify such differences so this may be a highly speculative explanation at best. Suffice it to say, however, that consistent with the literature (Brown et al., 2001; Cooney et al., 2007; Cooney et al., 2009; Joseph, Willenbring, Nugent, & Nelson, 2004; McClure, Wetter, de Moor, Cinciripini, & Gritz, 2002; Piper et al., 2010; Ziedonis et al., 2008), individuals with major depression or alcohol abuse do have a more difficult time staying abstinent after treatment ends than those with no disorder, suggesting a potentially chronic impact of these disorders on the course of treatment.

The results for those with anxiety disorders alone and for those with anxiety disorders comorbid with either depression or depression and alcohol abuse are more difficult to explain. Those with anxiety disorders alone did not differ from those with no disorder at either time point, in the main analysis nor in the model adjusting for the covariates of age, sex, and level of dependence. In fact, this group had the highest cessation rates among the psychiatrically disordered groups—approximately 40% and 45% at EOT and 6 months posttreatment, respectively, which is high by most treatment standards and similar to that of patients with no psychiatric disorders in the current study. In the unadjusted model, in comparison to those with no disorder, both comorbid groups quit significantly less often at EOT, but only those with comorbid alcohol abuse had poorer cessation outcome at 6 months. In the adjusted model, none of the comorbid groups (anxiety and depression, anxiety and/or depression and alcohol) differed from those with no disorder at either EOT or 6 months.

It is important to note that, in contrast to the current study findings of no differences between smokers with anxiety disorders and those with no disorders, a recent study, which examined differences in cessation between healthy smokers with and without psychiatric disorders following smoking cessation treatment, found that participants with current or history of anxiety disorders were less likely to be abstinent than smokers with no history of psychiatric disorder (Piper et al., 2010). Our failure to find abstinence differences between smokers with anxiety disorders and those with no psychiatric disorders could be related to problems with measurement of anxiety disorders in this study. The PHQ was developed for use as a screening measure for common psychiatric disorders in a general medical setting. The ability of the PHQ to correctly identify those who have panic and generalized anxiety disorder and those who do not has been found to be satisfactory in primary care patients, medical outpatients, older adults, and general hospital inpatients (Diefenbach, Tolin, Meunier, & Gilliam, 2009; Diez-Quevedo, Rangil, Sanchez-Planell, Kroenke, & Spitzer, 2001; Lowe et al., 2003; Persoons, Luyckx, Desloovere, Vandenberghe, & Fischler, 2003; Spitzer et al., 1999). However, it is possible that measurement of anxiety, especially generalized anxiety, is problematic in patients who are undergoing assessment and treatment for cancer. The PHQ “other” anxiety scale includes several somatic items. Use of somatic

items to assess anxiety and depressive disorders in medically ill patients has been criticized because of the possibility that these symptoms could be attributed to either medical or psychiatric conditions (Carroll, Kathol, Noyes, Wald, & Clamon, 1993). It is also important to note that the prevalence of anxiety disorders within clinical samples of cancer patients (2% to 12%) is low (Derogatis et al., 1983; Grassi, Sabato, Rossi, Marmai, & Biancosino, 2009; Keller et al., 2004; Kissane et al., 2004; Ozalp et al., 2008; Pasquini et al., 2006) in comparison to that of adjustment disorders with anxious or mixed anxiety and depressed mood (19% to 36%; Derogatis et al., 1983; Pasquini et al., 2006). It is possible that patients meeting criteria for PHQ anxiety disorders may have better fit criteria for adjustment disorder. In either case, anxiety symptoms may have been more situational in nature for this group of smokers and reflective of the circumstances surrounding a cancer diagnosis.

Although one could allow for the possibility of measurement error or symptoms of anxiety being more transient, particularly in the anxiety disorders alone group, it would still be expected that those with comorbid disorders would in fact quit less often than those with no disorder. This is true only in the unadjusted model, where comorbid anxiety and/or depression and alcohol abuse is predictive of lower cessation rates at EOT and 6 months and comorbid anxiety and depression is associated with poorer cessation at EOT. Controlling for nicotine dependence renders these effects nonsignificant. As noted previously, our smoking cessation program of combined pharmacotherapy and intensive individualized counseling may be effective at neutralizing the effects of these comorbid psychiatric conditions during the active treatment phase, as might be the case for major depressive disorder alone and alcohol abuse alone. However, in contrast to smokers initiating treatment with either major depression or alcohol abuse alone, those with comorbid disorders continue to fare favorably in comparison to those with no disorder through the 6-month follow-up. It is possible that those with either major depression or alcohol abuse alone have more chronic conditions that persist after smoking cessation treatment is completed, whereas those with multiple conditions for reasons that cannot be readily explained present with symptoms that are either more amenable to longer term effects of our treatment or are more transitory in nature, as noted previously. Unfortunately, in this clinical sample, we do not have a diagnostic measure of chronicity, such as could be derived from the *Structured Clinical Interview for DSM-IV Disorders* (First, Spitzer, Gibbon, & Williams, 2001), nor do we have repeated measures of psychiatric symptoms on the PHQ over the course of treatment and follow-up.

Our findings should be considered within the limitations that are inherent in observational studies involving comparisons between nonrandomly assigned groups where treatment varies according to the clinical needs of individual patients, and where the frequency and extent of measurement is limited to the clinical needs of the patients and feasibility of a real-world setting. In addition, smokers in this study were undergoing cancer treatment or were in follow-up care after cancer treatment. There is evidence that cancer patients differ from the general population of smokers in several ways, including having greater motivation to quit (Ostroff et al., 1995), high rates of quit attempts and cessation in individuals with smoking-related cancers (Gritz, Nisenbaum, Elashoff, & Holmes, 1991; Ostroff et al.; Walker et al., 2006), and delayed relapse associated with cancer treatments that interfere with smoking behavior (Gritz, Schacherer, Koehly, Nielsen, & Abemayor, 1999). The effects of psychiatric conditions on smoking cessation in this group of patients may be different

than in the general population for these and other reasons we have suggested in this discussion. Nevertheless, our findings suggest that both major depression and alcohol abuse may adversely affect treatment outcome even among cancer patients, particularly after active treatment has ended.

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TABLE 1.

Baseline Demographic and Smoking Characteristics

Variable	Major Depressive Disorder (*N* = 194) Mean (*SD*)/ %Within Group (freq)	Anxiety Disorders[a] (*N* = 53) Mean (*SD*)/ % Within Group (freq)	Alcohol Abuse[b] (*N* = 92) Mean (*SD*)/ % Within Group (freq)	Comorbid Anxiety[a] and Depressive Disorders (*N* = 192) Mean (*SD*)/ % Within Group (freq)	Comorbid Anxiety[a] Depressive Disorders and Alcohol Abuse[b] (*N* = 63) Mean (*SD*)/ % Within Group (freq)	No Psychiatric Disorder (*N* = (831) Mean (*SD*)/ % Within Group (freq)	Total (*N* = 1,425) Mean (*SD*)/% (freq)
Age (years)*	54.5 (11.3)$_1$	50.8 (12.0)$_{1,2}$	53.4 (11.0)$_{1,2}$	51.3 (11.5)$_2$	51.0 (11.1)$_2$	54.1 (10.7)$_1$	53.4(11.0)
Gender*							
Male	51.0 (99)	28.3 (15)	70.7 (65)	32.3 (62)	54.0 (34)	53.0 (443)	50.4 (718)
Female	49.0 (95)$_1$	71.7 (38)$_2$	29.3 (27)$_3$	67.7 (130)$_2$	46.0 (29)$_1$	46.7 (388)$_1$	49.6 (707)
Race/Ethnicity							
African American, non-Hispanic	11.3 (22)	7.6 (4)	5.4 (5)	12.5 (24)	9.5 (6)	9.6 (80)	10.1 (141)
White, non-Hispanic	80.4 (156)	81.1 (43)	82.5 (75)	78.7 (151)	76.2 (48)	79.9 (664)	81.2 (1137)
Hispanic	4.1 (8)	5.7 (3)	3.3 (3)	4.7 (9)	6.4 (4)	4.1 (34)	4.4 (61)
Other	1.6 (3)	3.8 (2)	2.2 (2)	0.5 (1)	0 (0)	2.7 (22)	2.1 (30)
Unknown[c]	2.6 (5)	1.9 (1)	7.6 (7)	3.7 (7)	7.9 (5)	3.7 (31)	2.3 (32)
Referring Clinic							
Breast	13.9 (27)	22.6 (12)	11.0 (10)	17.7 (34)	9.5 (6)	12.9 (107)	13.4 (196)
Dermatology	2.1 (4)	3.8 (2)	3.3 (3)	2.6 (5)	9.5 (6)	5.1 (42)	4.4 (62)
Gastrointestinal	7.2 (14)	3.8 (2)	5.4 (5)	5.2 (10)	3.2 (2)	6.6 (55)	6.0 (85)
Genitourinary	9.8 (19)	9.4 (5)	14.1 (13)	13.0 (25)	7.9 (5)	13.0 (108)	12.3 (175)
Head and neck	20.1 (39)	17.0 (9)	22.8 (21)	17.2 (33)	30.2 (19)	18.7 (155)	19.4 (276)
Hematology	10.3 (20)	7.6 (4)	4.4 (4)	9.4 (18)	9.5 (6)	9.6 (80)	9.3 (132)
Thoracic	17.0 (33)	13.2 (7)	14.1 (13)	15.1 (29)	15.9 (10)	13.0 (108)	14.1 (200)
Cancer prevention	8.8 (17)	11.3 (6)	18.5 (17)	5.7 (11)	14.3 (9)	11.9 (99)	9.6 (137)
Other[d]	10.8 (21)	11.3 (6)	6.5 (6)	14.1 (27)	0 (0)	9.3 (77)	11.2 (159)
Smoking rate (cigarettes/day)	20.8 (12.6)	18.6 (15.0)	21.6 (12.7)	20.4 (12.1)	20.7 (14.0)	18.8 (11.7)	19.0 (12.5)

Variable	Major Depressive Disorder (*N* = 194) Mean (*SD*)/ %Within Group (freq)	Anxiety Disorders[a] (*N* = 53) Mean (*SD*)/ % Within Group (freq)	Alcohol Abuse[b] (*N* = 92) Mean (*SD*)/ % Within Group (freq)	Comorbid Anxiety[a] and Depressive Disorders (*N* = 192) Mean (*SD*)/ % Within Group (freq)	Comorbid Anxiety[a] Depressive Disorders and Alcohol Abuse[b] (*N* = 63) Mean (*SD*)/ % Within Group (freq)	No Psychiatric Disorder (*N* = (831) Mean (*SD*)/ % Within Group (freq)	Total (*N* = 1,425) Mean (*SD*)/% (freq)
FTND[e] score *	5.4, $(2.0)_1$	5.2 $(2.5)_{1,2}$	5.0 $(2.3)_{1,2}$	5.3 $(2.1)_1$	5.1 $(2.7)_{1,2}$	4.7 $(2.2)_2$	4.9 (2.2)
Smoking Cessation Medication							
No medication	10.8 (21)	9.4 (5)	10.9 (10)	13.0 (25)	11.1 (7)	13.2 (110)	12.5 (178)
Bupropion	5.7 (11)	5.7 (3)	1.1 (1)	4.2 (8)	3.2 (2)	4.0 (33)	4.1 (585)
Varenicline	41.2 (80)	39.6 (21)	44.6 (41)	33.9 (65)	39.7 (25)	42.5 (353)	41.1 (585)
Nicotine replacement	14.4 (28)	13.2 (7)	15.2 (14)	14.1 (27)	17.5 (11)	16.6 (138)	15.8 (225)
Combination treatment	27.8 (54)	32.1 (17)	28.3 (26)	34.9 (67)	28.6 (18)	23.7 (197)	26.6 (379)
Counseling Sessions	8.4 (6.3)	9.2 (6.9)	8.3 (5.1)	8.3 (6.8)	7.6 (6.3)	8.2 (5.6)	8.2 (6.0)

Note.

[a] Includes panic and other anxiety disorders.

[b] Probable alcohol abuse/dependence.

[c] Patients had the option of not answering the question about race.

[d] Referring clinics with less than 2% of total.

[e] FTND = Fagerstrom Test for Nicotine Dependence. Means in the same row that do not share numeric subscripts differ at $p < .05$ on Tukey's Studentized Range Test for age and FTND and chi–square for sex.

* $p < .01$.

TABLE 2.

Abstinence Rates and Odds Ratios at End of Treatment and 6-month Follow-up

		Original Model		Adjusted Model	
	% Abstinent	Wald Chi-Square	OR (95% CI)	Wald Chi-Square	AOR[a] (95% CI)
Abstinence at EOT					
Psychiatric disorder					
Major depressive disorder	36.1	4.55*	.70 (0.51–0.97)*	2.30	.76 (0.53–1.09)
Anxiety disorder[b]	39.6	.48	.82 (0.46–1.44)	.003	.98 (0.54–1.80)
Alcohol abuse[c]	33.7	3.90*	.63 (0.40–0.99)*	3.34	.63 (0.38–1.03)
Comorbid anxiety[b] and major depressive disorders	35.4	5.25*	.68 (0.49–0.95)*	1.22	.82 (0.57–1.17)
Comorbid anxiety[b] major depressive disorder, and alcohol abuse[c]	27.0	7.03**	.46 (0.26–0.82)**	2.73	.60 (0.33–1.10)
No Psychiatric disorder	44.5				
Abstinence at 6-month follow-up					
Psychiatric disorder					
Major depressive disorder	37.6	3.58*	.73 (0.53–1.00)*	3.86*	.70 (0.49–0.99)
Anxiety disorder[b]	45.3	.0005	1.00 (0.58–1.76)	.50	1.24 (0.69–2.21)
Alcohol abuse[c]	33.7	4.33*	.62 (0.39–0.97)*	4.09*	.60 (0.37–0.99)
Comorbid anxiety[b] and major depressive disorders	38.0	3.19	.75 (0.54–1.03)	1.32	.81 (0.57–1.16)
Comorbid anxiety,[b] major depressive disorder, and alcohol abuse[c]	30.2	5.17*	.53 (0.30–0.92)*	2.76	.61 (0.34–1.09)
No psychiatric disorder	45.1				

Note. OR = odds ratio; AOR = age-adjusted odds ratio; CI = confidence interval; EOT = end of treatment.

[a]Adjusted ORs were calculated in models with the predictor variable while controlling for covariates that included age, sex, and FTND score at baseline.

[b]Includes panic and other anxiety disorders.

[c]Probable alcohol abuse/dependence.

*$p < .05$.

**$p < .01$.