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The Effect of Social Anxiety on Urge and Craving among Smokers with and without Anxiety Disorders

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Abstract

Background—Despite the often social nature of smoking, relatively little research has been conducted on the relationship between smoking and social anxiety disorder (SAD).

Method—Participants (N = 99) included 34 smokers without current mental health disorders, 37 smokers with SAD, and 28 smokers who met criteria for other anxiety disorder diagnoses (e.g., panic disorder or generalized anxiety disorder, but not SAD). Nicotine and placebo patches were administered to participants in a counterbalanced manner across two assessment days. Urge and craving were assessed before and after a 5-hour nicotine absorption/deprivation period.

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Contributors

Dr. Kimbrel developed the initial idea for this manuscript, conducted the data analyses, helped write the first draft of the manuscript, and helped with manuscript revisions. Dr. Morissette helped design the study, oversaw all aspects of data collection, helped write the first draft of the manuscript, and helped with manuscript revisions. Dr. Gulliver helped design the study and helped with manuscript revisions. Kirsten Johnson helped with data collection and helped with manuscript revisions. Dr. Zvolensky helped with manuscript revisions. All authors have approved and contributed to the final manuscript.

Conflict of Interest

No conflicts to declare.

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Results—Compared to smokers without current mental health disorders, smokers with SAD did not report greater nicotine dependence, but did endorse greater motivation to use nicotine to avoid negative outcomes. In addition, after controlling for demographic variables, smoking characteristics, pre-deprivation urge and craving, and other anxiety/depression symptoms, social anxiety symptoms uniquely predicted urge and craving in the placebo patch condition; however, social anxiety had no influence on urge and craving in the nicotine patch condition.

Conclusions—These findings suggest that one potential reason that smokers with SAD may have worse cessation outcomes is that they may experience higher levels of craving and urge to smoke during quit attempts. Thus, during a quit attempt, particularly in the absence of nicotine replacement therapy, smokers with SAD are likely to benefit from additional treatment aimed at managing or reducing their social anxiety symptoms.

Keywords

Nicotine; Tobacco; Smoking; Social Anxiety; Anxiety; Craving

1. INTRODUCTION

The relationship between smoking and some anxiety disorders is fairly well-established, particularly with respect to panic disorder/agoraphobia and post-traumatic stress disorder (Morissette et al., 2007; Zvolensky et al., 2003; Lasser et al., 2000). In contrast, despite the often social nature of smoking, far less attention has been paid to the relationship between smoking and social anxiety disorder (SAD). This neglect in the literature is surprising given previous estimates that approximately 14-32% of individuals with SAD are tobacco smokers (e.g., Morissette et al., 2007), with lower point prevalence estimates likely reflecting the exclusion of frequently comorbid alcohol and substance use disorders (cf. Baker-Morissette et al., 2004).

Social learning theory (Marlatt and Gordon, 1985) may be especially relevant to understanding the relationship between continued tobacco use, nicotine dependence, and SAD. Social learning theory purports that relapse to smoking occurs in response to high-risk situations, including stressful emotional and social situations. Smoking-related stimuli are also theorized to trigger increased cravings and urges (e.g., Ferguson and Shiffman, 2009; Tong et al., 2007). According to this theory, decreased self-efficacy, in combination with the positively reinforcing value of the drug, culminates in a relapse to smoking. Following this lapse, the person experiences conflict and may resort to smoking to cope. Thus, continued drug use is driven by the positive reinforcement of the drug as well as negative reinforcement through relief of negative affect. Consistent with social learning theory, early studies laid a foundation of research examining the interrelationship between smoking and social stressors (e.g., Hatch et al., 1983; Niaura et al., 1992). More recently, Buckner and Vinci (2013) found that among undergraduate smokers (N = 91), social anxiety was associated with smoking motives and daily smoking status among women and dependence severity among men. Similarly, in an undergraduate sample of 38 regular smokers, Watson and colleagues (2012) found that social anxiety predicted smoking to cope behaviors and number of cigarettes that participants estimated they would need to smoke to feel comfortable in social situations. Interestingly, social anxiety symptoms predicted increases

in craving during nicotine deprivation, but not during nicotine satiation (via cigarettes), suggesting that social anxiety might not only contribute to maintenance of smoking behaviors but also have differential effects depending on smoking status/nicotine state.

With respect to SAD, smoking, and their temporal relationship, Johnson et al. (2000) found that tobacco use did not prospectively confer increased risk for the development of SAD. However, reciprocal relationships between social anxiety and risk for nicotine dependence have been reported (e.g., Dierker et al., 2001; Sonntag et al., 2000). In addition, Piper et al. (2010) found that patients with SAD or panic attacks had greater quit-day negative affect compared to smokers without anxiety disorders. Smokers who met lifetime criteria for anxiety disorders were also less likely to be abstinent at 8 weeks and 6 months following a quit attempt relative to smokers without anxiety disorders, although differences were not found among smokers with anxiety disorders. An analysis of National Comorbidity Survey-Replication data also failed to find that SAD uniquely influenced smoking outcomes at 12 months; however, SAD was associated with lifetime heavy smoking, nicotine dependence, and failed quit attempts (Cogle et al., 2010). These findings are consistent with those of Goodwin and colleagues (2012) who found that SAD was associated with increased risk for nicotine dependence among cigarette users [odds ratio (OR) = 1.69] after accounting for demographic variables and other psychiatric disorders.

To date, limited research has evaluated predictors of response to nicotine-replacement therapy (NRT) versus placebo in smokers with SAD. In a placebo-controlled laboratory assessment investigating the effects of NRT among smokers with and without anxiety disorders (including SAD), Morissette et al. (2012) found that although NRT attenuated urge during a general deprivation period, no significant differences were observed between those with and without anxiety disorders. Given the accumulating literature demonstrating differences in smoking characteristics between the anxiety disorders (Morissette et al., 2007), these findings led to the question of whether subsets of smokers with certain anxiety disorders would have differential responses to NRT. Social anxiety was of particular interest given findings by Watson et al. (2012) that social anxiety predicted increased craving during nicotine deprivation, but not during nicotine satiation via cigarettes. To that end, this study aimed to expand upon Morissette et al. (2012) and Watson et al. (2012) to understand the relationship between social anxiety and transdermal nicotine. We hypothesized that, compared to smokers without a mental health disorder, smokers with SAD would be more nicotine dependent and more likely to smoke to reduce negative affect (i.e., negative reinforcement). We also hypothesized that social anxiety symptoms would uniquely predict urge and craving in the placebo patch condition after controlling for demographic variables, smoking characteristics, pre-deprivation urge and craving, and other anxiety/depression symptoms.

2. METHOD

2.1 Participants

Smokers with and without anxiety disorders were recruited through advertisements in local newspapers and websites as part of a larger cue-reactivity study (Morissette et al., 2012). To be eligible, participants had to be 18 or older, English-speaking, daily moderate to heavy

smokers [10-40 cigarettes per day (cpd) for at least one year] with a CO level of 8 ppm or higher. In addition, participants had to either meet full diagnostic criteria for at least one anxiety disorder (SAD, panic disorder, generalized anxiety disorder [GAD], obsessive compulsive disorder [OCD], post-traumatic stress disorder [PTSD]) or else have no current psychiatric diagnosis to be included in the no mental health disorders group. Because comorbidity is common among the anxiety and mood disorders, participants in the anxiety disorder groups were not excluded from the study if they met criteria for additional disorders with the exception of current substance use disorders and psychosis, as smokers with these conditions would likely have qualitatively different smoking patterns. Participants were also excluded if they reported suicidality warranting crisis intervention or had patch contraindications (e.g., an allergy to adhesive tape, heart disease, or high blood pressure [defined as 140/90 or higher]). Participants taking psychotropic medications were also required to be on a stable dose for at least three months so that reported symptoms were not reflective of starting or stopping medications.

The final sample of 99 participants contained 37 smokers with SAD (as well as a variety of other disorders), 28 smokers who met criteria for another anxiety disorder diagnosis (e.g., panic disorder, GAD, but not SAD), and 34 smokers without current mental health disorders. With respect to diagnostic comorbidity, the smokers with SAD group had an average of 2.6 ($SD = 1.1$) current mental health disorders (including SAD), whereas smokers with other anxiety disorders had an average of 2.3 ($SD = 1.4$) mental health disorders. This difference was not statistically significant [$t(59) = 1.116, ns$]. Other current disorders present within the smokers with SAD group included depression ($n = 15$), panic disorder ($n = 13$), specific phobia ($n = 10$), OCD ($n = 9$), GAD ($n = 3$), PTSD ($n = 2$), and bipolar disorder ($n = 1$). The smokers with other anxiety disorders group included specific phobia ($n = 14$), OCD ($n = 12$), GAD ($n = 9$), PTSD ($n = 6$), panic disorder ($n = 6$), and depression ($n = 5$).

Across groups, the sample was comprised primarily of European-Americans ($n = 64$) and African-Americans ($n = 25$). Approximately 41% of the sample was female ($n = 41$). Participants' mean age was 39.5 years ($SD = 11.8$). Participants had 13.8 years ($SD = 2.2$) of education on average and reported smoking an average of 18.9 cigarettes per day ($SD = 6.4$) for 13.5 years ($SD = 10.2$). Participants' mean score on the Fagerström Test for Nicotine Dependence (Heatherton et al., 1991) was 3.9 ($SD = 1.3$) across all three groups, reflecting moderate levels of dependence among the sample.

2.2 Procedures

Procedures are detailed in Morissette et al. (2012). Briefly, initial eligibility was determined during a telephone screen, after which potential participants were scheduled for two assessment sessions with 48 hours in between. Participants were instructed to refrain from using alcohol for 12 hours prior to each assessment day to account for acute withdrawal or the consequences of recent intoxication. They were also instructed to drink caffeine and smoke as usual to ensure they were not in caffeine and nicotine withdrawal prior to the assessment day. Each assessment day was identical, except for the diagnostic interview and

standardized measures, which were completed on opposite days during the 5-hour patch absorption period in a counterbalanced fashion.

At the beginning of the first assessment day, smoking status was verified by a CO monitor, blood pressure was taken, and a pregnancy test was given to female participants. Participants then smoked one cigarette and waited a standardized deprivation period of 30 minutes, during which time the pre-patch absorption measures of urge and craving were completed. Following the 30-minute deprivation period, participants were randomly given either the nicotine (21 mg) or placebo patch. Whichever patch was given during the first day, the alternate was assigned on the second day. The randomization was preassigned so that patch status was double-blind between the investigator and participants. Participants then waited a five-hour patch absorption (nicotine group) or deprivation (placebo) period. The 5-hour absorption period was chosen to ensure that nicotine fully absorbed across participants. Participants completed a diagnostic assessment on one assessment day and trait self-report measures on the other in a counter-balanced fashion to protect against order effects. During the remaining time of the 5-hour absorption period, participants were allowed to read a magazine, book, or watch a movie (containing no smoking cues) in a private office. During the last 15 minutes of each 5-hour absorption period, participants completed identical measures to those completed prior to the absorption period.

2.3 Measures

2.3.1 Semi-Structured Diagnostic Clinical Interview—The *Anxiety Disorders Interview Schedule – Fourth Edition (ADIS-IV)* (Brown et al., 1994) was used to assess psychiatric disorders. The ADIS-IV has sound psychometric properties, including good diagnostic agreement (Brown et al., 2001). The ADIS-IV was administered by either a licensed clinical psychologist (SBM) or a trained research assistant who underwent an extensive training and certification process, including being required to match perfectly with a licensed clinical psychologist on three interviews. All interviews were reviewed and supervised by a licensed clinical psychologist (SBM).

2.3.2 Measures of Urge and Craving—During the 30-minute pre-absorption period and during the last 15 minutes of the 5-hour absorption period, participants completed the Questionnaire of Smoking Urges (QSU-32; Tiffany and Drobes, 1991) and the Brief Questionnaire of Smoking Urges (QSU-Brief; Cox et al., 2001) to assess urge and craving in the two different conditions (i.e., placebo patch condition vs. nicotine patch condition). The QSU-32 is a 32-item self-report measure of urge and craving that contains four subscales: QSU-32: Desire to Smoke, QSU-32: Anticipation of Positive Outcomes, QSU-32: Relief of Withdrawal or Negative Affect, and QSU-32: Intention to Smoke. The QSU-Brief is a 10-item version of the QSU-32 that was also administered to participant to obtain an overall urge score. Both measures have demonstrated good psychometric properties in previous research with smokers (Cox et al., 2001; Tiffany and Drobes, 1991).

2.3.3 Self-Report Measures of Smoking Characteristics—A battery of self-report measures was administered to participants at the beginning of the 5-hour absorption periods to assess demographic variables, smoking characteristics, nicotine dependence, and

individual differences in nicotine reinforcement. The self-report measures are unlikely to have been influenced by deprivation during the 5-hour period, as they were administered at the beginning of the assessment period and were not used to assess momentary states, but rather ongoing characteristics. A demographic questionnaire was included to assess relevant demographic (age, gender) and smoking characteristics (cigarettes smoked per day, years as a smoker). The Fagerström Test for Nicotine Dependence (FTND; Heatherton et al., 1991) was administered to quantify current level of nicotine dependence. The *Michigan Nicotine Reinforcement Questionnaire* (MNRQ; Pomerleau et al., 2003) was administered to assess the degree to which participants were motivated to smoke by either positive (i.e., obtaining positive outcomes) or negative reinforcement (i.e., terminating or avoiding negative outcomes) motives. The MNRQ contains a total of 13-items and includes a 5-item Positive Reinforcement scale and an 8-item Negative Reinforcement scale, both of which have demonstrated good internal consistency and concurrent validity in previous research (Pomerleau et al., 2003).

2.3.4 Self-Report Measures of Anxiety and Depression—Self-report measures administered at the beginning of the 5-hour absorption periods were also used to assess key symptoms of anxiety and depression. The Albany Panic and Phobia Questionnaire (APPQ; Rapee et al., 1995) is a 27-item self-report measure that contains a 9-item Agoraphobia subscale, an 8-item Interoceptive subscale, and a 10-item Social Phobia subscale. Rapee and colleagues (1995) found the APPQ to demonstrate good internal consistency, test-retest reliability, and convergent/divergent validity. For example, compared with the Agoraphobia and Interoceptive subscales, the Social Phobia subscale had a stronger association with SAD diagnosis and another measure of social anxiety. The APPQ is also sensitive to change during treatment (Rapee et al., 1995). The Anxiety Sensitivity Index (Reiss et al., 1986; 16 items) assessed participants' level of anxiety sensitivity, which has been associated with many aspects of smoking behavior in prior research (e.g., Morissette et al., 2007). Finally, the 7-item Depression subscale from the Depression, Anxiety, Stress Scales (DASS; Lovibond and Lovibond, 1992; 21 items) assessed depressive symptoms, the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990; 16 items) assessed symptoms of generalized anxiety disorder, and the Maudsley Obsessional Compulsive Inventory (MOCI; Hodgson and Rachman, 1977; 30 items) assessed symptoms of obsessive-compulsive disorder.

2.4 Data Analysis Plan

ANOVA was used to test Hypothesis 1, whereas hierarchical linear regression analysis was used to test Hypothesis 2. Post-nicotine absorption scores for the QSU-Brief and the four QSU-32 subscales (i.e., Desire to Smoke, Anticipation of Positive Outcomes, Relief of Withdrawal or Negative Affect, Intention to Smoke) served as the criterion variables in the hierarchical linear regression models. Separate sets of regressions were conducted for each patch condition. The order of entry of variables into the regressions was identical for all of the regressions. Demographic variables (gender, age, years of education) were entered in step 1; smoking characteristic variables (cigarettes per day, FTND total, MNRQ scores) were entered in step 2 along with the pre-nicotine absorption scores for the criterion variables. For example, in the regression predicting post-absorption QSU-Brief total scores,

the pre-absorption QSU-Brief total scores were entered into step 2 to partial out pre-absorption differences in urge. Other anxiety and depression symptom scores (APPQ: Agoraphobia, APPQ: Interoceptive, ASI, MOCI, PSWQ, and DASS-Depression) were entered in the third step in order to account for their variance before examining the unique effects of social anxiety symptoms on urge and craving symptoms. Finally, APPQ: Social Phobia scores were entered in the fourth step of each of the regressions in order to examine the impact of social anxiety on urge and craving after accounting for variance due to demographic characteristics, smoking characteristics, positive and negative reinforcement, and other anxiety and depression scores, all of which might be expected to influence urge and craving scores.

3. RESULTS

3.1 Group Analyses

ANOVA and chi-square tests were used to test for possible group differences on demographic characteristics, smoking characteristics, nicotine dependence, and nicotine reinforcement. The three groups did not differ significantly on age [$F(2, 96) = 2.046, ns$], years of education [$F(2, 96) = .40, ns$], psychotropic medication use [$\chi^2 = .626(2), ns$], or gender [$\chi^2 = 4.8(2), ns$]. Groups also did not differ with respect to smoking characteristics, including cigarettes per day [$F(2, 96) = .427, ns$], years as a smoker [$F(2, 96) = 1.398, ns$], or nicotine dependence, as assessed by the FTND [$F(2, 96) = .109, ns$]. In addition, as hypothesized, the groups were found to differ significantly on the Negative Reinforcement scale of the MNRQ [$F(2, 96) = 3.788, p = .026$], but not the Positive Reinforcement scale [$F(2, 96) = .709, ns$]. Post-hoc pairwise comparisons assuming unequal sample sizes were conducted using the Dunnett T3 test. These comparisons revealed that smokers with SAD ($M = 11.2, SD = 5.7$) reported significantly higher MNRQ Negative Reinforcement scores (mean difference = 3.2; $p = .027$) than smokers without current mental health disorders ($M = 8.1, SD = 4.2$). No other pairwise comparisons were statistically significant.

3.2 Correlations

Correlation matrices were generated to assess the extent to which the scales of anxiety correlated with pre-absorption smoking urge and craving (Table 1). While a wide range of correlations was observed (range: $r = .02, ns$ to $r = .43, p < .001$), in general, the majority of measures of anxiety were positively correlated with pre-absorption urge and craving across conditions. The correlations between cpd and the different scales of anxiety were also examined; however, cpd was not significantly related with any of the measures of anxiety, including APPQ: Social Anxiety, $r = .15, p = .15$, APPQ: Agoraphobia, $r = .00, p = .97$, APPQ: Interoceptive, $r = .07, p = .51$, PSWQ, $r = .01, p = .94$, MOCI, $r = -.04, p = .67$, DASS-Depression, $r = -.02, p = .84$, and ASI, $r = .06, p = .53$.

3.3 Regression Analyses

The first five regressions examined the effect of social anxiety on urge and craving in the nicotine patch condition in which participants were tobacco-deprived. As can be seen in Table 2, only the smoking characteristics variables (cigarettes smoked per day, FTND scores, MNRQ scores, and the pre-absorption urge scores) were predictive of post-

absorption urge scores across most measures of urge and craving. In addition, none of the variables examined were predictive of QSU-32 desire to smoke. Notably, none of the anxiety and depression scores, including APPQ: Social Phobia scores, accounted for unique variance in urge and craving symptoms in the nicotine patch condition.

The second set of regressions examined the effect of social anxiety on urge and craving in the placebo patch condition in which participants were both tobacco- and nicotine-deprived. As can be seen in Table 3, smoking characteristics variables (i.e., pre-absorption urge scores, MNRQ scores) were generally associated with post-absorption urge scores, though none of the smoking characteristics variables were associated post-absorption urge and craving across all five measures. In addition, as was the case in the nicotine patch condition, none of the anxiety and depression scores entered in step 3 were predictive of post-absorption urge scores. In contrast, social anxiety was a robust predictor across all five craving measures, including QSU: Brief ($\beta = .43, p < .01$), Desire to Smoke ($\beta = .37, p < .05$), Anticipation of Positive Outcomes ($\beta = .30, p < .05$), Relief of Withdrawal or Negative Affect ($\beta = .41, p < .01$), and Intention to Smoke ($\beta = .53, p < .01$) in step 4. Notably, social anxiety was the strongest predictor of urge and craving symptoms across all five measures in the placebo patch condition.

4. DISCUSSION

The primary goal of the present research was to examine smoking motives among those with SAD and the impact of social anxiety on smoking urges under two different conditions: during transdermal nicotine (i.e., tobacco deprived only) versus placebo (i.e., nicotine and tobacco deprived). Contrary to predictions, smokers with SAD did not have greater nicotine dependence; however, as expected, smokers with SAD endorsed greater negative reinforcement contingencies. In addition, consistent with prior research conducted with nicotine administration via cigarettes in undergraduates (Watson et al, 2012), social anxiety symptoms uniquely predicted craving in the placebo patch condition, but not in the nicotine patch condition. In fact, social anxiety symptoms remained predictive of smoking urges during nicotine/tobacco deprivation (placebo) even after accounting for a variety of relevant factors, including demographic variables, smoking characteristics variables, and other symptoms of anxiety and depression. Thus, while there is good evidence that NRT can reduce overall level of craving during smoking cessation (Waters et al., 2004), the findings from the present research indicate that smokers with social anxiety may benefit from concurrent treatment for social anxiety while undergoing smoking cessation treatment. Specifically, concurrent treatment for SAD could help to promote long term abstinence once NRT has been discontinued, as the findings from the present research suggest that untreated SAD could increase risk of relapse due to increased urges and cravings in response to stressful social situations.

Data from the present research are highly relevant to recent findings suggesting that smokers diagnosed with SAD are at increased risk for smoking cessation failure. Specifically, Piper and colleagues (2010) reported that only 28.6% of smokers with lifetime diagnoses of SAD were abstinent six months post-treatment after controlling for treatment type, gender, and race, whereas the abstinence rate among smokers who had never met lifetime criteria for an

anxiety disorder was significantly higher (36.0%) at six months post-treatment. Thus, the presence of SAD was associated with meaningfully worse response to smoking cessation treatment. The present research suggests that one potential reason that smokers with SAD may have worse cessation outcomes is that they may experience higher levels of craving and urge to smoke during a quit attempt (i.e., when nicotine/tobacco-deprived). During a quit attempt, and particularly in the absence of NRT, smokers with SAD may need additional treatment to manage their social anxiety, which in turn fosters increased urge. This idea is consistent with findings by McFall et al. (2010), who found that integrating smoking cessation treatment into mental health care for PTSD resulted in better quit rates and prolonged abstinence than when attending a smoking cessation clinic only. Future research could build upon this work by examining if integrating smoking cessation treatment into mental health treatment for SAD will similarly result in improved quit rates and prolonged abstinence. Additional research into the mechanisms underlying the poor response to existing smoking cessation treatments among smokers with SAD is also warranted. For example, based on the findings from the present study, one might hypothesize that smokers with SAD would experience the most severe urges and cravings when they are nicotine/tobacco-deprived and exposed to social stressors, which would presumably trigger increased levels of acute social anxiety.

A final point of interest concerns the rather large amount of unexplained variance in acute craving and urge observed among participants in both the nicotine and placebo conditions. Among participants in the nicotine condition, approximately 68-82% of the variance was unaccounted for by the regression models (Table 2). Similarly, in the placebo condition, 57-82% of the variance was unexplained by the variables examined (Table 3). Given the large number of variables included in the regression equations (e.g., demographic variables, smoking variables, anxiety variables), it is surprising that more variance was not accounted for in the models. These finding suggests that more research is needed to identify additional factors that may underlie individual differences in acute craving and urge among smokers with and without anxiety disorders.

4.1 Study Limitations

The present research had several limitations that should be considered while interpreting the results. First, our results are based on a relatively small sample. Second, although a state-of-the-art clinician interview was used to diagnose SAD, measurement of craving relied heavily on self-report. Future replication studies might consider using behavioral measures of craving such as Wilner, Hardman, and Eaton's (1995) progressive-ratio measure, an objective behavioral measure that has been shown to be sensitive to tobacco deprivation. Third, the current study included many participants with co-occurring diagnoses. While this type of design likely increases the generalizability of our results in terms of our continuous analyses of social anxiety, it may have also masked differences between the groups in the ANOVA analyses.

4.2 Conclusion

The present research found that social anxiety symptoms were uniquely predictive of smoking urges during placebo, but not nicotine, administration after accounting for relevant

demographic factors, smoking variables, pre-absorption craving and urge, and other symptoms of anxiety and depression. The specific mechanisms underlying this association remain unclear, however. Thus, additional research into the relationship between social anxiety and smoking is warranted.

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Table 1
Correlations between Anxiety Symptoms and Pre-Absorption Urge and Craving Scores by Condition

	<i>Nicotine Patch Condition</i>				
	Pre-Absorption QSU-Brief Total	Pre-Absorption Desire to Smoke	Pre-Absorption Anticipation of Positive Outcomes	Pre-Absorption Relief of Withdrawal or Negative Affect	Pre-Absorption Intention to Smoke
APPQ Social Phobia	.25*	.27**	.26**	.25*	.27**
APPQ Agoraphobia	.24*	.34**	.26**	.27**	.25*
APPQ Interceptive	.23*	.26**	.26*	.30**	.26*
PSWQ Total	.18	.29**	.21*	.27**	.25*
MOCI Total	.41***	.43***	.32**	.37***	.29**
DASS Depression	.02	.10	.08	.22*	.10
ASI Total	.17	.27**	.18	.30**	.17

	<i>Placebo Patch Condition</i>				
	Pre-Absorption QSU-Brief Total	Pre-Absorption Desire to Smoke	Pre-Absorption Anticipation of Positive Outcomes	Pre-Absorption Relief of Withdrawal or Negative Affect	Pre-Absorption Intention to Smoke
APPQ Social Phobia	.12	.16	.17	.20*	.21*
APPQ Agoraphobia	.25*	.32**	.25*	.25*	.28**
APPQ Interceptive	.17	.24*	.30**	.31**	.27**
PSWQ Total	.19	.34**	.23*	.37***	.21*
MOCI Total	.23*	.38***	.24*	.24*	.30**
DASS Depression	.09	.27**	.12	.31**	.13
ASI Total	.15	.28**	.22*	.34**	.23*

Note:

* $p < .05$;

** $p < .01$;

CPD = Cigarettes per day; FTND = Fagerström Test for Nicotine Dependence; MNRQ = Michigan Nicotine Reinforcement Questionnaire; Pos. Rein. = Positive Reinforcement scale; Neg. Rein. = Negative Reinforcement scale; APPQ = Albany Panic and Phobia Questionnaire; ASI = Anxiety Sensitivity Index; MOCI = Maudsley Obsessive Compulsive Inventory; PSWQ = Penn State Worry Questionnaire; DASS = Depression-Anxiety-Stress Scales.

Table 2
Regressions Examining the Effects of Social Anxiety on Urge during the Nicotine Patch Condition

	Nicotine Patch Condition													
	Post-Absorption QSU-Brief Total			Post-Absorption Desire to Smoke			Post-Absorption Anticipation of Positive Outcomes			Post-Absorption Relief of Withdrawal or Negative Affect			Post-Absorption Intention to Smoke	
	R ²	β		R ²	β		R ²	β		R ²	β		R ²	β
Step 1	.02			.01			.01			.02			.02	
Gender		-.06			.04			-.03			-.07			-.11
Age		.10			.10			.07			-.11			.08
Years of Education		-.09			-.07			-.07			-.02			.02
Step 2	.25			.14			.30			.35			.24	
CPD		.19			.17			.27**			.22*			.26*
FTND Total		.18			.19			.23*			.10			.13
MNRQ: Pos. Rein.		.20			.17			.36**			.11			.13
MNRQ: Neg. Rein.		-.02			.06			-.01			.15			.06
Pre-Absorption Score		.27*			.06			.01			.35**			.22*
Step 3	.07			.03			.04			.03			.02	
APPQ Agoraphobia		.26			.21			.17			.18			.12
APPQ Interoceptive		.07			-.01			-.02			-.03			.03
ASI Total		-.17			-.04			-.17			.11			-.17
MOCI Total		.04			-.05			.09			-.07			.02
PSWQ Total		-.07			.09			.04			.02			.01
DASS Depression		-.09			-.11			-.14			-.10			-.03
Step 4	.00			.01			.00			.00			.00	
APPQ Social Phobia		.10			.13			.03			-.02			-.04
Total R ²	.35			.19			.34			.39			.28	

Note:

* $p < .05$;** $p < .01$;

CPD = Cigarettes per day; FTND = Fagerström Test for Nicotine Dependence; MNRQ = Michigan Nicotine Reinforcement Questionnaire; Pos. Rein. = Positive Reinforcement scale; Neg. Rein. = Negative Reinforcement scale; APPQ = Albany Panic and Phobia Questionnaire; ASI = Anxiety Sensitivity Index; MOCI = Maudsley Obsessive Compulsive Inventory; PSWQ = Penn State Worry Questionnaire; DASS = Depression-Anxiety-Stress Scales.

Table 3
Regressions Examining the Effects of Social Anxiety on Urge during the Placebo Patch Condition

	Placebo Patch Condition									
	Post-Absorption QSU-Brief Total		Post-Absorption Desire to Smoke		Post-Absorption Anticipation of Positive Outcomes		Post-Absorption Relief of Withdrawal or Negative Affect		Post-Absorption Intention to Smoke	
	R ²	β	R ²	β	R ²	β	R ²	β	R ²	β
Step 1	.01		.02		.02		.08		.02	
Gender		-.03		.06		-.02		-.09		.02
Age		-.09		-.11		-.15		-.27**		-.16
Years of Education		.08		-.04		.06		.13		.02
Step 2	.28		.22		.26		.38		.26	
CPD		.22*		.12		.13		.14		.15
FTND Total		-.03		.08		.07		.00		.15
MNRQ: Pos. Rein.		.24*		.11		.28***		.20*		.19
MNRQ: Neg. Rein.		.21*		.31***		.22*		.30***		.14
Pre-Absorption Score		.21*		.13		.09		.26***		.22*
Step 3	.02		.02		.03		.01		.02	
APPQ Agoraphobia		.10		.09		.02		.01		.05
APPQ Interoceptive		-.05		-.12		-.03		.05		-.03
ASI Total		.03		-.03		.10		.06		-.12
MOCI Total		.00		-.05		-.08		-.02		-.09
PSWQ Total		.02		.06		-.03		-.05		.03
DASS Depression		-.19		-.13		-.18		.02		-.04
Step 4	.07		.05		.04		.07		.11	
APPQ Social Phobia		.43***		.37*		.30*		.41***		.53***
Total R²	.39		.31		.35		.53		.42	

Note:

* $p < .05$;

**
 $p < .01$;

CPD = Cigarettes per day; FTND = Fagerström Test for Nicotine Dependence; MNRQ = Michigan Nicotine Reinforcement Questionnaire; Pos. Rein. = Positive Reinforcement scale; Neg. Rein. = Negative Reinforcement scale; APPQ = Albany Panic and Phobia Questionnaire; ASI = Anxiety Sensitivity Index; MOCI = Maudsley Obsessive Compulsive Inventory; PSWQ = Penn State Worry Questionnaire; DASS = Depression-Anxiety-Stress Scales.