Socially anxious smokers experience greater negative affect and withdrawal during self-quit attempts

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HIGHLIGHTS

- At baseline, social anxiety was related to greater negative affect.
- Social anxiety was related to increase in post-quit day negative affect.
- Social anxiety was robustly related to greater post-quit day withdrawal.

ARTICLE INFO

ABSTRACT

Despite evidence of a strong and consistent relation between smoking and elevated social anxiety, strikingly little empirical work has identified mechanisms underlying the smoking-social anxiety link. Persons with elevated social anxiety may rely on smoking to cope with more severe nicotine withdrawal and post-quit negative mood states; yet, no known studies have investigated the relation of social anxiety to withdrawal severity. The current study examined the relation of social anxiety to post-quit nicotine withdrawal severity among 51 (33.3% female, $M_{age} = 34.6$) community-recruited smokers during the first two weeks following an unaided (i.e., no treatment) cessation attempt. Ecological momentary assessment was used to collect multiple daily ratings of withdrawal and negative mood states. Baseline social anxiety was related to increases in negative affect during the monitoring period and remained significantly related to post-quit withdrawal after controlling for negative affect, gender, lapses, and substance use. Persons with elevated social anxiety experience more severe post-quit withdrawal symptoms and increases in negative affect during a cessation attempt and may therefore benefit from intervention and treatment strategies geared toward helping them learn to cope with withdrawal and negative affect to improve cessation rates among these vulnerable smokers.

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1. Introduction

One-third of persons with social anxiety disorder (SAD) suffer from nicotine dependence (Grant et al., 2005). Among smoking cessation treatment patients, those with SAD report greater nicotine dependence than those without anxiety disorders (Piper et al., 2011). Further, greater physiological reactivity to social stress is related to lower odds of abstinence following smoking cessation (Niaura et al., 2002) and SAD is associated with more failed quit attempts (Cougle et al., 2010). Notably, SAD tends to onset prior to nicotine dependence and elevated social anxiety is prospectively related to more severe nicotine dependence after controlling for depression (Cougle et al., 2010; Sonntag et al., 2000). Social anxiety may be unique among the anxiety conditions as a risk factor for smoking and/or nicotine dependence given that SAD tends to onset prior to smoking, whereas smoking tends to onset prior to other anxiety disorders (Cougle et al., 2010).

Despite evidence of a strong, consistent relation between smoking and social anxiety, strikingly little empirical work has identified mechanisms underlying the smoking-social anxiety link. In line with negative reinforcement models (Baker et al., 2004), socially anxious persons may smoke to cope with their chronically elevated negative affect [NA] (American Psychiatric Association, 2013). In fact, smokers with SAD report greater quit-day NA compared to smokers without anxiety disorders (Piper et al., 2011) and social anxiety is related to smoking to cope in social situations (Watson et al., 2012). Yet it is unknown

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whether socially anxious smokers experience an increase in NA following a quit attempt or whether they smoke to manage already chronically elevated anxiety.

Further, there is reason to posit that socially anxious smokers may also experience more severe withdrawal. Anxiety sensitivity (fear of anxiety-related sensations) is related to more severe nicotine withdrawal (Zvolensky et al., 2004), yet no known research has examined whether socially anxious smokers experience more severe withdrawal. Socially anxious smokers' poorer cessation outcomes may be at least in part due to more severe nicotine withdrawal as well as to increases in NA post-quit.

The current study sought to further understanding of the relation of social anxiety to post-quit nicotine withdrawal and NA during the first two weeks following a voluntary, unaided (no treatment) cessation attempt in several ways. First, per data among treatment-seeking smokers (Piper et al., 2011), it was hypothesized that among self-quitters, social anxiety would be related to greater NA during the quit attempt. Second, extending prior work, we tested whether social anxiety was related to experiencing a greater *increase* in NA from pre-quit to during the two-weeks post-quit. Third, we tested whether social anxiety was related to more severe nicotine withdrawal during the post-quit period. Given that many withdrawal symptoms are types of NA (American Psychiatric Association, 2013), change in NA was included as a covariate. Given that social anxiety is related to gender, alcohol, and cannabis (Grant et al., 2005; Buckner et al., 2008), these variables were included as covariates. Social anxiety was assessed continuously given that social anxiety exists on a continuum (Crome et al., 2010) and individuals higher on this continuum are vulnerable to smoking and nicotine dependence (Sonntag et al., 2000; Buckner & Vinci, 2013).

2. Method

2.1. Participants

Participants were recruited via flyers and other methods (e.g., Craigslist) for a research study on "quitting smoking." An initial 122 participants consented to the study following a brief phone screen. However, 39 individuals were excluded due to (1) current substance dependence ($n = 19$); (2) CO breath analysis indicating low levels of smoking (CO < 8 ppm; $n = 14$); (3) current use of psychotropic medications, taken PRN ($n = 3$); (4) decreased the number of cigarettes by more than half in the past six months ($n = 2$); and (5) current use of Nicotine Replacement Therapy ($n = 1$).

Of the 83 eligible persons, 25 did not attend their second appointment, which was the scheduled quit day. An additional four were excluded due to equipment malfunction and/or participants' failure to return the PDA device, and three were excluded for non-compliance with the EMA protocol (described below). The final sample consisted of 51 participants (33.3% female) with a mean age of 34.6 ($SD = 13.8$). The racial composition was 86.3% White, 7.8% Black or African American, 3.9% "mixed," and 2.0% Asian, with 2.0% endorsing Hispanic/Latino ethnicity. Approximately 24% of the sample endorsed drinking alcohol at least 2–4 times per month and participants scored an average of 8.5 ($SD = 6.8$) on the AUDIT. Approximately 56% endorsed marijuana use. The mean age of first smoking was 14.6 ($SD = 2.8$), with a mean number of cigarettes smoked per day at baseline of 15.9 ($SD = 10.2$). The majority (87.8%) had made a prior, serious quit attempt. The majority (85.4%) lapsed during the post-quit 2 week monitoring period.

2.2. Measures

Inventory of Depression and Anxiety Symptoms [IDAS] (Watson et al., 2007) is a 64-item self-report measure of the degree to which symptoms were experienced in the past two weeks from 1 (*not at all*) to 5 (*extremely*). The social anxiety subscale consists of 5 items. The IDAS has strong psychometric properties (Watson et al., 2007). Internal

consistency of the social anxiety subscale in the current study was excellent ($\alpha = .91$).

Minnesota Nicotine Withdrawal Scale (*MNWS*) is an 8-item scale of the extent to which withdrawal symptoms are experienced rated from 0 (*None*) to 4 (*Severe*) (Hughes & Hatsukami, 1986). In the present investigation, withdrawal during the cessation attempt was measured via EMA procedures and internal consistency was good ($\alpha = .86$).

NA was assessed with the negative affect subscale of the *Positive and Negative Affect Scale* [PANAS] (Watson, Clark, & Tellegen, 1988), a self-report measure of 10 different emotions rated from 1 (*Very slightly or not at all*) to 5 (*Extremely*). The measure has strong psychometric properties (Watson et al., 1988). In the present study, two different time referents were utilized: (a) at baseline to assess trait-level NA, and (b) throughout the monitoring period to assess momentary NA. Internal consistency for the NA scale at baseline was excellent ($\alpha = .94$).

Ecological Momentary Assessment (*EMA*). Participants completed daily assessments in their regular daily environments for the first 14 days of their cessation attempt using a PalmPilot per past smoking research (Shiffman et al., 1996) to administer the self-report measures. The PalmPilot presented auditory cues that prompted participants to respond to the questions. Participants were administered 42 signal contingent assessments — three random signals per day (10 AM–7 PM) for 14 days. The relative infrequency of this EMA protocol was carefully selected by balancing feasibility, burden on the participants, response rate and risk of missed observations with highly frequent observations (Shiffman, 2000).

2.2.1. Covariates

The *Timeline Follow-Back* (TLFB) is an interview-style calendar-guided assessment (Sobell & Sobell, 1992) that assessed cigarettes smoked per day during the monitoring period. The smoking version has adequate psychometric properties (Harris et al., 2009). The *Alcohol Use Disorders Identification Test* [AUDIT] (Babor et al., 2001) is a 10-item self-report measure of alcohol problems and internal consistency was good in the present sample ($\alpha = .83$). One item from the *Marijuana Smoking History Questionnaire* (Bonn-Miller & Zvolensky, 2009) was used in the current study to assess lifetime cannabis use (no vs. yes).

2.3. Procedures

Participants were recruited from two sites – University of Vermont (86.3%) and University of Houston (13.7%) – at which identical procedures were executed. Sites did not differ on social anxiety, NA, post-quit smoking, or post-quit day withdrawal ($p > .189$). Institutional Review Boards approved the study. Individuals who appeared eligible based on screening were scheduled for a baseline session in the laboratory to determine eligibility and collect baseline data. Upon arrival, participants provided informed consent and biochemically verified their smoking status by CO analysis of breath samples [>8 ppm] (Society for Research on Nicotine and Tobacco Research Subcommittee on Biochemical Verification, 2002). Participants also completed self-report questionnaires. They were compensated $20 for the baseline session. Eligible participants were then invited to complete an unaided quit attempt and were scheduled for a quit day to take place approximately 14 days following baseline.

On quit day, participants came back to the laboratory to verify abstinence and receive a PalmPilot. They were given a standardized orientation on the use of the PalmPilot and asked to carry the PalmPilot with them from 10 AM to 7 PM for the two weeks following their quit day. They were compensated $10 for the quit-day appointment.

Compliance with the EMA protocol was determined by mean daily percentage of random prompts completed per participant. Consistent with prior work (Buckner, Zvolensky, & Ecker, 2013; Hopper et al., 2006), participants with less than 20% overall compliance rates were excluded from analyses ($n = 3$). The remaining participants completed a