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Socially Anxious Smokers Experience Greater Negative Affect and Withdrawal during Self-Quit Attempts

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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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Author Disclosures

Conflict of Interest.

All authors declare no conflicts of interest.

Contributors.

JDB conceived hypotheses and conducted analyses. Data were collected by KJL and MJZ. JDB led the drafting of the manuscript and oversaw subsequent revisions completed by KJL, ERJ, and MJZ. All authors contributed to and approve of the final manuscript.

Keywords

social anxiety; self-quit; smoking cessation; nicotine withdrawal; negative affect; ecological momentary assessment

1. Introduction

One-third of persons with social anxiety disorder (SAD) suffer from nicotine dependence [1]. Among smoking cessation treatment patients, those with SAD report greater nicotine dependence than those without anxiety disorders [2]. Further, greater physiological reactivity to social stress is related to lower odds of abstinence following smoking cessation [3] and SAD is associated with more failed quit attempts [4]. 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 [4, 5]. Social anxiety may be unique among 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 [4].

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 [6], socially anxious persons may smoke to cope with their chronically elevated negative affect [NA; 7]. In fact, smokers with SAD report greater quit-day NA compared to smokers without anxiety disorders [2] and social anxiety is related to smoking to cope in social situations [8]. Yet it is unknown 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 [9], 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 [2], 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 [7], change in NA was included as a covariate. Given that social anxiety is related to gender, alcohol, and cannabis [1, 10], these variables were included as covariates. Social anxiety was assessed continuously given that social anxiety exists on a continuum [11] and

individuals higher on this continuum are vulnerable to smoking and nicotine dependence [5, 12].

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 ($\text{CO}<8$ 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; 13] 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 [13]. 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*) [14]. 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; 15], 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 [15]. 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 [16] 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 (10AM–7PM) 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 [17].

2.2.1 Covariates—The *Timeline Follow-Back (TLFB)* is an interview-style calendar-guided assessment [18] that assessed cigarettes smoked per day during the monitoring period. The smoking version has adequate psychometric properties [19]. The *Alcohol Use Disorders Identification Test* [AUDIT; 20] 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* [21] 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; 22]. 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 10AM to 7PM 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 [23, 24], participants with less than 20% overall compliance rates were excluded from analyses ($n=3$). The remaining participants completed a mean of 47% ($SD=19\%$; range=21–88% per participant) of assessments.

3. Results

Four hierarchical linear regression analyses were conducted to examine whether social anxiety was incrementally related to NA at baseline and during the two-week post-quit period. Separate models were analyzed for the four outcomes: baseline NA, mean NA during the two-week post-quit period, change in NA (mean NA during the monitoring period –

baseline NA), and peak post-quit NA. Number of cigarettes smoked at each respective time period (baseline, during post-quit period) was also included as a covariate. Predictor variables were: Step 1: covariates (number of cigarettes baseline or post-quit), gender, baseline alcohol problems and marijuana use) and Step 2: social anxiety. This strategy ensured that the effect at Step 2 cannot be attributed to variance shared with variables in Step 1 [25]. Baseline social anxiety was incrementally related to baseline NA (accounting for 40.8% of the unique variance), to mean post-quit NA (accounting for 11.5% of the variance), and to increase in NA (accounting for 8.5% of the variance; Table 1). It was unrelated to peak post-quit NA.

Two hierarchical linear regressions tested whether social anxiety was incrementally related to mean and peak post-quit day withdrawal. Because nearly all participants lapsed, number of cigarettes smoked during the monitoring period was included as a covariate. Baseline social anxiety remained incrementally related to post-quit withdrawal (Table 2), accounting for 12.5% of the unique variance. It was unrelated to peak post-quit withdrawal.

4. Discussion

Consistent with prior work with smoking cessation treatment patients [2], social anxiety among our self-quitters was significantly related to greater mean post-quit day NA. Prior work was further extended by determining that baseline social anxiety was related to greater increase in NA post-quit day and to greater post-quit day nicotine withdrawal. Importantly, the relation between social anxiety and withdrawal remained after controlling for change in NA as well as post-quit day smoking, gender, and baseline alcohol problems and marijuana use. Social anxiety was not related to peak NA or withdrawal suggesting that observed relations were not simply due to over endorsement of pathology. Participants resembled other self-quit samples in terms of alcohol use [26], alcohol problems [27], and marijuana use [28]. Notably, 85% of our sample smoked post-quit, which is somewhat higher than rates reported in other studies of self-quit behaviors (e.g., 79%; [29]). A possible explanation is that our sample also reported higher rates of prior quit attempts (87% vs 83%; [30]), suggesting that our sample may have experienced greater nicotine dependence and/or other barriers to quitting.

Findings are in line with work suggesting that individuals with elevated social anxiety smoke to cope with NA [8] and that social stress is associated with urges to smoke [3]. Given that socially anxious smokers have more failed quit attempts [4], health care workers may consider using motivational interviewing techniques [31] to explore and resolve ambivalence not only about quitting smoking but about seeking treatment to aid in a quit attempt so that socially anxious patients can learn skills to manage their increase in NA and more severe withdrawal symptoms.

Findings should be considered in light of limitations. First, participants volunteered to participate in an unaided quit attempt; it is therefore unknown whether results generalized to smokers receiving psychosocial and/or pharmacotherapy. Second, we relied solely on self-report and future research could benefit by utilizing a multi-method approach. Third, the sample was a relatively homogenous group of smokers and it will be important for future

studies to recruit a more ethnically/racially diverse sample. Fourth, participants were not financially compensated for completing EMA assessments. EMA studies that compensate participants [e.g., 32, 33] obtain higher compliance rates suggesting that lack of compensation may have impacted compliance rates.

Despite these limitations, data add to a growing body of work suggesting that social anxiety may be an important smoking vulnerability factor [e.g., 5]. Specifically, social anxiety was related to greater post-quit day NA and nicotine withdrawal, which may contribute to their poorer cessation outcomes [4].

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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

Table 1

Incremental relation of social anxiety to negative affect

	<i>R</i> ²	<i>F</i>	β	<i>t</i>	<i>p</i>	<i>sr</i> ²
Mean baseline negative affect						
Step 1	.176	1.50			.230	
Pre-quit smoking			0.03	0.19	.848	0.00
Alcohol problems			0.40	2.20	.036	0.14
Cannabis use			-0.26	-1.37	.182	0.06
Gender			0.07	0.41	.681	0.01
Step 2	.408	26.48			<.001	
Social anxiety			0.66	5.15	<.001	0.41
Mean post-quit day negative affect						
Step 1	.086	0.99			.424	
Pre-quit smoking			-0.17	-1.14	.261	0.03
Alcohol problems			-0.22	-1.43	.160	0.04
Cannabis use			0.03	0.22	.826	0.00
Gender			-0.08	-0.49	.628	0.01
Step 2	.115	5.93			.019	
Social anxiety			0.35	2.43	.019	0.12
Change in negative affect						
Step 1	.241	3.26		.021		
Pre-quit smoking			-0.05	-0.35	.731	0.00
Alcohol problems			0.49	3.47	.001	0.22
Cannabis use			-0.03	-0.21	.834	0.00
Gender			0.13	0.93	.358	0.02
Step 2	.085	5.05		.030		
Social anxiety			0.30	2.25	.030	0.09
Peak post-quit day negative affect						
Step 1	.063	0.70		.594		
Pre-quit smoking			-0.09	-0.58	.565	0.01
Alcohol problems			0.16	1.05	.299	0.02

	R^2	F	β	t	p	sr^2
Cannabis use			-.022	-1.41	.167	0.04
Gender			-.009	-.056	.576	0.01
Step 2	.047	2.15		.150		
Social anxiety			0.22	1.47	.150	0.05

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Table 2
Incremental relation of social anxiety to post-quit day nicotine withdrawal severity

	R^2	F	β	t	p	s^2
Mean post-quit day nicotine withdrawal severity						
Step 1	.127	1.17			.341	
Post-quit smoking			-.24	-1.54	.132	0.05
Alcohol problems			.02	.14	.893	0.00
Cannabis use			.05	.29	.771	0.00
Gender			.01	.06	.950	0.00
Change in negative affect			-.28	-1.65	.106	0.06
Step 2	.125	6.54			.015	
Social anxiety			.38	2.56	.015	0.113
Peak post-quit day nicotine withdrawal severity						
Step 1	.061	0.52			.757	
Post-quit smoking			-0.22	-1.37	.177	0.04
Alcohol problems			0.16	0.88	.386	0.02
Cannabis use			-0.08	-0.48	.631	0.01
Gender			-0.10	-0.64	.525	0.01
Change in negative affect			-0.09	-0.50	.619	0.01
Step 2	.024	1.03			.316	
Social anxiety			0.17	1.02	.316	0.02