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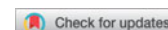
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The role of anxiety sensitivity-physical concerns in terms of quit day withdrawal symptoms and cravings: A pilot test among smokers with asthma

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ABSTRACT

Objective: The aim of the current study was to conduct secondary analyses of data collected from a study examining a self-guided quit attempt of smokers with and without asthma in order to examine the unique predictive ability of precessation (i.e., baseline) anxiety sensitivity physical concerns in terms of quit day withdrawal symptoms and cravings among abstinent smokers with asthma. **Methods:** Participants were 24 regular cigarette smokers with asthma (50% female, $M_{\text{age}} = 37.63$ years, $SD = 12.20$) who participated in a self-guided-quit attempt and were able to maintain abstinence on their quit day. **Results:** After controlling for the effects of the cognitive and social concerns domains of anxiety sensitivity, anxiety sensitivity-physical concerns significantly predicted greater quit day withdrawal symptoms (20.8% unique variance) and urges to smoke (38.0% unique variance). **Conclusions:** These findings suggest that smokers with asthma who fear anxiety-related sensations due to their feared physical consequences are more likely to experience intense withdrawal symptoms and desire to smoke at the beginning of a quit attempt. Clinically, smokers with higher levels of anxiety sensitivity physical concerns may benefit from smoking cessation interventions that specifically target anxiety sensitivity as well as prolonged use of nicotine replacement therapies to target withdrawal symptoms and cravings.

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Despite its well-established negative health effects, cigarette smoking is more common among individuals with asthma compared to those without (1,2) resulting in increased frequency and severity of asthma symptoms, decreased lung function, and decreased effectiveness of inhaled corticosteroids (3–6). Fortunately, quitting smoking results in significant improvements in lung function, reductions in asthma medication use, and improved quality of life (7,8). While recent research has shown that smokers with and without asthma have similar abstinence rates following a cessation attempt (9,10), there is also evidence that smokers with asthma demonstrate a slower decline in withdrawal symptoms and cravings during the first month of abstinence (10).

This prolonged experience of withdrawal among smokers with asthma is potentially problematic, as prolonged withdrawal symptoms and cravings are associated with a greater likelihood of smoking relapse (11,12). Research suggests that withdrawal symptoms, particularly the trajectory of these symptoms during a quit attempt, are especially important in predicting lapse and relapse

to smoking due to the undesirable nature of these symptoms (13,14). Despite the documented importance of withdrawal and cravings in cessation success, there has been little exploration of factors that might impact withdrawal and craving among smokers with asthma. This lack of attention is unfortunate, as the identification of such factors would provide important targets for intervention efforts in this at-risk population.

One important factor to examine in this regard is anxiety sensitivity (AS), a transdiagnostic cognitive-affective vulnerability factor defined as the fear of arousal-related sensations due to their perceived negative physical, psychological, or social consequences (15–17). Anxiety sensitivity reflects a relatively stable, albeit malleable, cognitive predisposition that results in an amplification of pre-existing anxiety levels. A large body of literature suggests that anxiety sensitivity is associated with poorer smoking cessation outcomes, particularly early in the quit attempt, including higher odds of early lapse and relapse to smoking and increased withdrawal symptoms and craving during a quit attempt (18–22).

Extant research suggests that it is the physical concerns domain that may be particularly problematic for smokers with asthma. Among smokers in general, AS-physical concerns is associated with increased odds in early smoking relapse during a quit attempt (23). Among nonsmokers with asthma, AS-physical concerns is also associated with poorer asthma control and asthma-related quality of life (24,25) as well as greater anxiety and poorer lung function in response to asthma-like sensations (26). Research therefore suggests that individuals with asthma are generally more fearful of physical sensations (24–28) and may react with greater levels of anxiety or related negative affect when confronted with such stressors (29). Therefore, during a quit attempt, these individuals will likely be more fearful of arousal-related physical withdrawal symptoms (e.g., dizziness, nausea), resulting in increased desire to smoke (i.e., cravings) in order to decrease these symptoms.

Taken together, empirical work suggests that AS-physical concerns negatively impacts smoking cessation and asthma-related outcomes. However, no studies, to date, have prospectively examined relations between AS-physical concerns and predictors of smoking cessation success among smokers with asthma undergoing a cessation attempt. Thus, the aim of the current study was to examine the unique predictive ability of precessation (i.e., baseline) AS-physical concerns in terms of quit day withdrawal symptoms and cravings among abstinent smokers with asthma during a self-guided quit attempt. Due to the well-documented impact of abstinence on withdrawal symptoms and cravings (30,31), only abstinent smokers were utilized in the current study. In order to clearly identify the unique predictive ability of AS-physical concerns, specifically, as it has demonstrated unique associations with asthma outcomes over the social and cognitive concerns subscales (24–26), AS-cognitive and AS-social concerns were chosen on an a priori basis as covariates. It was hypothesized that, after controlling for the effects of baseline levels of AS-cognitive and AS-social concerns, greater baseline AS-physical concerns would be predictive of greater withdrawal symptoms and cravings on quit day.

Method

Participants

The current analyses were based on data that were collected as part of a larger study examining differences between smokers with and without asthma during a self-guided quit attempt (10). For inclusion in the larger study, participants had to: (1) be a regular smoker for at least one year; (2) be currently smoking at least 10

cigarettes per day; (3) have smoking status confirmed via carbon monoxide (CO) testing (see measures section); (4) report a motivation to quit smoking of at least 5 on a 10 point scale; and (5) be interested in quitting smoking in the next month. Participants were excluded from the study based on: (1) current substance dependence (excluding nicotine dependence); (2) decreased smoking rate by more than a half in the past six months; (3) current use of or intention to use nicotine replacement therapy, bupropion, or varenicline; or (4) regular, current use of other tobacco products. For the current study, only participants with an asthma diagnosis who were able to remain abstinent on quit day (see measures section below for more detail on asthma diagnosis and smoking status verification) were eligible ($n = 24$). These selection criteria were utilized because our outcome variables (i.e., withdrawal and craving symptoms) would only be present for those who had been abstinent. That is, those smokers who were still smoking would not be experiencing withdrawal symptoms or cessation-related cravings. Further, as the research question is centered on understanding these processes among smokers with asthma rather than comparing smokers with and without asthma, only those smokers with an asthma diagnosis were included in the current analyses.

Participants were 50% female and an average of 37.63 ($SD = 12.20$) years old. On average, participants were 8.13 ($SD = 5.50$) years of age when they were diagnosed with asthma and had been regular smokers for an average of 19.12 ($SD = 11.21$) years. They smoked an average of 16.96 ($SD = 8.31$) cigarettes per day. Average asthma control of the current sample was 10.4 ($SD = 3.7$), indicating poorly controlled asthma. Full demographic information for the current sample is presented in Table 1.

Measures

Demographics and asthma history

Participants were asked to provide demographic information as well as information about their asthma (e.g., age at initial diagnosis).

Smoking history questionnaire (SHQ)

The SHQ (32) was used to assess smoking pattern and history, including items pertaining to smoking rate, age of onset at initiation, and number of serious quit attempts. The SHQ has been successfully used in previous studies and has been identified as a psychometrically sound descriptive measure of smoking history (33).

Asthma diagnosis

Asthma status was initially assessed during an eligibility phone screen via self-report of a physician diagnosis of

Table 1. Demographic data for abstinent smokers with Asthma at baseline.

	Baseline
Gender (% Female)	50
Age (M (SD))	37.6 (12.2)
Race (%)	
Caucasian	37.5
African American	62.5
Education (%)	
<High school degree	30.4
High school degree	21.7
Some college	30.4
2-year college degree	4.3
4-year college degree	8.7
Some graduate level	4.3
Asthma Onset (M (SD))	8.1 (5.5)
Years regular smoker (M (SD))	19.1 (11.2)
CPD (M (SD))	17.0 (8.3)
ACT (M (SD))	10.4 (3.7)
FEV ₁ /FVC ratio	0.7 (0.1)

Note: Gender: coded as 0 = male, 1 = female; Race: coded as 4 = Caucasian, 2 = African American; Education: coded as 0 = < High school degree, 1 = High school degree, 2 = Some college, 3 = 2-year college degree, 4 = 4-year college degree, 5 = Some graduate level; CPD: Cigarettes per day; ACT: Asthma Control Test (35); FEV₁/FVC: forced expiratory volume in 1 second/Forced volume capacity ratio.

asthma as well as experiencing asthma symptoms within the past year as well as current asthma medication use. Asthma diagnosis was then verified at the initial baseline assessment session by spirometry assessed using a KoKo Legend portable office spirometer (nSpire Health, Inc., Longmont, CO) using current guidelines (34).

Asthma control test (ACT)

The ACT (35) is a 5-item self-report measure used to assess asthma control. The ACT assesses frequency of asthma symptoms and functional impairment due to these symptoms (within the past 4 weeks. The ACT has demonstrated good psychometric properties, including the ability to discriminate groups of patients with differing levels of asthma control (35). The ACT was used for descriptive purposes only in this study.

Expired carbon monoxide (CO)

Smoking status was biochemically verified by CO analysis of breath samples assessed using a Bedfont Micro 4 Smokerlyzer CO Monitor (Model EC50; coVita, Haddonfield, NJ). Research indicates that 10 ppm is an optimal score for reliably discriminating smoking status (36). CO analysis was conducted at the baseline assessment to ensure smoking status (i.e., CO $\geq$ 10) and again at the quit day assessment to determine whether or not the person was abstinent (i.e., CO < 10).

Anxiety sensitivity index-3 (ASI-3)

The ASI-3 (17) is an 18-item self-report measure that assesses the degree to which individuals fear the negative consequences associated with anxiety-related symptoms. The ASI-3 consists of one higher-order AS factor and three lower-order factors of physical, social, and cognitive concerns (17). The ASI-3 has demonstrated strong psychometric properties compared to other measures of AS (17) and has been validated among smokers, specifically (37). Internal consistency in the current sample was questionable for the social subscale ($\alpha = 0.61$), excellent for the cognitive subscale ($\alpha = 0.94$), and good for the physical subscale ($\alpha = 0.82$). The ASI-3 was administered at the baseline assessment session prior to quit day.

Minnesota nicotine withdrawal scale (MNWS)

The MNWS (31) is a 9-item self-report measure that assesses severity of nicotine withdrawal symptoms. The MNWS has demonstrated good reliability and predictive validity, and internal consistency in the current study was excellent ($\alpha = 0.91$).

Brief questionnaire of smoking urges (QSU)

The QSU (38) is a 10-item self-report measure that assesses the desire and intention to smoke (e.g., “I have a desire for a cigarette right now) as well as the desire to smoke to reduce negative affect (e.g., “Smoking would make me less depressed”). The QSU has demonstrated good psychometric properties (38), and internal consistency in the current study was excellent ($\alpha = 0.92$).

Procedure

Participants were daily smokers participating in a larger study examining differences between smokers with and without asthma (see (10) for details). The current study utilizes data from the study's baseline and quit day assessment visits and only for participants who were able to remain abstinent on quit day. At the baseline visit, after providing informed, written consent, participants' smoking status was biochemically verified via CO analysis and their asthma status objectively verified via spirometry. Participants then completed a demographic and asthma history questionnaire, the ACT, and the ASI-3. At the quit day visit, on average about 1 week after the baseline assessment, participants had their smoking status verified via CO analysis and then completed the MNWS and QSU. Participants were compensated \$50 for completing the baseline study visit and \$30 at the quit day visit. In order to increase the likelihood that participants would make a concerted effort at smoking cessation on their specified quit date, participants who abstained from smoking for

Table 2. Descriptive data and intercorrelations among study variables.

	ASI-Cognitive	ASI-Social	ASI-Physical	Withdrawal	Craving	<i>M</i>	<i>SD</i>	Range
ASI-Cognitive	–	.79**	.67**	.50*	–.16	6.35	6.73	0–23
ASI-Social	–	–	.59**	.33	–.12	7.82	4.83	0–18
ASI-Physical	–	–	–	.67**	.45*	10.43	6.17	2–23
Withdrawal	–	–	–	–	.66**	13.40	10.19	0–41
Craving	–	–	–	–	–	400.55	237.45	2–800

Note: * $p < 0.05$, ** $p < 0.01$. ASI-Cognitive: Anxiety Sensitivity Index-3- Cognitive Concerns subscale (17); ASI-Social: Anxiety Sensitivity Index-3- Social Concerns subscale (17); ASI-Physical: Anxiety Sensitivity Index-3- Physical Concerns subscale (17); Withdrawal: Quit Day Minnesota Nicotine Withdrawal Scale (31); Cravings: Quit Day Brief Questionnaire of Smoking Urges (38).

12 hours prior to the quit day visit were compensated an additional \$20. The Institutional Review Board approved all study procedures and materials prior to data collection.

Data analytic plan

First, bivariate correlations were computed to examine the relationship among all study variables. Next, the main effect of baseline AS-physical concerns for the primary dependent variables was evaluated using a hierarchical multiple regression procedure (39). Due to the small sample size, demographic variables were not included as covariates in analyses in order to allow for enough power to detect significant results. Separate hierarchical multiple regression models were constructed for predicting quit day withdrawal symptoms and cravings. For each model, AS-cognitive and AS-social concerns were entered as covariates at step one in order to control for these theoretically relevant factors. At the second step of the model, baseline AS-physical concerns was entered in order to estimate the amount of variance accounted for by this variable.

Results

Associations between all study variables are presented in Table 2. Quit day withdrawal symptoms were significantly associated with AS cognitive and physical concerns, but not social concerns. Quit day cravings were significantly

associated with AS-physical concerns only. Results from the regression analyses are presented in Table 3. For both quit day withdrawal and cravings, step one was not significant, but AS-physical concerns was a significant predictor at step two, accounting for 20.8% ($\beta = 0.68$, $t = 2.43$, $p < 0.05$) and 38% ($\beta = 0.77$, $t = 3.15$, $p < 0.01$) of unique variance, respectively.

Discussion

The aim of the current study was to examine the role of AS-physical concerns in terms of predictors of smoking cessation success (i.e., quit day withdrawal symptoms and cravings) among smokers with asthma undergoing a self-guided quit attempt. As hypothesized, relative to the other AS domains, elevated levels of baseline AS-physical concerns were uniquely predictive of more withdrawal symptoms and cravings on quit day. These findings suggest that smokers with asthma who fear anxiety-related sensations because of their perceived negative physical consequences are more likely to experience negative physical withdrawal sensations associated with quitting and experience strong cravings that would place them at risk for early lapse or relapse to smoking.

Clinically, the current findings suggest that smokers with asthma who are high in AS-physical concerns would benefit from smoking cessation interventions that specifically target AS (40–42). Further, these findings as well as those of McLeish and colleagues (10) suggest that smokers

Table 3. Anxiety sensitivity-physical concerns predicting quit day withdrawal and craving.

	ΔR^2	<i>t</i> (each predictor)	β	sr^2	<i>p</i>
Criterion Variable: Quit Day Withdrawal Symptoms					
Step 1	.26				.09
ASI-Cognitive		1.82	.63	.15	.09
ASI-Social		–.47	–.16	.01	.64
Step 2	.21				.03*
ASI-Physical		2.43	.68	.21	.03*
Criterion Variable: Quit Day Cravings					
Step 1	.01				.95
ASI-Cognitive		–.04	–.11	.00	.91
ASI-Social		–.05	–.13	.00	.90
Step 2	.38				.01**
ASI-Physical		3.15	.77	.38	.01**

Note: * $p < 0.05$, ** $p < 0.01$. β : standardized beta weight; sr^2 squared semi-partial correlation.

with asthma who are high in AS-physical concerns might also benefit from trying to reduce their smoking rate prior to quit day in order to help decrease nicotine dependence as well as prolonged use of nicotine replacement therapy (NRT) and/or use of multiple forms of NRT (e.g., patch and gum) to combat withdrawal symptoms and cravings.

There are, however a number of interpretive caveats that warrant consideration. First, as this was a pilot study, the sample size was relatively small, making it difficult to detect small effects. Future work with larger sample size is needed to replicate these findings. Second, the study included regular daily smokers who smoked at least 10 cigarettes per day, and thus, it remains unclear whether these findings generalize to individuals who are intermittent or light smokers. Third, although the current study utilized a prospective design, longer follow-up periods would be useful to examine how anxiety sensitivity physical concerns impacts cessation-related factors beyond quit day. Finally, the social concerns subscale of the ASI-3 demonstrated questionable internal consistency for this sample, suggesting that the social concerns subscale may not be reliable for use in this specific population. Notably, however, the small sample size of this study may have artificially deflated the internal reliability scores of this sample as research suggests a 5-point scale require at least 50 participants for appropriate measurement of internal reliability using Cronbach's alpha (43). Despite these limitations, results from this study suggest that smokers with asthma who are fearful of physiological arousal are a particularly "at-risk" population for early lapse and relapse to smoking during a quit attempt because of greater withdrawal symptoms and craving.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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