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An Examination of Smoking Outcome Expectancies, Smoking Motives and Trait Worry in a Sample of Treatment-seeking Smokers

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Abstract

The present study examined the role of trait worry in predicting smoking-based cognitive processes (motives, expectancies, and beliefs about quitting) in a sample of 286 treatment-seeking, daily smokers (43.7 % female; $M_{\text{age}} = 37.25$; $SD = 12.83$). Consistent with prediction, trait worry was significantly and uniquely associated with smoking outcome expectancies and motives pertaining to negative affect reduction after controlling for other relevant variables such as negative affectivity, gender, smoking rate and tobacco-related disease. Trait worry also was significantly independently related to greater perceived barriers to quitting smoking. The significant effects remained consistent when adjusted for axis I psychopathology. These findings provide initial evidence of the theoretical and clinical importance of trait worry with regard to tobacco-related motives, outcome expectancies, and beliefs about quitting smoking.

Keywords

Trait Worry; Smoking; Smoking Cessation; Perceived Barriers in Quitting; Expectancies; Motives

Over 50% of daily smokers have a lifetime history of a psychiatric disorder and such persons consume a disproportionately large percentage of overall cigarettes (Ziedonis et al., 2008; Lasser et al., 2000). Although smoking has historically been studied in relation to co-occurring schizophrenia, substance use and mood disorders (Ziedonis et al., 2008),

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Contributors

All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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comparatively less scholarly attention has been focused on anxiety and its disorders. Anxiety disorders are among the most common psychiatric conditions (Kessler, Chiu, Demler, & Walters, 2005), and some studies indicate higher rates of smoking among the anxiety-disorder population relative to both persons with no psychiatric illness as well as many other psychiatric conditions (McCabe et al., 2004; Lasser et al., 2000).

Notably, little research to date has examined the potential explanatory value of trait worry in the context of smoking and anxiety, despite the fact that this construct is a common component of anxiety psychopathology (Barlow, 2002; Brown, Antony & Barlow, 1992) and is the core feature of generalized anxiety disorder (GAD; American Psychiatric Association, 2000). Worry has been operationalized as thoughts focused on the possibility of future negative events (Borkovec, 1994; Borkovec, Alcaine & Behar, 2004). This mental activity is theorized to sometimes create cognitive avoidance that interferes with emotional processing (Borkovec, 1994; Borkovec, Ray, & Stöber, 1998) and is considered to be a 'formative element' to many types of anxiety psychopathology (Barlow, 2002). Although trait worry is related to other negative mood states, there is both theoretical and empirical evidence that it is a distinct psychological construct (Borkovec et al., 1998).

The vast majority of the work relating to worry in terms of smoking has focused on worry specific to tobacco use. For example, smokers tend to worry about a lack of smoking-related self-control (e.g., worry whether they are addicted to nicotine) and the health consequences of smoking (Köblitz et al., 2009; McCaul et al., 2006). Smoking-focused worry also has often been associated with an increased level of current motivation to quit smoking and a greater number of quit attempts (Dijkstra & Brosschot, 2003; Magnan, Köblitz, Zielke, & McCaul, 2009; McCaul, Mullens, Romanek, Erickson, & Gatheridge, 2007), though this support is not entirely consistent (Klein, Zajac, & Monin, 2009). In one test of daily smokers, Spada, Nikčević, Moneta & Wells (2007) examined whether metacognitive knowledge (i.e., information about one's own thoughts and emotions) mediated the relationship between emotion and smoking dependence. Spada and colleagues (2007) found that two facets of metacognition related to worry--positive beliefs about worry and its usefulness and negative beliefs about worry related to uncontrollability--were positively associated with smoking dependence (Spada et al., 2007). Also, in a study examining smokers thoughts and worries about their smoking behavior using ecological momentary assessment procedures, Köblitz et al. (2009) found a positive correlation between baseline trait worry scores and intensity of worry regarding thoughts specific to smoking. The present study sought to explicate the relationship between chronic, excessive worry and important smoking-related processes believed to influence smoking behavior, such as smoking outcome expectancies and motives.

Although no prior research has examined associations between trait worry per se and cognitive-based smoking processes or smoking behavior, studies have recently begun to examine GAD diagnostic status and smoking. These studies have primarily documented an association between GAD and smoking prevalence; specifically, individuals diagnosed with GAD are twice as likely to smoke relative to individuals without this diagnosis (Cranford, Eisenberg, & Serras, 2009) or with no psychiatric illness (Lasser et al., 2000; Ziedonis et al., 2008). In addition to high rates of tobacco use, a GAD diagnosis is significantly related to decreased success in quitting smoking (Lasser et al., 2000; McCabe et al., 2004; Piper, Cook, Schlam, Jorenby & Baker, 2010). Data examining the temporal relationship between GAD and tobacco use suggests that smoking 20 or more cigarettes per day in adolescence is related to an increased risk for developing GAD in early adulthood (Johnson et al., 2000). Similarly, using data from the National Comorbidity Survey-Replication, Coughle, Zvolensky, Fitch, & Sachs-Ericsson (2010) found that approximately 68% of individuals

with a lifetime history of ‘regular smoking’ reported smoking prior to the onset of their GAD diagnosis.

This GAD-smoking work, although only indirectly related to trait worry, provides empirical support for exploring the potential explanatory relevance of trait worry in terms of smoking-based cognitive processes (e.g., outcome expectancies for smoking, motives for smoking, and perceived barriers to quitting). Smoking outcome expectancies have been defined as one’s expectations or beliefs about the outcome of smoking (Brandon & Baker, 1991) while smoking motives have been conceptualized as one’s specific reasons for smoking (Ikard, Green, & Horn, 1969). Perceived barriers to quitting reflect one’s perception of personal obstacles associated with the quitting process (MacNee & Talsma, 1995).

Theoretical models of GAD and worry such as the Avoidance Theory of Worry (Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004) and the Emotion Dysregulation Model (Mennin, Heimberg, Turk, & Fresco, 2002) emphasize the role of emotional avoidance in response to perceived threat (see Behar, DiMarco, Hekler, Mohlam, & Staples, 2009, for a review). Specifically, trait worry is viewed as a tactic of avoiding negative mental images and subsequent autonomic activation (Borkovec, 1994; Borkovec et al, 2004), or of coping with or avoiding strong emotions (Mennin et al, 2002). Given the link between worry and avoidance (Borkovec, 1994), smokers higher in trait worry may be more apt to smoke for negative affect reduction reasons, maintain beliefs that smoking can down regulate negative mood, and perceive more challenges or barriers in successfully quitting. Indeed, Cogle et al. (2010) suggest that the act of smoking among individuals with GAD may function as a “safety seeking behavior” used to avoid and/or alleviate anxiety but one that may ultimately worsen anxiety or possibly interfere with its successful treatment.

Together, the purpose of the current study was to examine the predictive value of trait worry with regard to the cognitive-based smoking processes of tobacco smoking motives, outcome expectancies, and perceived barriers to cessation. It was hypothesized that after controlling for daily smoking rate, negative affectivity, gender, and a composite health score for tobacco-related disease as well as other (non-criterion) smoking motives and expectancies, trait worry would be significantly and uniquely associated with negative affect reduction smoking motives, mood-based outcome expectancies, and greater perceived barriers in quitting. These hypotheses were globally guided by extant smoking-GAD research as well as theoretical models of trait worry suggesting this construct may confer increased risk for avoidant coping and negative evaluations about the ability to manage life events (Borkovec, 1994), and therefore, may be associated with greater reasons for mood-based smoking beliefs and expectancies, and perceived barriers for quitting smoking.

Method

Participants

The sample consisted of 286 daily smokers (43.7 % female; $M_{\text{age}} = 37.25$; $SD = 12.83$). The racial and ethnic distribution of this sample was as follows: 86.7% identified as White/Caucasian; 7.7% identified as Black/Non-Hispanic; .3% identified as Black/Hispanic; 2.1% identified as Hispanic; 1.0% identified as Asian; and 2.1% identified as ‘Other.’ Thirty-three percent had at least some college education, 23.1% had graduated high school, 14.3% had a 4-year college degree, 9.1% had a 2-year college degree, 9.1% had a graduate degree, 5.2% had completed some graduate school, and 6.6% had less than a high school degree.

Participants smoked, on average, 19.3 cigarettes per day ($SD = 9.33$) and had been daily smokers for 18.9 years ($SD = 12.56$). The average level of nicotine dependence, as indexed by the Fagerström Test for Nicotine Dependence, was 5.43 ($SD = 2.18$); this number reflects

a moderate level of overall nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Of the sample, 40.5% met criteria for at least one current Axis I diagnosis, the most common diagnoses including Social Anxiety Disorder (13.5%), Major Depressive Disorder (7.8%), Generalized Anxiety Disorder (6.8%), Posttraumatic Stress Disorder (4.6%) and Alcohol Dependence (4.3%).

Procedure

Participants were daily smokers who responded to community-based advertisements (e.g., flyers, newspaper ads, radio announcements) to participate in a larger study examining the efficacy of two smoking cessation interventions: a novel 4-session smoking cessation behavioral intervention that focused on vulnerability to panic (Panic-Smoking Program), and a standard smoking cessation program. Both treatments took place over four, 90-minute sessions occurring once per week and also included nicotine replacement therapy. The Panic-Smoking Program integrates interoceptive exposure, cognitive restructuring, and psychoeducation exercises developed for panic prevention and treatment programs with standard smoking cessation counseling. The Standard Cessation Program includes only the smoking-related components of the Panic-Smoking Program as well as a review of general health information not specific to anxiety or smoking (in order to equilibrate contact time across the two conditions).

Participants were recruited at two sites (University of Vermont, Burlington, VT, USA and Florida State University, Tallahassee, FL, USA). The collection of outcome data is currently ongoing as of August 2011. To participate, individuals had to report smoking 8 or more cigarettes per day on average for at least 1 year, had to be motivated to quit smoking, and be at least 18 years old. Participants were excluded from participation if they were currently suicidal, psychotic, or had ever met criteria for panic disorder, had an inability to give informed consent, or were currently using any other smoking cessation treatment.

The current report is based on secondary analyses of a sub-sample of people who provided data to date during the study's baseline assessment session ($n = 286/341$ assessed = 84%), which took place prior to the commencement of the intervention. Individuals responding to study advertisements were scheduled for an in-person, baseline assessment and were evaluated according to study inclusion and exclusion criteria. After providing written informed consent, participants were interviewed using the Structured Clinical Interview for DSM-IV Axis I Disorders and completed an on-line survey as well as biochemical verification of smoking status. Eligible participants were randomly assigned to one of the two treatment conditions and were scheduled for their first individual session.

For the current study, individuals were selected based on meeting the eligibility criteria for the larger study as previously described. These analyses have not been published or presented previously. All participants provided informed consent and the study protocol was approved by the university's IRB.

Measures

Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I)—Diagnostic assessments were conducted using the SCID-I-NP (Non-Patient Version; First, Spitzer, Gibbon, & Williams, 2007) to yield DSM-IV-TR diagnoses for current and past Axis I Disorders. All SCID-I interviews were administered by trained research assistants or doctoral level staff and supervised by independent doctoral-level professionals. Interviews were audio-taped and the reliability of a random selection of 12.5% of interviews were checked (MJZ) for accuracy; no cases of (diagnostic coding) disagreement were noted. We

report rates of current axis I psychopathology (see Participant Section) for descriptive purposes.

Medical Screening Questionnaire—This author-constructed measure contains a variety of questions assessing medical history. Items of interest for the current study involved those specific to tobacco disease in which participants indicated having ever been diagnosed with the following: heart problems (0=no, 1=yes), hypertension (0=no, 1=yes), respiratory disease (0=no, 1=yes), and asthma (0=no, 1=yes). A composite score was created ranging from 0–4, with greater scores reflecting the occurrence of multiple markers of tobacco-related disease.

Smoking History Questionnaire (SHQ)—The Smoking History Questionnaire (Brown, Lejuez, Kahler, & Strong, 2002) assesses smoking rate, age of onset of initiation, years of being a daily smoker, and other characteristics. Smoking rate was obtained from the question, “Since you started regular daily smoking, what is the average number of cigarettes you smoked per day?”

Fagerström Test for Nicotine Dependence (FTND)—The Fagerström Test for Nicotine Dependence is a six-item scale that assess gradations in tobacco dependence (Heatherton et al., 1991) and exhibits adequate internal consistency, positive relations with key smoking variables, and high test-retest reliability (Heatherton, et al., 1991; Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). Cronbach’s alpha in the present study = .61.

The Penn State Worry Questionnaire (PSWQ)—The Penn State Worry Questionnaire is a 16-item measure of trait worry (Meyer, Miller, Metzger, & Borkovec, 1990). Items are rated on a 5-point Likert-type scale (5 reverse-scored) and assess the excessiveness and uncontrollability of worry (e.g., “Once I start worrying, I cannot stop”). This scale has demonstrated good internal consistency in undergraduate, community, and clinical samples (Brown et al., 1992; Meyer et al., 1990) as well as good test-retest reliability (Meyer et al., 1990). Individuals with a primary generalized anxiety disorder diagnosis have scored higher on this scale relative to other anxiety disorder groups (Brown et al., 1992). Furthermore, results of receiver operating characteristic analyses support the utility of the Penn State Worry Questionnaire in identifying individuals who meet criteria for generalized anxiety disorder (Behar et al., 2003; Fresco et al., 2003). This scale demonstrated high levels of internal consistency in the current sample (Cronbach’s alpha = .94).

Positive and Negative Affect Schedule (PANAS)—The Positive Affect Negative Affect Schedule (Watson, Clark & Tellegen, 1988) is a 20-item, trait-like measure of positive (PA) and negative affect (NA). Mood descriptors (e.g., “Nervous,” “Excited”) are rated on a 5-point Likert-style scale, with instructions in the current investigation to rate “to what extent you generally feel this way, that is, how you feel on average.” Use of this specified time frame is believed to demonstrate trait-like stability (Watson et al., 1988). Both 10-item PA and NA subscales have demonstrated strong internal consistency (Watson et al., 1988; Watson, 2000) and test-retest reliability (Watson et al., 1988). The sum of the 10-item PANAS-NA scale was used as a covariate in the current investigation, with higher scores reflecting greater self-reported negative affect (Cronbach’s alpha = .92 in the current sample).

Reasons for Smoking Scale (RFS)—A 23-item version of the Reasons for Smoking Scale (Ikard, Green, & Horn, 1969) was used to assess six domains (subscales) of smoking motives: Habitual (e.g., “I’ve found a cigarette in my mouth and didn’t remember putting it

there”), Addictive (“Between cigarettes, I get a craving only a cigarette can satisfy”), Negative Affect Reduction (“When I feel uncomfortable or upset about something, I light up a cigarette”), Pleasurable Relaxation (“I find cigarettes pleasurable”), Sensorimotor (“Part of the enjoyment of smoking a cigarette comes from the steps I take to light up”), and Stimulation (“I like smoking when I am busy and working hard”). Items are rated on a 1 (*never*) to 5 (*always*) scale. The factor structure, internal consistency, and test-retest reliability of this scale have been well-established (Shiffman, 1993). The negative affect reduction subscale of the Reasons for Smoking scale was analyzed as a dependent variable (RFS-NA; Cronbach’s $\alpha = .88$ for this sub-scale in the current sample), while the other five Reasons for Smoking subscales were used as control variables for analyses pertaining to this criterion variable to ensure that any observed effects were not attributable to shared variance with these other smoking motives.

Smoking Consequences Questionnaire (SCQ)—The Smoking Consequences Questionnaire (Brandon & Baker, 1991) is a 50-item self-report measure that assesses tobacco use expectancies believed to underlie smoking motivation on a Likert-type scale, ranging from 0 (“*completely unlikely*”) to 9 (“*completely likely*”). Coefficient alpha reliabilities for each the four constituent factors (Negative Consequences, Positive Reinforcement-Sensory Satisfaction, Negative Reinforcement-Negative Affect Reduction and Appetite-Weight Control) exceeded .90 and subjective expected utility scores varied appropriately within subscales based on smoking status (Brandon & Baker, 1991). The negative reinforcement/negative affect reduction subscale of the Smoking Consequences Questionnaire was analyzed as a dependent variable (SCQ-NR/NA, e.g., “Smoking helps me calm down when I feel nervous”), while the other three subscales were employed as control variables for analyses pertaining to this criterion variable to ensure that any observed effects were not attributable to shared variance with these other smoking outcome expectancies. The SCQ-NR/NA subscale demonstrated high levels of internal consistency in the current sample (Cronbach’s $\alpha = .90$).

Barriers to Cessation Scale (BCS)—The Barriers to Cessation Scale (Macnee & Talsma, 1995a) was used to assess barriers, or specific stressors, associated with smoking cessation. The BCS is a 19-item measure on which respondents indicate, on a 4-point Likert-style scale (0 = “*not a barrier*” to 3 = “*large barrier*”) the extent to which they identify with each of the identified barriers to cessation. It has been found to have good internal consistency in regard to the total score (Cronbach’s $\alpha = .81-.87$; Macnee & Talsma, 1995a) as well as the three subscales: Addictive Barriers (Cronbach’s $\alpha = .84$), External Barriers (Cronbach’s $\alpha = .80$), and Internal Barriers (Cronbach’s $\alpha = .71$; Macnee & Talsma, 1995a). The Barriers to Cessation Scale also has evidenced good content and predictive validity (Macnee & Talsma, 1995a). Items reflecting addiction barriers include “Withdrawal symptoms” and “Feeling lost without cigarettes.” Items relevant to external barriers include “No encouragement or help from friends” and “Seeing things or people which remind you of smoking.” Internal Barriers items include “Feeling less in control of your moods” and “Having strong feeling such as anger, or feeling upset when you are with other people.” To maintain consistency with past work using the BCS (e.g., Macnee & Talsma, 1995b), only the total score was utilized in the present study. This scale demonstrated high levels of internal consistency in the current sample (Cronbach’s $\alpha = .90$).

Analytic Approach

Incremental validity of trait worry was examined in relation to the criterion variables using hierarchical multiple regression (Cohen & Cohen, 1983). Separate models were constructed for Reasons for Smoking negative affect reduction motives, Smoking Consequences-negative reinforcement/negative affect reduction outcome expectancies, and Barriers to

Cessation total score. At level 1, cigarettes smoked per day, negative affectivity (PANAS-NA), gender, and a composite health score for tobacco-related disease were simultaneously entered. The non-criterion Reasons for Smoking and Smoking Consequences Questionnaire subscales were entered at Level 2 for the RFS-NA and SCQ-NR/NA analyses, respectively, to ensure any observed effects were not attributable to shared variance with other motives or expectancies. Penn State Worry Questionnaire total scores were entered at Level 3 (Level 2 for the BCS analysis). This analytic approach ensures variance due to trait worry is not better explained by other theoretically-relevant predictor variables (Sechrest, 1963), such as general negative mood, tobacco-related illness, and smoking rate or is more representative of females.

Results

Descriptive Data and Correlations Among Theoretically Relevant Variables

See Table 1 for descriptive data and bivariate correlations among study variables. As expected, Penn State Worry Questionnaire scores were significantly and positively associated with Reasons for Smoking-negative affect reduction, ($r = .50, p < .01$), Smoking Consequences Questionnaire-negative reinforcement/negative affect reduction ($r = .47, p < .01$), and Barriers to Cessation Scale scores ($r = .41, p < .01$). PSWQ scores were not significantly related to cigarettes per day ($r = .12$) or to tobacco-related disease ($r = -.02$), but were positively associated with gender ($r = .24, p < .01$; females compared to males reporting greater worry) and PANAS-NA scores ($r = .73, p < .01$).

Regression Analyses

Overall, the model predicted 64.4% of variance in Reasons for Smoking-negative affect reduction motives, $F(10,283) = 49.53, p < .001$. Step 1 of the model accounted for a significant 23.7% of variance; both negative affectivity ($t = 7.19, \beta = .38, p < .001$) and being female ($t = 4.58, \beta = .24, p < .001$) were significantly associated with greater RFS-NA scores. Step 2 predicted an additional 38.8% of variance, with RFS-Addictive ($t = 8.77, \beta = .44, p < .001$) and RFS-Stimulation ($t = 5.57, \beta = .24, p < .001$) motives demonstrating significant, independent effects. As hypothesized, Step 3 accounted for a significant 1.9% of variance, with worry being a significant, independent predictor of RFS-NA reduction motives ($t = 3.87, \beta = .22, p < .001$).

The model predicted a significant 54.6% of variance in Smoking Consequences Questionnaire-negative reinforcement/negative affect reduction expectancies, $F(8,280) = 40.78, p < .001$. The predictor set at the first level of the model accounted for 17.5% of variance, with negative affectivity ($t = 6.87, \beta = .38, p < .001$) and being female ($t = 2.36, \beta = .13, p < .05$) demonstrating significant independent effects. At Level 2 of the model, SCQ-Negative Consequences ($t = 3.04, \beta = .14, p < .01$), SCQ-Positive Reinforcement ($t = 8.18, \beta = .38, p < .001$), and SCQ-Appetite/Weight Control ($t = 7.02, \beta = .33, p < .001$) expectancies each demonstrated significant, independent effects. As hypothesized, worry was significantly incrementally associated with SCQ-NR/NA expectancies ($t = 3.91, \beta = .25, p < .001$) and accounted for 2.6% of additional variance¹.

The model predicted a significant 22.1% of variance in perceived barriers to quitting smoking, $F(5,282) = 15.63, p < .001$. Level 1 of the model accounted for 20.4% of variance, with negative affectivity ($t = 6.86, \beta = .37, p < .001$) and being female ($t = 3.98, \beta = .22, p$

¹We ran an alternative set of analyses adding a third step to the respective models (with worry at the fourth step) including the other negative affect subscale as a *predictor* variable (i.e., SCQ-NR/NA for the RFS-NA analyses and RFS-NA for the SCQ-NR/NA analyses). In both instances, the negative affectivity subscale used as a predictor variable explained additional variance in the model and worry remained a unique statistically significant predictor in the fourth step.

< .001) each accounting for a significant amount of variance. Additionally, worry, entered at Level 2 of the model, incrementally explained a significant amount of unique variance ($t = 2.42, \beta = .20, p < .05$).²

Discussion

The primary purpose of the current investigation was to evaluate the role of trait worry in regard to smoking processes in a sample of treatment-seeking smokers. Consistent with prediction, trait worry was significantly and incrementally related to negative affect reduction smoking beliefs and outcome expectancies. Also as predicted, trait worry was uniquely associated with greater perceived barriers to smoking cessation. The observed significant effects were evident above and beyond negative affectivity, smoking rate, gender, and tobacco-related disease as well as non-criterion smoking motives and outcome expectancies. Post hoc tests adjusting for current Axis I psychopathology did not alter the pattern of observed findings (see footnote #2). Our decision to control for psychopathology is based on research demonstrating that smoking prevalence rates increase with increasing numbers of psychiatric disorders (Lasser et al., 2000) as well as data suggesting high rates of tobacco use and dependence in other psychiatric disorders such as mood disorders (Ziedonis et al., 2008).

In the current study sample, worry was not related to smoking rate or to tobacco-related illness. Worry was, however, associated with female gender, consistent with prior research using this scale (e.g., Robichaud, Dugas and Conway, 2003; Zlomke & Hahn, 2010) and with epidemiological data showing an increased prevalence of GAD in women compared to men (Vesga-Lopez et al., 2008; Wittchen et al., 1994). Not surprisingly, worry also was positively correlated with negative affect, consistent with prior research demonstrating a relationship between the PSWQ and measures of anxiety and depression (e.g., Fresco et al., 2002; Meyer et al., 1990).

Overall, the present findings suggest that smokers who are prone to trait worry may 1) be more likely to be motivated to smoke to reduce negative affect, 2) expect that smoking will aid in negative affect reduction, and 3) perceive greater hurdles associated with the quitting process. These results are consistent with avoidance-based models of GAD and trait worry, which suggest that this cognitive activity may function to temporarily avoid or reduce negative internal experiences or intense emotion (Borkovec, 1994; Mennin et al, 2002), but ultimately maintain anxiety due to its interference with emotional processing (Borkovec, 1994; Borkovec et al., 1998). Given that chronic, excessive worry is also associated with the tendency to perceive threat and to minimize one's ability to cope with various life events (Borkovec, 1994), it follows that smokers high in trait worry may perceive greater barriers associated with cessation, particularly if smoking is consistently relied upon as a means of coping with negative affect. Paradoxically, regular (daily) smoking may actually maintain or worsen anxiety in individuals high in trait worry (Cogle et al. 2010) and has been suggested as a potential risk marker or factor for GAD (Cogle et al., 2010; Johnson et al., 2000).

Although the unique variance offered by trait worry was modest, the fact that this construct predicted negative affect reduction smoking outcome expectancies and smoking motives as well as perceived barriers to cessation after controlling for several variables known to be associated with smoking outcomes suggests the relevance of worry with regard to these

²In a *post hoc* test, we added a psychopathology composite (number of current axis I disorders) to Step 1 of each of the regression models. The results did not substantively change. Indeed, trait worry remained significantly associated with RFS-NA reduction motives, SCQ-NR/NA outcome expectancies and perceived barriers to cessation (BCS).

cognitive processes. If the current findings of negative affect reduction expectations and motives are indeed indicators of smoking behavior in individuals high in trait worry, the present results have direct implications for smoking cessation efforts. Namely, smoking may serve as a safety-signal for negative affect reduction (perceived or objectively). Hence, helping smokers high in worry quit smoking may need to involve using exposure to negative affect to promote emotional processing and fostering more adaptive (non-tobacco) emotional regulatory behavior for mood management.

A number of interpretive caveats warrant consideration in understanding the current findings, which highlight targets for future research. First, the correlation between trait worry and negative affectivity was high, making it difficult to fully disentangle the explanatory utility of these two variables in this particular study. In future work, it may be useful to further examine the interrelation between these two constructs, perhaps using alternative methodological approaches for their assessment (e.g., behavioral indices of state-like worry in response to imagery provocation). This type of approach may decrease the likelihood of method variance influencing the interrelation between these variables and provide an even more powerful test of the study hypotheses. Second, self-report methods were utilized to index the variables of interest. As noted above, there is the possibility of shared method variance contributing to the study results. Future studies could, therefore, usefully incorporate a multi-method assessment approach to address this concern. Third, the present sample is comprised of adult smokers who volunteered to participate in a prevention intervention study for monetary reward. Consequently, this sample of smokers may be at greater risk for smoking cessation difficulties or have greater motivation to quit smoking than the general smoking population. It will be important for researchers to draw as well from a non-treatment seeking sample to see if these findings extend to the larger smoking population. Likewise, the level of nicotine dependence in this sample was relatively low. To further enhance the generalizability of these results, it may be useful to replicate and extend the present findings to heavier smoking samples to evaluate if similar patterns emerge. Finally, given the cross-sectional nature of these baseline data, we do not have a clear sense of the stability of these outcome expectancies and beliefs or of their temporal relationship with regard to smoking behavior. For example, do negative affect reduction smoking outcome expectancies predict negative affect reduction smoking motives? Do these expectations and motives change over time while smoking regularly or during the quitting process? Future research might employ prospective methodology to examine these questions.

In sum, the present results provide initial and novel support for the role of trait worry in a number of clinically-relevant cognitive-based smoking processes. Additional research is necessary to replicate the current findings and to address moderating variables between worry and our cognitive variables of interest and how these cognitive variables may mediate the relationship between worry and tobacco use. Future research might also examine worry with regard to specific perceived barriers related to smoking cessation. Overall, the current investigation suggests that trait worry may be an important construct to consider in the context of tobacco use.

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References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: 2000. text revision
- Barlow, DH. Anxiety and its disorders: The nature and treatment of anxiety and panic. 2. New York, NY, US: Guilford Press; 2002.
- Behar E, Alcaine O, Zuellig AR, Borkovec TD. Screening for generalized anxiety disorder using the Penn State Worry Questionnaire: a receiver operating characteristic analysis. *Journal of Behavior and Experimental Psychiatry*. 2003; 34:25–43.10.1016/S0005-7916(03)00004-1
- Behar E, DiMarco ID, Hekler EB, Mohlam J, Staples AM. Current theoretical models of generalized anxiety disorder (GAD): Conceptual review and treatment implications. *Journal of Anxiety Disorders*. 2009; 23:1011–1023.10.1016/j.janxdis.2009.07.006 [PubMed: 19700258]
- Borkovec, TD. The nature, functions and origins of worry. In: Davey, G.; Tallis, F., editors. *Worrying: perspectives on theory assessment and treatment*. Sussex, England: Wiley & Sons; 1994. p. 5-33.
- Borkovec, TD.; Alcaine, OM.; Behar, E. Avoidance theory of worry and generalized anxiety disorder. In: Heimberg, R.; Turk, C.; Mennin, D., editors. *Generalized anxiety disorder: advances in research and practice*. New York, NY, US: Guilford Press; 2004. p. 77-108.
- Borkovec TD, Ray WJ, Stöber J. Worry: A cognitive phenomenon intimately linked to affective, physiological, and interpersonal behavioral processes. *Cognitive Therapy and Research*. 1998; 22:561–576.10.1023/A:1018790003416
- Brandon TH, Baker TB. The smoking consequences questionnaire: The subjective utility of smoking in college students. *Psychological Assessment*. 1991; 3:484–491.10.1037/1040-3590.3.3.484
- Brown TA, Antony MM, Barlow DH. Psychometric properties of the Penn State Worry Questionnaire in a clinical anxiety disorders sample. *Behaviour Research and Therapy*. 1992; 30:33–37.10.1016/0005-7967(92)90093-V [PubMed: 1540110]
- Brown RA, Lejuez CW, Kahler CW, Strong D. Distress tolerance and duration of past smoking cessation attempts. *Journal of Abnormal Psychology*. 2002; 111:180–185.10.1037/0021-843X.111.1.180 [PubMed: 11866171]
- Buckley TC, Wolfson KB, Mozley SL, Gulliver SB, Holohan DR, Helstrom AW, Kassel JD. A psychometric evaluation of the Smoking Consequences Questionnaire- adult in smokers with psychiatric conditions. *Nicotine and Tobacco Research*. 2005; 7:739–745.10.1080/14622200500259788 [PubMed: 16191745]
- Cohen, J.; Cohen, P. *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum; 1983.
- Cougle JR, Zvolensky MJ, Fitch KE, Sachs-Ericsson N. The role of comorbidity in explaining the associations between anxiety disorders and smoking. *Nicotine & Tobacco Research*. 2010; 12:355–364.10.1093/ntr/ntq006 [PubMed: 20156885]
- Cranford JA, Eisenberg D, Serras AM. Substance use behaviors, mental health problems, and use of mental health services in a probability sample of college students. *Addictive Behaviors*. 2009; 34:134–145.10.1016/j.addbeh.2008.09.004 [PubMed: 18851897]
- Dijkstra A, Brosschot J. Worry about health in smoking behavior change. *Behaviour Research and Therapy*. 2003; 41:1081–1092.10.1016/S0005-7967(02)00244-9 [PubMed: 12914809]
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. *Structured Clinical Interview for DSM-IV-TR Axis I Disorders- Non-patient Edition (SCID-I/NP, 1/2007 revision)*. New York: New York State Psychiatric Institute; 2007.
- Fresco DM, Heimberg RG, Mennin DS, Turk CL. Confirmatory factor analysis of the Penn State Worry Questionnaire (2002). *Behaviour Research and Therapy*. 2002; 40:313–323.10.1016/S0005-7967(00)00113-3 [PubMed: 11863241]
- Fresco DM, Mennin DS, Heimberg RG, Turk CL. Using the Penn State Worry Questionnaire to identify individuals with generalized anxiety disorder: a receiver operating characteristic analysis. *Journal of Behavior Therapy and Experimental Psychiatry*. 2003; 34:283–291.10.1016/j.jbtep.2003.09.001 [PubMed: 14972674]

- Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The Fagerstrom test for nicotine dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*. 1991; 86:1119–1127.10.1111/j.1360-0443.1991.tb01879.x [PubMed: 1932883]
- Ikard FF, Green DE, Horn D. A scale to differentiate between types of smoking as related to the management of affect. *The International Journal of the Addictions*. 1969; 4:649–659.
- Johnson JG, Cohen P, Pine DS, Klein DF, Kasen S, Brook JS. Association between cigarette smoking and anxiety disorders during adolescence and early adulthood. *JAMA: Journal of the American Medical Association*. 2000; 284:2348–2351.10.1001/jama.284.18.2348
- Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 6:617–627.10.1001/archpsyc.62.6.617 [PubMed: 15939839]
- Klein WMP, Zajac LE, Monin MM. Worry as a moderator of the association between risk perceptions and quitting intentions in young adult and adult smokers. *Annals of Behavioral Medicine*. 2009; 38:256–261.10.1007/s12160-009-9143-2 [PubMed: 20049660]
- Koblitz AR, Magnan RE, McCaul KD, Dillard AJ, O'Neill HK, Crosby R. Smokers' thoughts and worries: A study using ecological momentary assessment. *Health Psychology*. 2009; 28:484–492.10.1037/a0014779 [PubMed: 19594273]
- Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: A population-based prevalence study. *JAMA: Journal of the American Medical Association*. 2000; 284:2606–2610.10.1001/jama.284.20.2606
- MacNee CL, Talsma A. Development and testing of the Barriers to Cessation Scale. *Nursing Research*. 1995a; 44:214–219.10.1097/00006199-199507000-00005 [PubMed: 7624231]
- MacNee CL, Talsma A. Predictors of progress in smoking cessation. *Public Health Nursing*. 1995b; 12:242–248.10.1111/j.1525-1446.1995.tb00143.x [PubMed: 7667177]
- Magnan RE, Koblitz AR, Zielke DJ, McCaul KD. The effects of warning smokers on perceived risk, worry, and motivation to quit. *Annals of Behavioral Medicine*. 2009; 37:46–57.10.1007/s12160-009-9085-8 [PubMed: 19255818]
- McCabe RE, Chudzick SM, Antony MM, Young L, Swinson RP, Zvolensky MJ. Smoking behaviors across anxiety disorders. *Anxiety Disorders*. 2004; 18:7–18.10.1016/j.janxdis.2003.07.003
- McCaul KD, Hockemeyer JR, Johnson RJ, Zetocha K, Quinlan K, Glasgow RE. Motivation to quit using cigarettes: A review. *Addictive Behaviors*. 2006; 31:42–56.10.1016/j.addbeh.2005.04.004 [PubMed: 15916861]
- McCaul KD, Mullens AB, Romanek KM, Erickson SC, Gatheridge BJ. The motivational effects of thinking and worrying about the effects of smoking cigarettes. *Cognition and Emotion*. 2007; 21:1780–1798.10.1080/02699930701442840
- Mennin DS, Heimberg RG, Turk CL, Fresco DM. Applying an emotion regulation framework to integrative approaches to Generalized Anxiety Disorder. *Clinical Psychology: Science and Practice*. 2002; 9:85–90.10.1093/clipsy/9.1.85
- Meyer TJ, Miller RL, Metzger RL, Borkovec TD. Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy*. 1990; 28:487–495.10.1016/0005-7967(90)90135-6 [PubMed: 2076086]
- Piper ME, Cook JW, Schlam TR, Jorenby DE, Baker TB. Anxiety diagnoses in smokers seeking cessation treatment: relations with tobacco dependence, withdrawal, outcome and response to treatment. *Addiction*. 2010; 106:418–427.10.1111/j.1360-0443.2010.03173.x [PubMed: 20973856]
- Pomerleau CS, Carton SM, Lutzke ML, Flessland KA, Pomerleau OF. Reliability of the Faegerstrom Tolerance Questionnaire and the Fagerstrom Test for nicotine dependence. *Addictive Behaviors*. 1994; 19:33–39.10.1016/0306-4603(94)90049-3 [PubMed: 8197891]
- Robichaud M, Dugas MJ, Conway M. Gender differences in worry and associated cognitive-behavioral variables. *Journal of Anxiety Disorders*. 2003; 17:501–516.10.1016/S0887-6185(02)00237-2 [PubMed: 12941362]
- Sechrest L. Incremental validity: A recommendation. *Educational and Psychological Measurement*. 1963; 23:153–158.

- Shiffman S. Assessing smoking patterns and motives. *Journal of Consulting and Clinical Psychology*. 1993; 61:732–742.10.1037/0022-006X.61.5.732 [PubMed: 8245271]
- Spada MM, Nikčević AV, Moneta GB, Wells A. Metacognition as a mediator of the relationship between emotion and smoking dependence. *Addictive Behaviors*. 2007; 32:2120–2129.10.1016/j.addbeh.2007.01.012 [PubMed: 17307299]
- Vesga-Lopez O, Schneier FR, Wang S, Heimberg RG, Lieu S, Hasin DS, Blanco C. Gender differences in Generalized Anxiety Disorder: Results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Journal of Clinical Psychiatry*. 2008; 69:1606–1616.10.4088/JCP.v69n1011 [PubMed: 19192444]
- Watson, D. *Mood and temperament*. New York: Guilford Press; 2000.
- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*. 1988; 54:1063–1070.10.1037/0022-3514.54.6.1063 [PubMed: 3397865]
- Wittchen H-U, Zhao S, Kessler RC, Eaton WW. DSM-III-R GAD in the National Comorbidity Survey. *Archives of General Psychiatry*. 1994; 51:355–364. [PubMed: 8179459]
- Ziedonis D, Hitsman B, Beckham JC, Zvolensky M, Adler LE, Audrain-McGovern J, Riley WT. Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. *Nicotine & Tobacco Research*. 2008; 10:1691–1715.10.1080/14622200802443569 [PubMed: 19023823]
- Zlomke KR, Hahn KS. Cognitive emotion regulation strategies: Gender differences and associations to worry. *Personality and Individual Differences*. 2010; 48:408–413.10.1016/j.paid.2009.11.007

Highlights

- Examined the role of worry in predicting smoking-based cognitive processes
- Trait worry predicted negative affect reduction smoking motives
- Trait worry predicted negative affect reduction outcome expectancies
- Trait worry related to greater perceived barriers to quitting smoking

Table 1
Bivariate Correlations among and Descriptive Statistics for the Studied Variables.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Mean or % (SD)	Observed range
1. Gender (% female)	1	.02	-.09	.10	-.03	.17**	.11	.08	.02	.13*	.04	.30**	.24**	.28**	.25**	.17**	(43.7%)	
2. Health	1	.00	.05	.07	-.01	-.01	-.12	-.01	-.06	.06	-.13*	.01	-.02	-.06	-.02	-.07	.34 (.59)	0-3
3. Cigarettes/day ^a	1	.09	.39**	.26**	-.08	-.08	.09	-.04	.04	.04	.04	.00	.12	.09	.05	.01	19.28 (9.33)	8-70
4. NA	1	.25**	.29**	.07	.23**	.23**	.07	.23**	.17**	.22**	.13*	.73**	.41**	.40**	.39**	.39**	19.35 (7.46)	10-48
5. RFS-Habitual	1	.49**	.03	.35**	.34**	.20**	.21**	.15*	.19**	.39**	.23**	.15**	.39**	.23**	.15**	.15**	2.38 (.75)	1-5
6. RFS-Addictive	1	.38**	.44**	.41**	.32**	.48**	.31**	.36**	.68**	.56**	.49**	.332 (.77)	.36**	.68**	.56**	.49**	3.32 (.77)	1.4-5
7. RFS-Pleasure	1	.25**	.31**	.00	.63**	.19**	.09	.36**	.33**	.34**	.34**	.372 (.82)	.36**	.33**	.33**	.34**	3.72 (.82)	1.5-5
8. RFS-Stimulation	1	.43**	.11	.29**	.35**	.26**	.55**	.35**	.48**	.48**	.28**	2.69 (.93)	.55**	.35**	.48**	.48**	2.69 (.93)	1-5
9. RFS-Sensorimotor	1	.01	.48**	.22**	.16**	.42**	.33**	.28**	2.45 (.98)	.33**	.28**	2.45 (.98)	.42**	.33**	.28**	.28**	2.45 (.98)	1-5
10. SCQ-Neg. Consequences	1	.23**	.23**	.23**	.23**	.23**	.23**	.23**	.23**	.23**	.23**	6.54 (1.27)	.23**	.23**	.23**	.32**	6.54 (1.27)	1.06-8.94
11. SCQ-Pos. Reinforcement	1	.30**	.23**	.46**	.49**	.57**	5.66 (1.49)	.46**	.49**	.57**	.57**	5.66 (1.49)	.46**	.49**	.57**	.57**	5.66 (1.49)	.67-9
12. SCQ-Appetite/weight	1	.22**	.39**	.28**	.50**	4.28 (2.22)	.39**	.28**	.50**	.50**	.50**	4.28 (2.22)	.39**	.28**	.50**	.50**	4.28 (2.22)	0-9
13. PSWQ	1	.50**	.41**	.47**	43.44 (14.58)	.50**	.41**	.47**	.47**	.47**	.47**	43.44 (14.58)	.50**	.41**	.47**	.47**	43.44 (14.58)	18-80
14. RFS-NA Reduction	1	.61**	.71**	1.50-5	.61**	.71**	.71**	.71**	.71**	.71**	.71**	1.50-5	.61**	.71**	.71**	.71**	1.50-5	0-53
15. BCS	1	.55**	24.86 (11.3)	.55**	.55**	.55**	.55**	.55**	.55**	.55**	.55**	24.86 (11.3)	.55**	.55**	.55**	.55**	24.86 (11.3)	0-53
16. SCQ-NA Reduction	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	5.67 (1.74)	1	1-9

Note: Health= tobacco-related disease; NA= Negative Affect subscale of the Positive Affect Negative Affect Schedule (Watson et al., 1988); RFS=Reasons for Smoking Scale (Ikard et al., 1969); SCQ= Smoking Consequences Questionnaire (Brandon & Baker, 1991); PSWQ=Penn State Worry Questionnaire (Meyer et al., 1990); BCS=Barriers to Cessation Scale (Macnee & Talsma, 1995a)

^aCigarettes/day= average number of cigarettes smoked per day

* p<.05;

** p<.01

Table 2
 Hierarchical Regression Analyses: RFS-NA reduction, SCQ-Negative Reinforcement/NA Reduction and Barriers to Cessation (BCS)

Variable	R ²	t	β	sr ²	p
Criterion variable: RFS-NA Reduction					
Step 1	.24				
Health		-1.79	-.09	.01	ns
NA		7.19	.38	.16	<.001
Cigs/day		1.64	.09	.01	ns
Gender		4.58	.24	.07	<.001
Step 2	.39				
RFS-Habit		1.21	.06	.01	ns
RFS-Addictive		8.77	.44	.22	<.001
RFS-Pleasure/Relaxation		1.85	.08	.01	ns
RFS-Stimulation		5.57	.24	.10	<.001
RFS-Sensation		.93	.04	.00	ns
Step 3	.02				
PSWQ		3.87	.22	.05	<.001
Criterion variable: SCQ- Negative Reinforcement/NA Reduction					
Step 1					
Health	.18	-1.63	-.09	.01	ns
NA		6.87	.38	.15	<.001
Cigs/day		-.26	-.01	.00	ns
Gender		2.36	.13	.02	<.05
Step 2	.35				
SCQ-Neg. Consequences		3.04	.14	.03	<.01
SCQ-Pos. Reinforcement		8.18	.38	.20	<.001
SCQ-Appetite/Weight Control		7.02	.33	.15	<.001
Step 3	.03				
PSWQ		3.91	.25	.05	<.001
Criterion variable: Barriers to Cessation					
Step 1	.20				
Health		-.86	-.05	.00	ns

Variable	R ²	t	β	sr ²	p
NA		6.86	.37	.14	<.001
Cigs/day		.80	.04	.00	ns
Gender		3.98	.22	.05	<.001
Step 2	.02				
PSWQ		2.42	.20	.02	<.05

Note: Health= tobacco-related disease; NA= Negative Affect subscale of the Positive Affect Negative Affect Schedule (Watson et al., 1988); Cigs/day = average number of cigarettes smoked per day; RFS=Reasons for Smoking Scale (Ikard et al., 1969); SCQ= Smoking Consequences Questionnaire (Brandon & Baker, 1991); BCS=Barriers to Cessation Scale (Macnee & Talsma, 1995a); PSWQ=Penn State Worry Questionnaire (Meyer et al., 1990)