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Kirsten A. Johnson  
*The University of Vermont*

Michael J. Zvolensky  
*The University of Vermont*

Erin C. Marshall  
*The University of Vermont*

Adam Gonzalez  
*The University of Vermont*

Kenneth Abrams  
*Carleton College*

*See next page for additional authors*

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**Article Author**

Kirsten A. Johnson, Michael J. Zvolensky, Erin C. Marshall, Adam Gonzalez, Kenneth Abrams, and Anka A. Vujanovic



## Linkages between cigarette smoking outcome expectancies and negative emotional vulnerability

Kirsten A. Johnson<sup>a</sup>, Michael J. Zvolensky<sup>a,\*</sup>, Erin C. Marshall<sup>a</sup>, Adam Gonzalez<sup>a</sup>, Kenneth Abrams<sup>b</sup>, Anka A. Vujanovic<sup>a</sup>

<sup>a</sup> The University of Vermont, United States

<sup>b</sup> Carleton College, United States

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### ABSTRACT

The present investigation examined whether smoking outcome expectancies, as measured by the Smoking Consequences Questionnaire (SCQ; [Brandon, T.H., & Baker, T.B., (1991). The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment*, 3, 484–491.]), were incrementally related to emotional vulnerability factors among an adult sample of 202 daily cigarette smokers (44.6% women;  $M_{age}=23.78$  years,  $SD=9.69$  years). After controlling for cigarettes smoked/day, past 30-day marijuana use, current alcohol consumption, and coping style, negative reinforcement/negative affect reduction outcome expectancies were significantly associated with greater levels of negative affectivity, emotional dysregulation, and anxiety sensitivity. The observed effects for negative reinforcement/negative affect reduction also were independent of shared variance with other outcome expectancies. Negative personal consequences outcome expectancies were significantly and incrementally related to anxiety sensitivity, but not negative affectivity or emotional dysregulation. Findings are discussed in terms of the role of negative reinforcement/negative affect reduction smoking outcome expectancies and clinically-relevant negative emotional vulnerability for better understanding cigarette smoking-negative mood problems.

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### 1. Introduction

There is a recent and increasingly well-documented association between cigarette smoking and depressive and anxiety symptoms and disorders (Morrell & Cohen, 2006; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Patton et al., 1998). Indeed, epidemiological (Grant, Hasin, Chou, Stinson, & Dawson, 2004; Lasser et al., 2000), community (Hayward, Killen, & Taylor, 1989) and clinical (Himle, Thyer, & Fischer, 1988; McCabe et al., 2004; Pohl, Yeragani, Balon, Lycaki, & McBride, 1992) studies have found that daily cigarette smoking is more common among those with anxiety and depressive psychopathology compared to those without such problems. Other studies have found that smoking, particularly at higher rates, increases the risk for developing and maintaining clinically-significant anxiety and depressive symptoms (Breslau & Klein, 1999; Breslau, Novak, & Kessler, 2004; Goodwin, Lewinsohn, & Seeley, 2005; Isensee, Wittchen, Stein, Höfler, & Lieb, 2003; Johnson et al., 2000; Korhonen et al., 2007; McLeish, Zvolensky, & Bucossi, 2007; Steuber & Banner, 2006). There is also evidence to suggest daily smokers experiencing high levels of anxiety and/or depressive symptoms tend to experience more severe withdrawal sensations (Breslau, Kilbey, & Andreski, 1992), resulting in more difficult and less successful quit attempts (Anda et al., 1999; Zvolensky et al., in press). Such findings demonstrate the clinically-significant relations between negative emotional vulnerability and tobacco use.

\* Corresponding author. The University of Vermont, Department of Psychology, 2 Colchester Avenue, John Dewey Hall, Burlington, VT 05405-0134, United States. Tel.: +802 656 8994; fax: +802 656 8783.

E-mail address: Michael.Zvolensky@uvm.edu (M.J. Zvolensky).

Although extant research linking cigarette smoking and negative emotional vulnerability problems is persuasive, there is far less empirical information pertaining to the explanatory relevance of *outcome expectancies* for cigarette smoking (beliefs about the effects of smoking; Brandon, Juliano, & Copeland, 1999) in regard to the experience of negative emotional states. Outcome expectancies reflect anticipated consequences of smoking (Brandon, 1994; Brandon et al., 1999; Cohen, McCarthy, Brown, & Myers, 2002; Cox & Klinger, 1988; Niaura, Goldstein, & Abrams, 1991) and include beliefs about positive reinforcement (e.g., “I enjoy the taste sensations while smoking”), negative reinforcement/negative affect reduction (e.g., “Smoking helps me calm down when I feel nervous”), negative consequences (e.g., “The more I smoke, the more I risk my health”), and appetite control (e.g., “Smoking helps me control my weight”; Brandon & Baker, 1991). Outcome expectancies are related to key aspects of smoking behavior (Kelemen & Kaighobadi, 2007). For instance, smokers who smoke at higher rates tend to endorse more positive expectancies about the effects of smoking (Ahijevych & Wewers, 1993; Copeland, Brandon, & Quinn, 1995; Downey & Kilbey, 1995), whereas expectancies for negative reinforcement/negative affect reduction predict greater rates of smoking cessation failure (Wetter et al., 1994). Other work suggests simply believing that smoking reduces negative affect is sufficient to reduce negative affect even in the absence of a direct pharmacological effect (Juliano & Brandon, 2002). Overall, smoking expectancies are important because they are predictive of smoking behavior and are self-fulfilling.

Linkages between smoking outcome expectancies and anxiety and depressive states have received little scientific attention. To date, research has focused predominately on the association between anxiety-related traits (individual differences in anxiety vulnerability) and smoking outcome expectancies. Among college and community-recruited daily adult smokers, for example, anxiety sensitivity (fear of the expected negative consequences of anxiety symptoms; McNally, 2002) is related to negative reinforcement/negative affect reduction expectancies for smoking and negative personal consequences expectancies (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008; Leyro, Zvolensky, Vujanovic, & Bernstein, in press; Zvolensky, Feldner et al., 2004). In a study of college students, McChargue, Spring, Cook, & Neumann (2004) found that smokers' expectations about the positively reinforcing effects of smoking (e.g., increases pleasure), but not the negatively reinforcing effects (e.g., reduces negative mood), mediated the association between smoking status and lifetime major depression. These findings, albeit limited in overall scope, collectively indicate that individual differences in anxiety and depressive factors may be relevant to certain outcome expectancies among adult smokers.

Integrative models of the co-occurrence of smoking-anxiety and depressive relations posit that negative reinforcement/negative affect reduction expectancies among smokers, in particular, may be strongly related to negative emotional vulnerability (Morissette et al., 2007; Zvolensky & Bernstein, 2005; Zvolensky, Schmidt, & Stewart, 2003). These predictions are informed by self-regulation theory and stress-coping perspectives of substance use (Abrams & Niaura, 1987; Baker, Piper, McCarthy, Majeskie & Fiore, 2004; Shiffman & Wills, 1985). That is, among certain daily smokers, smoking serves important perceived affect regulatory functions (Comeau, Stewart, & Loba, 2001; Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart, Karp, Pihl, & Peterson, 1997; Zvolensky, Bonn-Miller, Bernstein & Marshall, 2006). Those individuals who expect tobacco use to help alleviate aversive affective states (Zvolensky, Feldner et al., 2004) may be particularly motivated to smoke for affect regulation purposes (Brown et al., 2001). Although the objective physiological and subjective mood-dampening qualities of smoking are complex (Kassel, Stroud, & Paronis, 2003), in the absence of other more adaptive coping strategies, such persons may learn to rely on smoking to manage negative mood states in the short-term. Moreover, as such individuals repeatedly smoke to reduce nicotine withdrawal symptoms (e.g., shakiness, anxiety), they may learn to rely on smoking to manage anxiety and related emotional states in other situations (Parrot, 1998). This type of smoking behavior may ultimately contribute to beliefs (negative affect reduction expectancies) that smoking is a personally powerful self-regulation strategy for managing negative affect states such as anxiety and depression (Brandon et al., 1999; Juliano & Brandon, 2002). Smoking outcome expectancies may thus play an important role in the maintenance of smoking behavior and/or negative emotional vulnerability for individuals with affect regulatory smoking-relevant expectancies.

Overall, theory and empirical research on outcome expectancies would suggest that simply *believing* smoking could be used as an effective response strategy for managing aversive emotional states may serve to confer risk for negative emotional vulnerability (Kirsch, 1985). Indeed, the expectancy that one can effectively regulate or cope with negative mood – not specific to smoking or other forms of substance use – is a consistent predictor of concurrent and prospective anxious and depressed mood (Catanzaro & Greenwood, 1994; Catanzaro, Horaney, & Creasey, 1995; Kassel, Bornovalova, & Mehta, 2007; Kirsch, Mearns, & Catanzaro, 1990; Mearns & Cain, 2003). Extended to cigarette smoking, holding the belief that smoking can reduce negative affect may be related to greater negative emotional vulnerability among smokers for two non-mutually exclusive reasons. First, these persons may simply have less self-confidence (or self-efficacy) in their ability to successfully manage stressors without smoking (regardless of actual coping skills). And second, they may have less opportunity to learn and practice other more adaptive coping skills for dealing with such affect-relevant stressors (Kirsch, 1985). This type of explanatory account would suggest that negative reinforcement/negative affect reduction expectancies may offer unique explanatory value in terms of understanding negative emotional vulnerability; such that, those persons that hold the strongest beliefs that smoking will yield emotional benefits in terms of alleviating negative mood may come to rely solely on tobacco as a mood management technique. In the absence of other adaptive coping strategies, this subgroup of smokers may be a particularly at-risk population with regard to emotional disturbances such as more intense and problematic (dysregulated) anxiety and depressive symptoms.

Together, the overarching aim of the present investigation was to evaluate the incremental validity of specific, theoretically-relevant smoking outcome expectancies in predicting negative emotional vulnerability factors in a community-recruited sample of adult daily smokers. Based upon basic outcome expectancy theory (Kirsch, 1985), it was hypothesized that expectancies for negative reinforcement/negative affect reduction would be significantly and uniquely positively related to emotional dysregulation (difficulties in regulating emotional states), a greater tendency to experience negative affect symptoms (negative affectivity), and

fears of internal anxiety and bodily states (anxiety sensitivity). Furthermore, these observed effects would be significant, even after accounting for current substance use (amount of daily tobacco use, weekly alcohol use, or monthly marijuana use) or coping style. It also was hypothesized that beliefs about negative personal consequences would be positively related to anxiety sensitivity, as past theory and research has found significant relations between this expectancy variable and fears of negative consequences of anxiety symptoms (Brown et al., 2001; Zvolensky, Feldner et al., 2004). Once again, these observed effects would be significant, even after accounting for current substance use (amount of daily tobacco use, weekly alcohol use, or monthly marijuana use) or coping style. Finally, it was hypothesized that no significant relation will be observed among any of the other types of smoking outcome expectancies (positive reinforcement; appetite control) and our dependent variables.

## 2. Method

### 2.1. Participants

The present sample consisted of 202 adult daily cigarette smokers (44.6% women;  $M_{\text{age}} = 23.78$  years,  $SD = 9.69$ ), smoking a minimum of 10 cigarettes/day. See the Results section for a detailed description of the sample characteristics. Participants were deemed eligible for enrollment in the present study if they were current daily cigarette smokers and between the ages of 18 and 65 years. Participants were excluded based on the following criteria: (1) current suicidality or homicidality, (2) limited mental competency (not oriented to person, place, or time) or inability to give informed, written consent, (3) endorsement of current or past psychotic-spectrum symptoms via structured interview screening; and (4) self-reported major medical illness (e.g., human immunodeficiency virus; cancer). Of the 322 participants screened in the study, 120 were deemed ineligible due to the previously mentioned criteria.

### 2.2. Measures

The *Structured Clinical Interview for DSM-IV Axis I Disorders-Non-Patient Edition (SCID-NP)*. The SCID-NP (First, Spitzer, Gibbon, & Williams, 1995) is a well-established diagnostic interview for psychiatric problems. The interview was principally administered in order to determine if participants had current or past psychotic-spectrum symptoms and suicidal ideation in the context of the exclusionary criteria.

The *Smoking History Questionnaire (SHQ)*; Brown, Lejuez, Kahler, & Strong, 2002) is a self-report questionnaire used to assess smoking history and pattern. The SHQ includes items pertaining to smoking rate, age of onset of smoking initiation, and years of being a daily smoker. The SHQ also assesses information regarding quit attempts, including problematic symptoms experienced during such attempts. The SHQ has been successfully used in previous studies as a measure of smoking history, pattern, and symptom problems during quitting (Zvolensky, Lejuez, Kahler, & Brown, 2004). The current investigation utilized the following variables from the SHQ: age at first cigarette and age at onset of regular (daily) cigarette smoking.

The *Fagerström Tolerance Questionnaire (FTQ)*; Fagerström, 1978) was used as a continuous self-report measure of nicotine dependence. Specifically, the FTQ was administered and scored as the Fagerström Test for Nicotine Dependence (FTND). The FTND is a 6-item scale designed to assess gradations in tobacco dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Two items are rated on a 4-point Likert-style scale (0–3); and four items are rated dichotomously (yes/no). The FTND has shown good internal consistency, positive relations with key smoking variables (e.g., saliva cotinine; Heatherton et al., 1991; Payne, Smith, McCracken, McSherry, & Antony, 1994), and high degrees of test–retest reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). The FTND was used in the present study to assess continuously the average number of cigarettes smoked/day (item #2) as well as the overall level of nicotine dependence.

The *Alcohol Use Disorders Identification Test (AUDIT)*; Babor, de la Fuente, Saunders, & Grant, 1992) is a 10-item self-report screening measure developed by the World Health Organization to identify individuals with alcohol problems (Babor et al., 1992). There is a large body of literature attesting to the reliability and validity of the AUDIT (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). In the present study, the frequency and quantity items from the AUDIT were used to index current alcohol consumption (an average frequency-by-quantity composite score; Stewart, Zvolensky, & Eifert, 2001). Additionally, the AUDIT total score was utilized to identify current difficulties with alcohol use.

The *Marijuana Smoking History Questionnaire (MSHQ)*; Bonn-Miller & Zvolensky, 2005) was used to assess marijuana smoking history and pattern. The MSHQ is a self-report instrument that includes items pertaining to marijuana smoking rate (frequency of use in lifetime and past 30 days). The MSHQ has been employed successfully in past research to assess current marijuana use (Bonn-Miller, Zvolensky, Leen-Feldner, Feldner, & Yartz, 2005; Zvolensky et al., 2006) and is available by contacting Dr. Zvolensky.

The *Smoking Consequences Questionnaire (SCQ)*; Brandon & Baker, 1991) is a 50-item self-report measure that assesses smoking expectancies on a Likert-type scale, ranging from 0 (“completely unlikely”) to 9 (“completely likely”). The measure and its constituent factors have excellent psychometric properties (Buckley et al., 2005; Brandon & Baker, 1991; Downey & Kilbey, 1995). The SCQ includes the following subscales: positive reinforcement (15-items) (e.g., “I enjoy the taste sensations while smoking”), negative reinforcement/negative affect reduction (12-items) (e.g., “Smoking helps me calm down when I feel nervous”), negative consequences (18-items) (e.g., “The more I smoke, the more I risk my health”), and appetite control (5-items) (e.g., “Smoking helps me control my weight”). In the present study, the SCQ subscales demonstrated good internal consistencies with Cronbach alphas ranging from .90–.95.

The *Emotional Approach Coping Scale (EAC)*; Stanton, Danoff-Burg, Cameron, & Ellis, 1994) is an 8-item measure of coping that contains two 4-item subscales: emotional processing (e.g., “I take time to figure out what I’m really feeling”) and emotional

**Table 1**  
Descriptive data and zero-order correlations among theoretically-relevant variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Cigarettes/day (FTQ) <sup>1</sup>	1	-.052	**-.172	-.048	-.016	**.207	**186	.036	**174	.038	**180	.076
2. Past 30 30-day marijuana use <sup>2</sup>	–	1	**319	.089	.119	.001	.081	.082	.063	–.051	–.009	.083
3. Alcohol consumption (AUDIT) <sup>3</sup>	–	–	1	–.045	–.114	.006	.067	**179	–.035	.018	–.047	.012
4. Emotional expression (EAC) <sup>4</sup>	–	–	–	1	**427	.062	.047	.042	.062	**304	*130	–.048
5. Emotional processing (EAC) <sup>5</sup>	–	–	–	–	1	.085	.110	–.045	.098	**304	.041	.114
6. SCQ-negative reinforcement/negative affect reduction <sup>6</sup>	–	–	–	–	–	1	**711	**381	**563	**4311	**333	**396
7. SCQ-positive reinforcement <sup>7</sup>	–	–	–	–	–	–	1	**312	**553	**237	**269	**333
8. SCQ-appetite control <sup>8</sup>	–	–	–	–	–	–	–	1	**385	**230	**186	**283
9. SCQ-negative consequences <sup>9</sup>	–	–	–	–	–	–	–	–	1	**251	**276	**396
10. DERS <sup>10</sup>	–	–	–	–	–	–	–	–	–	1	**667	**577
11. Negative affect (PANAS-NA) <sup>11</sup>	–	–	–	–	–	–	–	–	–	–	1	**692
12. ASI <sup>12</sup>	–	–	–	–	–	–	–	–	–	–	–	1

Note: \* $p < .05$ ; \*\* $p < .01$ ; <sup>1</sup>Cigarettes smoked/day, Fagerström Tolerance Questionnaire; <sup>2</sup>Frequency of marijuana use in the past 30 days, Marijuana Smoking History Questionnaire; <sup>3</sup>Alcohol Use Disorders Identification Test (frequency  $\times$  quantity); <sup>4</sup>Emotional expression, Emotional Approach Coping Scale; <sup>5</sup>Emotional processing, Emotional Approach Coping Scale; <sup>6</sup>Negative reinforcement/negative affect reduction, Smoking Consequences Questionnaire; <sup>7</sup>Positive reinforcement, Smoking Consequences Questionnaire; <sup>8</sup>Appetite control, Smoking Consequences Questionnaire; <sup>9</sup>Negative consequences, Smoking Consequences Questionnaire; <sup>10</sup>Difficulties in emotional regulation scale; <sup>11</sup>Positive affect negative affect scale; <sup>12</sup>Anxiety Sensitivity Index-total score.

expression (e.g., “I take time to express my emotions”). Items are assessed on a 4-point Likert-type scale (1 = “I usually don’t do this at all”; 4 = “I usually do this a lot”). Consistent with past work (Stanton, Kirk, Cameron, & Danoff-Burg, 2000), the emotional processing and emotional expression subscales have yielded high levels of internal consistency in the current sample (Cronbach  $\alpha = .84$  and  $.88$ , respectively). Additionally, both subscales have demonstrated sound predictive validity (Stanton et al., 2000) and have been employed successfully in past research to assess both adaptive and maladaptive coping styles (Zvolensky, Solomon et al., 2006).

The *Positive Affect Negative Affect Scale* (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item measure in which respondents indicate, on a 5-point Likert-type scale (1 = “very slightly or not at all” to 5 = “extremely”), the extent to which they generally feel different feelings and emotions (e.g., “Hostile”). The PANAS is a well-established mood measure commonly used in psychopathology research (Watson et al., 1988) and factor analysis indicates that the PANAS assesses the global dimension of negative affect (PANAS-NA). The PANAS-NA subscale of the PANAS has demonstrated good convergent and discriminant validity (Watson, 2000). Additionally, the negative affect scale demonstrated high levels of internal consistency in the current sample (Cronbach  $\alpha = .90$ ).

The *Anxiety Sensitivity Index* (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is a 16-item measure in which respondents indicate, on a 5-point Likert-type scale (0 = “very little” to 4 = “very much”), the degree to which they are concerned about possible negative consequences of anxiety symptoms (e.g., “It scares me when I feel shaky”). The ASI has high levels of internal consistency for the global score (Cronbach  $\alpha = .92$  in the current sample). The ASI is unique from, and demonstrates incremental validity relative to, trait anxiety (Rapee & Medoro, 1994) as well as negative affectivity (Zvolensky, Kotov, Antipova, & Schmidt, 2005). In the present investigation, the total ASI score was used, as it represents the global-order AS factor and therefore takes into consideration different types of fears, including fears of anxiety-related somatic, cognitive, and social cues.

The *Difficulties in Emotion Regulation Scale* (DERS; Gratz & Roemer, 2004) was used to assess emotion dysregulation. This scale consists of 36 items, which comprise six subscales. Items are rated on a 1 (“almost never”) to 5 (“almost always”) scale. Consistent with past work (e.g., Gratz & Roemer, 2004), the DERS DERS-total score demonstrated good internal consistency in the current sample (Cronbach  $\alpha = .93$ ). In the present study, DERS-total score was employed as a global index of emotional dysregulation (Vujanovic, Zvolensky & Bernstein, in press).

### 2.3. Procedure

Participants were recruited from the Burlington, VT community for participation in a laboratory study on “emotion” via placement of specifically-tailored (i.e., “Are you a smoker?”) study flyers throughout various community settings and posting of printed advertisements in local newspapers. Interested participants who contacted the research team about the study were given a detailed description of the investigation via telephone and scheduled for an initial laboratory visit. Upon arrival to the laboratory, participants provided verbal and written informed consent and were administered the SCID-I/NP (First et al., 1995) by trained interviewers to assess for current or past psychotic-spectrum symptoms. If deemed eligible, participants then completed a battery of self-report measures.<sup>1</sup> At the completion of the study, participants were debriefed and compensated \$20 for their time and effort.

### 2.4. Data analytic strategy

Zero-order correlations were first obtained to examine associations between the predictor and criterion variables. Subsequently, criterion variables in the hierarchical regression analyses included: (1) DERS-total score, (2) PANAS-NA, and (3) ASI-total score. The

<sup>1</sup> The present data were a subset of a larger project that involved a laboratory challenge component. The present data have not been published previously and represent a novel heretofore un-examined aspect of the larger data set.

main effects of average number of cigarettes smoked/day, alcohol use (an average frequency-by-quantity composite score), marijuana use in the past 30 days, and the emotional expression and emotional processing subscale scores of the EAC were entered as a block at step 1. These covariates were chosen on an *a priori* basis on theoretical grounds as factors that could affect relations between the studied predictor and criterion variables. At step 2, the main effects of SCQ: positive reinforcement, negative reinforcement/negative affect reduction, negative consequences, and appetite control were simultaneously entered. In this procedure, any additional variance accounted for by step two is unique to those predictor variables and cannot be attributed to variables in step one (Cohen & Cohen, 1983) (Table 1).

### 3. Results

#### 3.1. Participants

Generally consistent with the racial distribution of Vermont (State of Vermont Department of Health, 2007), 96% of participants identified as Caucasian, 2.5% identified as African-American, and 1% identified as “other.” Participants reported smoking an average of 15.9 cigarettes/day (SD=8.01), smoking their first cigarette at 14.2 years of age (SD=3.57), and smoking regularly at 15.9 years of age (SD=3.53). The average score on the Fagerström Test for Nicotine Dependence (FTND; Heatherington et al., 1991) was 2.78 (SD=1.66), indicating low overall levels of nicotine dependence. Approximately 87% of the sample reported drinking alcohol an average of 2–3 days/week, consuming an average of 5–6 drinks/occasion. Additionally, participants scored an average of 10.52 on the Alcohol Use Disorders Identification Test (SD=7.36) (AUDIT; Babor et al., 1992), with 62.7% of participants meeting criteria for at

**Table 2**  
Summary of hierarchical regression analyses

	$\Delta R^2$	<i>t</i> (each predictor)	$\beta$	$sr^2$	<i>p</i>
<b>Criterion variable: DERS-total score<sup>10</sup></b>					
Step 1	.12				<.001
Cigarettes smoked/day <sup>1</sup>		.11	.01	.00	ns
Marijuana use <sup>2</sup>		-.23	-.02	.00	ns
Alcohol use <sup>3</sup>		.38	.03	.00	ns
EAC: Emotional expression <sup>4</sup>		-2.47	-.19	.04	<.05
EAC: Emotional processing <sup>5</sup>		-2.73	-.21	.03	<.01
Step 2	.14				<.001
SCQ: Negative reinforcement/negative affect <sup>6</sup>		2.18	.21	.03	<.05
SCQ: Positive reinforcement <sup>7</sup>		.74	.07	.00	ns
SCQ: Appetite control <sup>8</sup>		1.29	.10	.00	ns
SCQ: Negative consequences <sup>9</sup>		1.25	.10	.00	ns
<b>Criterion variable: PANAS-NA<sup>11</sup></b>					
Step 1	.07				<.05
Cigarettes smoked/day <sup>1</sup>		2.52	.18	.03	ns
Marijuana use <sup>2</sup>		-.13	-.01	.00	ns
Alcohol use <sup>3</sup>		-.08	-.01	.00	ns
EAC: Emotional expression <sup>4</sup>		-2.37	-.18	.03	<.05
EAC: Emotional processing <sup>5</sup>		2.28	.18	.03	<.05
Step 2	.12				<.001
SCQ: Negative reinforcement/negative affect <sup>6</sup>		2.16	.21	.02	<.05
SCQ: Positive reinforcement <sup>7</sup>		.74	.07	.00	ns
SCQ: Appetite control <sup>8</sup>		.74	.06	.00	ns
SCQ: Negative consequences <sup>9</sup>		1.16	.09	.00	ns
<b>Criterion variable: ASI-total score<sup>12</sup></b>					
Step 1	.06				<.05
Cigarettes smoked/day <sup>1</sup>		1.46	.10	.01	ns
Past 3030-day marijuana use <sup>2</sup>		1.19	.09	.00	ns
Alcohol consumption <sup>3</sup>		-.03	-.002	.00	ns
EAC: Emotional expression <sup>4</sup>		-2.06	-.16	.02	<.05
EAC: Emotional processing <sup>5</sup>		2.63	.2	.04	<.01
Step 2	.19				<.001
SCQ: Negative reinforcement/negative affect <sup>6</sup>		2.22	.21	.03	<.05
SCQ: Positive reinforcement <sup>7</sup>		1.07	.10	.00	ns
SCQ: Appetite control <sup>8</sup>		1.5	.11	.01	ns
SCQ: Negative consequences <sup>9</sup>		2.2	.17	.03	<.05

Note:  $\Delta R^2$ =Variance accounted for by each step of the model;  $\beta$ =standardized beta weight;  $sr^2$ =Squared semi-partial correlation; <sup>1</sup>Cigarettes smoked/day, Fagerström Tolerance Questionnaire; <sup>2</sup>Frequency of marijuana use in the past 30 days, Marijuana Smoking History Questionnaire; <sup>3</sup>Alcohol Use Disorders Identification Test (frequency×quantity); <sup>4</sup>Emotional expression, Emotional Approach Coping Scale; <sup>5</sup>Emotional processing, Emotional Approach Coping Scale; <sup>6</sup>Negative reinforcement/negative affect reduction, Smoking Consequences Questionnaire; <sup>7</sup>Positive reinforcement, Smoking Consequences Questionnaire; <sup>8</sup>Appetite control, Smoking Consequences Questionnaire; <sup>9</sup>Negative consequences, Smoking Consequences Questionnaire; <sup>10</sup>Difficulties in emotional regulation scale; <sup>11</sup>Positive affect negative affect scale; <sup>12</sup>Anxiety Sensitivity Index-total score.

least moderate alcohol problems. Approximately 72% of participants reported being current (i.e., past 30-day) marijuana users, smoking an average of 4.0 (SD=3.2) times in the past 30 days.

### 3.2. Hierarchical regression analyses

A summary of the hierarchical regression analyses can be found in Table 2. Regarding the DERS-total score, predictor variables accounted for 25.8% of the overall variance [ $F(9, 188)=6.93, p<.001$ ]. Variables entered at level one of the model accounted for 12.1% of the variance, with significant predictors being both the emotional expression ( $\beta=-.19, p<.05$ ) and emotional processing ( $\beta=-.21, p<.01$ ) subscales. Level two of the model accounted for an additional 13.7% of the variance, with the negative reinforcement/negative affect reduction subscale being the only significant predictor ( $\beta=.20, p<.05$ ).<sup>2</sup>

Analyses for PANAS-NA indicated that the predictor variables accounted for 18.9% of the overall variance [ $F(9, 197)=4.8, p<.001$ ]. Level one of the model accounted for 7.2% of the variance, with cigarettes/day ( $\beta=.17, p<.05$ ), emotional expression ( $\beta=.18, p<.05$ ), and emotional processing ( $\beta=.17, p<.05$ ) each being significant predictors. Level two of the model accounted for an additional 11.7% of the variance, with the negative reinforcement/negative affect reduction subscale being the only significant predictor ( $\beta=.21, p<.05$ ).

Regarding the ASI-total score, predictor variables accounted for 25.1% of the overall variance [ $F(9, 198)=7.04, p<.001$ ]. Level one of the model accounted for 6.1% of the variance, with significant contributions by the emotional expression and emotional processing subscales ( $\beta=-.16, p<.05$  and  $\beta=.20, p<.01$ , respectively). Level two of the model accounted for an additional 19% of the variance, with significant contribution by the negative reinforcement/negative affect reduction and negative consequences subscales ( $\beta=.20, p<.05$  and  $\beta=.16, p<.05$ , respectively).

## 4. Discussion

There has been little scientific attention focused on the relation between cigarette smoking outcome expectancies and negative emotional vulnerability. To address this gap, the present investigation examined the associations between smoking outcome expectancies and concurrent negative mood variables among adult daily smokers.

As hypothesized, negative reinforcement/negative affect reduction outcome expectancies were significantly associated with negative affectivity, emotional dysregulation, and anxiety sensitivity. Although results revealed relatively small effect sizes, the observed effects were evident above and beyond the statistically significant variance accounted for by the covariates of concurrent substance use and coping style, as well as independent of shared variance with other outcome expectancies. With the exception of the expectancy for negative personal consequences and anxiety sensitivity relation (see below for a discussion), there was no evidence that any other smoking outcome expectancy (i.e., appetite control and positive reinforcement) was incrementally related to the dependent measures. Such data, considered in the context of the unique contribution made by negative reinforcement/negative affect reduction expectancies, suggest that the other studied smoking outcome expectancy variables are not likely part of the explanatory mechanism linking cigarette smoking and anxiety and depressive disorders; that is, they are not uniquely associated with the studied negative emotional dependent variables. Thus, there was evidence to suggest a differential pattern of associations between type of smoking outcome expectancy and the studied negative emotional vulnerability factors. To further explicate the observed associations, future research could explore the directional nature between the smoking expectancies and the studied negative emotion vulnerability factors using a prospective measurement design. For instance, expectancies in regard to smoking for negative reinforcement/negative affect reduction may be shaped by emotional vulnerability and/or emotional vulnerability factors may shape such smoking expectancies. As one hypothetical example, negative emotional vulnerability factors may shape smoking expectancies for negative reinforcement/negative affect reduction, and smoking expectancies may subsequently shape smoking behavior in a manner that maintains negative emotional vulnerability, in a reciprocal or transactional manner.

Also consistent with prediction, negative personal consequences outcome expectancies were significantly incrementally related to anxiety sensitivity. Such results replicate past work that has found an association between anxiety sensitivity and negative personal consequences (Brown et al., 2001; Gregor et al., 2008; Zvolensky, Feldner et al., 2004), and extend it by clarifying the findings from these investigations by illustrating the observed effect is not attributable to concurrent substance use or coping style. This outcome expectancy was not, however, apparent for the other dependent variables. Thus, believing smoking will yield negative personal consequences is related to believing internal cues may yield personal harm or be dangerous (anxiety sensitivity) but may not be broadly applicable to negative emotional symptoms (negative affectivity) or dysregulated emotional experiences. One possible explanation for this pattern of findings is that individuals who fear their negative internal states (i.e., individuals high in anxiety sensitivity) may be more reactive to, and hyper-aware of, adverse smoking-related effects (e.g., coughing), which might then, in turn, contribute to the perception of smoking as being especially problematic or personally harmful. Further research is necessary for better understanding the mechanism by which anxiety sensitivity and negative personal consequences outcome expectancies are linked.

<sup>2</sup> Although not a primary aim of the current study, exploratory analyses focused on positive affectivity were completed for comparative purposes. These analyses were completed in an identical fashion to those reported in the paper except positive affectivity was employed as the dependent variable. Here, predictor variables accounted for 22.1% of the overall variance for positive affectivity [ $F(9, 198)=5.95, p<.001$ ]. Level one of the model accounted for 17.1% of the variance, with significant contributions by the emotional processing and emotional expression subscales ( $\beta=.30, p<.001$  and  $\beta=.16, p<.05$ , respectively). Level two of the model accounted for an additional 5% of the variance, with the appetite control subscale being the only significant predictor ( $\beta=-.16, p<.05$ ).

Overall, the observed findings provide novel evidence that negative reinforcement/negative affect reduction expectancies for smoking are related to a variety of negative emotional vulnerability factors. Thus, daily smokers who believe smoking can alleviate negative moods are more likely to concurrently report greater levels of negative affect, emotional dysregulation, and fears of the negative consequences of anxiety symptoms. These findings build off of previous research demonstrating that smokers tend to utilize cigarettes as a self-regulation process (Brandon et al., 1999; Juliano & Brandon, 2002), aimed at alleviating aversive affective states (Zvolensky, Feldner et al., 2004). Specifically, simply holding the belief that smoking is an effective method of mood management may prevent the development of healthy, adaptive coping strategies, thus conferring risk for subsequent anxiety and depressive symptoms. The results of the present investigation suggest that models accounting for relations between smoking and anxiety and depressive symptoms or disorders may need to incorporate certain outcome expectancies as explanatory factors. Without addressing such smoking beliefs, it may be difficult to comprehensively account for how cigarette smoking may be related to anxiety and depressive symptoms and disorders. The present data suggest, in particular, that negative reinforcement/negative affect reduction expectancies may potentially explain variance in negative emotional vulnerability factors that is not accounted for by other known relevant risk factors for anxiety and depressive states. Building from such work, it is possible that beliefs about smoking also may need to be addressed as part of clinical care for smokers with pre-morbid risk factors for anxiety and depressive disorders, who are attempting to quit smoking. Indeed, without addressing beliefs about the effects of smoking on mood management, interventions may not be maximizing behavior change efforts.

There are a number of interpretative caveats to the present investigation. First, the present study utilized a cross-sectional design. Although such a methodological strategy was useful for providing an initial test of a smoking expectancy-negative emotional vulnerability linkage, it cannot shed light on processes over time or identify causal relations between variables. Thus, the study results are best construed as a “snapshot” of the relations among smoking expectancies and negative emotional vulnerability factors. It is possible bi-directional effects between the studied variables are evident or some third unmeasured factor accounts for the observed association. Moreover, building from the current study, future work is poised to making further exciting inroads into this domain of study by exploring the empirical merit of more complex models. For example, it is possible that certain coping mechanisms may interact with or mediate specific smoking expectancies (e.g., negative affect reduction) in regard to negative emotional states. Second, the smokers in the current study were daily, but not necessarily “heavy” smokers (Pomerleau, Majchrzak, & Pomerleau, 1989). Thus, the results could be related to a self-selection bias and the corresponding smoking history characteristics of the present sample (e.g., rate of smoking, age). As previously noted, heavier smoking is associated with greater risk for anxiety- and depressive-related symptoms and problems (e.g., Johnson et al., 2000). Therefore, it would be useful for researchers to replicate and extend the current findings among a group of heavier smokers in future work to assess whether stronger associations between expectancies and emotional vulnerability exist among more dependent smokers. Furthermore, our sample is comprised of relatively young smokers, who also endorsed high levels of concurrent substance use (e.g. alcohol and marijuana). Given the characteristics of this sample, future work is needed to discern the singular and interactive effects of concurrent substance use on psychological smoking processes. Third, given that self-report measures were employed as the assessment methodology, method variance due to the mono-method approach employed may have contributed to the observed results. To address this concern, future research could utilize alternative assessment methodologies, including experimental cognitive methodologies that tap both strategic and automatic aspects of psychological processes (e.g., outcome expectancies predicting attentional biases for emotional-relevant stimuli). Fourth, the present sample was comprised of a relatively homogeneous (e.g., primarily Caucasian) group of adult smokers who volunteered to participate in the study for monetary compensation. To increase the generalizability of these findings, it will be important for future work of this type to draw from other populations and utilize recruitment tactics aimed at obtaining more diverse samples. Finally, the studied dependent variables represent some key factors of known theoretical and clinical relevance to anxiety and depressive symptoms and disorders. However, they naturally are some, but not all, possible factors. Future work may be usefully focused on extending the range of studied factors to place explanatory parameters on the nature of the observed relations. Here, future work would benefit by evaluating a broader array of dependent measures that include a variety of negative mood variables in order to explicate the relative specificity of the observed effects to anxiety and related negative mood states and psychopathology.

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