Depression Vulnerability Predicts Cigarette Smoking among College Students: Gender and Negative Reinforcement Expectancies as Contributing Factors

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Abstract

This study examined the association between vulnerability to depression and smoking behavior in college students in 1214 college students (54% female), and evaluated gender and expectancies of negative affect reduction as moderators or mediators of this relationship. Depression vulnerability predicted smoking in females, but not males. The relationship between depression vulnerability and smoking status was mediated by expectancies of negative affect reduction in females only. Female college students who are vulnerable to depression may smoke because they expect smoking to relieve negative affect. Smoking interventions for college females may increase in effectiveness by targeting depression and emphasizing mood regulation.

Keywords

Cigarette Smoking; College Students; Depression; Gender; Negative Affect Reduction; Smoking Expectancies

1. Introduction

Cigarette smoking is the leading preventable cause of death in the United States, and data suggest that it is responsible for over 438,000 deaths per year (Centers for Disease Control and Prevention, 2002, 2005; National Institute on Drug Abuse, 2001). Recent statistics indicate that approximately 19.8% of the general United States population currently smokes cigarettes, but prevalence estimates rise to 22.2% for college-aged adults ages 18 to 24 years (Centers for Disease Control and Prevention, 2007, 2008). Furthermore, studies have shown that 11% of smokers report that they first tried cigarettes after the age of 19, that between 11.5% and 22% of college students who have never smoked progress to occasional or daily smoking during the college years, and that the period of risk for smoking initiation may continue until age 20 (Costa, Jessor, & Turbin, 2007; DeWit, Offord, & Wong, 1997; Everett, et al., 1999; Stockdale,

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Dawson-Owens, & Sagrestano, 2005; Wetter, et al., 2004). Therefore, it is important to understand the factors that influence smoking behavior among college students.

Research suggests that smoking among college students may be influenced by the presence of clinical depression or depressive symptomatology (Brown, et al., 2001). As many as 31.9% of undergraduate smokers report that they smoke to manage depression (DeBernardo, et al., 1999). Higher levels of depression are associated with lower self-efficacy to resist smoking, which in turn is associated with higher levels of self-reported smoking behavior (Kear, 2002). In addition, higher scores on specific subscales of the Multiscore Depression Inventory (Instrumental Helplessness, Social Isolation/Withdrawal) are associated with an increased likelihood and intention to smoke among high school and college students (Vogel, Hurford, Smith, & Cole, 2003). What is more, college students are more likely to use tobacco if they have a history of depression, which may represent a proneness or vulnerability to depression (Lenz, 2004; McChargue & Cook, 2007; Schleicher, Harris, Catley, & Nazir, 2009). For example, college students are five to seven times more likely to use tobacco within the past month or year if they have a lifetime diagnosis of depression or have been treated for depression (McChargue, Spring, Cook, & Neumann, 2004).

If vulnerability to depression is linked to smoking behavior in college students, then it is important to understand the moderators and mediators of this relationship so that researchers and clinicians can develop more effective targeted smoking prevention and cessation interventions for this population. Gender may be one such important moderator, given that women are two times more likely than men to experience depression and that depressed female college students exhibit greater levels of nicotine dependence compared to their male counterparts (American Psychiatric Association, 2000; McChargue, Cohen, & Cook, 2004).

Expectations that smoking will reduce negative affect may mediate the relationship between depression and smoking, such that college students may be more likely to smoke because they expect it will relieve negative mood (i.e., they hold *negative reinforcement expectancies*). There is evidence to suggest that heavier, more dependent smokers hold more positive expectations about the consequences of smoking compared to lighter smokers or non-smokers (Brandon & Baker, 1991). In addition, expectancies for positive outcomes (e.g., social facilitation, relaxation, mood enhancement) appear to be more strongly related to cigarette consumption than expectancies for negative outcomes (e.g., negative health consequences) (Brandon, Juliano, & Copeland, 1999; Copeland & Carney, 2003).

Although research has demonstrated that affect and smoking expectancies are linked and may predict smoking behavior, only three studies to our knowledge have examined the role of smoking expectancies as a mediating variable between negative affect and smoking behavior in young adults (Brandon, Wetter, & Baker, 1996; McKee, Wall, Hinson, Goldstein, & Bissonnette, 2003; Schleicher, et al., 2009). One study found that positive smoking expectancies, or expectations of positive reinforcement from smoking, partially mediated the relationship between negative affect and self-reported smoking behavior among young adults (Cohen, McCarthy, Brown, & Myers, 2002). In a similar study among college students, positive smoking expectancies mediated the relationship between history of depression and smoking status, such that students with a history of depression were more likely to smoke when they held positive expectations about the consequences of smoking (McChargue, Spring, et al., 2004). A more recent study showed that negative reinforcement expectancies, in the form of negative affect reduction expectancies, mediated the relationship between a history of depression and number of cigarettes smoked in the past month (Schleicher, et al., 2009).[17] While these studies are informative, the first two did not evaluate negative reinforcement expectancies as a mediator of the relationship between depression and smoking status, and

none of the three studies addressed whether smoking expectancies operate differently for males and females.

The present study was designed to examine the relationship between vulnerability to depression and smoking behavior among college students, while evaluating gender and negative reinforcement expectancies (specifically, expectations of negative affect reduction) as potential moderators or mediators of this relationship. It was hypothesized that depression vulnerability would predict self-reported smoking behavior. It was also hypothesized that gender would moderate the relationship between depression vulnerability and self-reported smoking behavior, such that this predictive relationship would exist for females, but not males. Finally, it was hypothesized that the relationship between depression vulnerability and self-reported smoking behavior would be mediated by negative reinforcement expectancies, but only among female participants.

2. Methods

2.1. Participants

Participants included 1214 undergraduate introductory psychology students (60% female) who completed the study for course credit. The modal age in the sample was 18 years, and the self-reported ethnic composition of the sample was 80.1% Caucasian, 11.4% Hispanic, 3.3% African American, 2.5% Asian American, 0.7% Native American, and 2.0% Other. Approximately 30.1% of males and 28.6% of females reported that they were current smokers. Among current smokers, 58.4% reported smoking fewer than 5 cigarettes per day, 16% reported smoking 6-10 cigarettes per day, 8.6% reported smoking 10-15 cigarettes per day, 2.9% reported smoking 16-19 cigarettes per day, 5.4% reported smoking one pack of cigarettes per day, and 1.1% reported smoking more than one pack of cigarettes per day (7.6% did not report their smoking status; these participants were excluded from analyses where appropriate).

2.2. Measures

2.2.1. Demographic Characteristics and Smoking Behavior—Participants completed a questionnaire developed by the researchers that included questions about demographic characteristics (gender, age, and ethnicity) and smoking behavior.

2.2.2. Depression Vulnerability—The present study utilized two single-item measures (the *depression* and *anhedonia* questions) that have been shown to indicate a vulnerability to depression (McChargue & Cook, 2007). One question assessed history of depressed mood (*Have you ever been down or depressed most of the day nearly every day for 2 weeks or more?*), and the other assessed history of anhedonia (*Have you ever lost interest or pleasure in most things you typically enjoy most of the day nearly every day for 2 weeks or more?*). Single-item measures of history of depression are well-established in the literature (Niaura, et al., 1999; Schleicher, et al., 2009). Responses to the two items used in the current study have been shown to predict depression vulnerability, as defined by clinician-diagnosed history of Major Depressive Disorder, number of past major depressive episodes, levels of depressive rumination, and proneness to depression (Schleicher, et al., 2009).

2.2.3. Smoking Expectancies—Negative reinforcement expectancies in the form of affect reduction expectancies were measured using three items: (1) How much do you think smoking increases your ability to experience pleasure during situations that other people typically enjoy? (2) Do you feel like you can't experience pleasure during typically enjoyable situations without smoking? and (3) If you feel down or sad, do you think that smoking takes away your unhappy mood? Participants responded to items 1 and 3 on a four-point Likert scale (0 = *I do not smoke*; 1 = *Not at all*; 2 = *Moderately*; and 3 = *A lot*). Participants responded to item 2 by

indicating that they did not smoke or did not agree with the statement (0), or that they agreed with the statement (1). There is no standardized scoring method for creating an expectancy score from these items. Therefore, responses on the three items were summed for each participant, such that higher summed scores corresponded with higher expectations regarding the positive effects of smoking. Reliability analyses indicated that this index of smoking expectancies had excellent reliability (Cronbach's α = .92) and high inter-item correlations (r = .78 to .83).

2.3. Procedure

Potential participants signed up for assessment sessions that were held weekly in groups of 15 to 20 individuals. Informed consent was obtained prior to participants completing the research survey. Rights and privileges of volunteer participants in accordance with the university Institutional Review Board were explained to participants before they provided written informed consent. The Institutional Review Board approved all study procedures.

2.4. Analytical Plan

Hierarchical binomial logistic regression analyses were performed to test the hypothesis that gender would moderate the relationship between depression vulnerability, as defined by responses to the depression and anhedonia questions separately, and self-reported smoking behavior. Moderation is said to occur when the following conditions are met: (1) the independent variable (depression/anhedonia) significantly predicts the dependent variable (smoking behavior), (2) the moderator (gender) does not significantly predict the dependent variable, and (3) the interaction between the moderator and the independent variable significantly predicts the dependent variable (Baron & Kenny, 1986).

Linear and logistic regression analyses were conducted to test the hypothesis that the relationship between depression vulnerability (as defined by responses to the depression and anhedonia questions separately) and self-reported smoking behavior would be mediated by negative reinforcement expectancies. These analyses were conducted for the full sample, as well as separately for males and females to test for gender effects. Mediation was said to occur if (1) the independent variable (history of depression or anhedonia) significantly predicted the dependent variable (smoking status), (2) the mediator variable (negative reinforcement expectancies) predicted the dependent variable, and (3) the independent variable was no longer a significant predictor of the dependent variable when the mediator variable was included in the regression model (Baron & Kenny, 1986). Partial mediation was said to occur if the relationship between the independent and dependent variables became attenuated after including the mediator variable in the regression model, and full mediation was said to occur if the relationship between the independent and dependent variables became non-significant after including the mediator variable in the regression model (Baron & Kenny, 1986). Although both mediation and moderation analyses were originally utilized with longitudinal data, there is evidence to support using such analyses with cross-sectional data, with the understanding that causal interpretations are more limited (Baron & Kenny, 1986; Judd & Kenny, 1981).

3. Results

The rates of anhedonia and depression in males were 24.8% and 25.4%, respectively. The rates of anhedonia and depression in females were slightly higher at 27.9% and 30.5%, respectively. These observed gender differences in self-reported anhedonia and depression were not statistically significant [$\chi2$ (1, N = 1157) = 1.3, p > .2 and $\chi2$ (1, N = 1160) = 3.5, p > .05]. There were no differences in smoking rates between males and females, $\chi2$ (6, N = 1161) = 7.7, p > .2. Percentages reflecting depression vulnerability as a function of number of cigarettes smoked per day are presented in Table 1. There were significant differences in depression

vulnerability according to number of cigarettes smoked per day, χ^2 (6, N = 1183) = 18.0, $p < .01$ for the depression question and χ^2 (6, N = 1183) = 18.0, $p < .01$ for the anhedonia question. Individuals with a history of depression reported significantly greater negative reinforcement expectancies ($M = 1.7$, $SD = 2.3$) than those without such history ($M = 1.3$, $SD = 2.0$), $t(1177) = 3.4$, $p < .01$. Similarly, individuals with a history of anhedonia reported significantly greater negative reinforcement expectancies ($M = 1.8$, $SD = 2.3$) than those without such history ($M = 1.2$, $SD = 2.0$), $t(1174) = 4.2$, $p < .001$.

As hypothesized, logistic regression analyses indicated that individuals with a history of depression or anhedonia were more likely to smoke (OR = 1.8, 95% CI = 1.3 – 2.4 and OR = 2.1, 95% CI = 1.5 – 2.8, respectively). Gender moderated the relationship between history of depression and smoking status, such that a history of depression was associated with a greater likelihood of being a smoker in females, but not males (OR = 2.4, 95% CI = 1.6 – 3.5 for females and OR = 1.1, 95% CI = 0.7 – 1.8 for males). The following conditions for moderation were met (see Model A in Table 2): (1) having history of depression was associated with a greater likelihood of being a smoker ($p < .001$), (2) gender alone did not predict smoking status ($p > .10$), and (3) the interaction between history of depression and gender significantly predicted smoking status ($p < .05$). Initial analyses indicated that gender did not moderate the relationship between history of anhedonia and smoking status, because the interaction between history of anhedonia and gender did *not* predict smoking status ($p > .09$) (see Model B in Table 2). However, post hoc analyses suggested the presence of an interaction effect: history of anhedonia predicted smoking status in females, but not males (OR = 2.6, 95% CI = 1.7 – 3.8 for females and OR = 1.5, 95% CI = 0.9 – 2.5 for males).

The results of the mediation analyses supported the hypothesis that participants' expectations regarding the affect-regulating properties of smoking would explain the relationship between depression vulnerability and smoking status. Depression vulnerability, as defined by responses to the depression and anhedonia questions separately (Figure 1), significantly predicted smoking status before negative reinforcement expectancies were entered into the regression model, but this effect was no longer statistically significant after expectancies were included in the model. This pattern of results is consistent with full mediation (Baron & Kenny, 1986). Separate analyses according to gender showed that smoking expectancies fully mediated the relationship between depression vulnerability and smoking status among females (Figure 2). Smoking expectancies did not mediate the relationship between depression vulnerability and smoking status in males, as evidenced by the finding that depression vulnerability did not predict negative reinforcement expectancies or smoking status in this group (Figure 3).

4. Discussion

Results from the current study indicate that self-reported depression vulnerability is associated with a greater likelihood of smoking in college students. This relationship was moderated by gender, such that it only remained significant among females. These findings suggest that depression vulnerability may warrant attention as a potential risk factor for smoking among female college students. Female non-smoking college students who are being treated for depression may benefit from receiving information about the dangers of smoking from their health care providers, such as physicians and mental health care professionals, in order to reduce the likelihood of smoking initiation among this potentially vulnerable group. Female college students who smoke and who wish to quit may benefit from cessation programs that emphasize management of depressive symptoms. This strategy is especially important to consider, because the nicotine withdrawal syndrome includes depressed mood as a symptom (American Psychiatric Association, 2000). This group may be less likely to turn to cigarettes to relieve depressed mood if they are taught alternate ways to cope with feelings of depression. Staff developing university-based smoking prevention and smoking cessation programs may

wish to consider providing information about smoking and depressed mood in freshman welcome packages (including lists of appropriate resources for care), adding a mood management component to pre-existing cessation programs, and encouraging providers in student health care centers to screen for and follow up on depressed mood and smoking, particularly among female patients.

The effect of depression vulnerability on smoking status was explained by negative reinforcement expectancies, which corroborates previous research in this area (Schleicher, et al., 2009). Specifically, smokers with a vulnerability to depression were more likely to hold negative reinforcement expectations about smoking, and were more likely to smoke. The negative affect reduction expectancies measured in the present study were related to how smoking could improve mood or loss of pleasure. Hence our findings suggest that one of the reasons college students with a vulnerability to depression may smoke is that they believe smoking will alleviate the hallmark symptoms of depression (e.g., low mood and lack of interest or pleasure). This finding has implications for smoking prevention campaigns. It is possible that informing at-risk non-smokers (e.g., those with a vulnerability to depression) that expectations of negative affect reduction may influence their decision to start smoking can make these individuals more aware of potential pitfalls that can lead to smoking behavior. Such awareness, coupled with teaching them healthy alternative ways to cope with depressed mood, may reduce their likelihood of smoking in the first place.

The current study represents an important extension of previous research by showing that negative reinforcement expectancies act as a mediator between depression vulnerability and smoking status among female college students, but not male college students (Schleicher, et al., 2009). These results held true even though the direct relationship between negative affect reduction expectancies and smoking status was not gender specific (i.e., holding stronger beliefs that smoking will improve low mood and increase one's experience of pleasant events was associated with being a smoker for both males and females). Taken together, these findings suggest that female college students who have a vulnerability to depression may be more likely to smoke to regulate mood because they believe that smoking will relieve negative mood.

It is notable that depression vulnerability did not differentially predict smoking status among males, nor was the relationship between depression vulnerability and smoking status mediated by smoking expectancies among males. These findings cannot be explained by differences in prevalence rates, as men and women reported similar rates of depression and anhedonia in the present study. However, it is possible that college-age males are motivated to smoke for different reasons than their female peers. This is consistent with prior research indicating that men are less likely to smoke in response to negative affect or believe that smoking can relieve negative affect when compared to women (Brandon & Baker, 1991; Livson & Leino, 1988). Alternatively, males may be less willing to report that they smoke to improve their mood (i.e., they are less likely to endorse negative reinforcement expectancies). In addition, research suggests that the relationship between negative affect (e.g., depression), is simply stronger in women than in men (Husky, Mazure, Paliwal, & McKee, 2008; McKee, Maciejewski, Falba, & Mazure, 2003). Whether these effects are the result of genetic, social, or other factors either in isolation or combination remains unclear and should be addressed by future studies.

4.1. Limitations

Several limitations of the current study must be noted. First, the cross-sectional nature of the study precludes drawing causal inferences. However, the results of the present study suggest the presence of significant associations among the variables under investigation and indicate the need for longitudinal studies in this area. Second, smoking expectancies were measured using only three items, which limits our ability to generalize to a wide variety of smoking expectations. To address this issue, future studies should attempt to replicate the present results

using more comprehensive measures of smoking expectancies, such as the Smoking Consequences Questionnaire (Brandon & Baker, 1991). It is important to note, however, that the small number of items used in the present study is not likely to have posed a threat to our statistical analysis, given that our measure of smoking expectancies demonstrated excellent psychometric properties and that we did not observe weak relationships between smoking expectancies and other measured variables (Viswanathan, 2005). Third, the influence of beliefs in the negative consequences of smoking was not assessed. It is possible that expectations of negative smoking outcomes may play a protective role, such that depressed females who have strong negative smoking expectancies may be less likely to smoke than females with strong positive smoking expectancies. Furthermore, negative smoking expectancies may also affect smoking behavior differently among males and females. Finally, the way that we scored smoking expectancies may be improved by adding more specific response options, such as combining smoking status and level of smoking expectancies (e.g., "I do not smoke and I do not expect <insert negative reinforcement expectancy>;" "I do smoke, but I do not expect <insert negative reinforcement expectancy>;" "I do not smoke and moderately expect <insert negative reinforcement expectancy>;" etc.).

4.2. Conclusions

This study is among the first to demonstrate associations among depression vulnerability, gender, negative reinforcement expectancies related to negative affect reduction, and smoking status among college students. A history of depression was associated with a greater likelihood of being a smoker among female, but not male, college students. Expectations that smoking would reduce negative affect mediated the relationship between depression vulnerability and smoking status only among female college students. Although future research in this area is warranted, the results of the current study implicate the need for smoking prevention and cessation efforts that focus on affectively vulnerable young adults, such as female college students.

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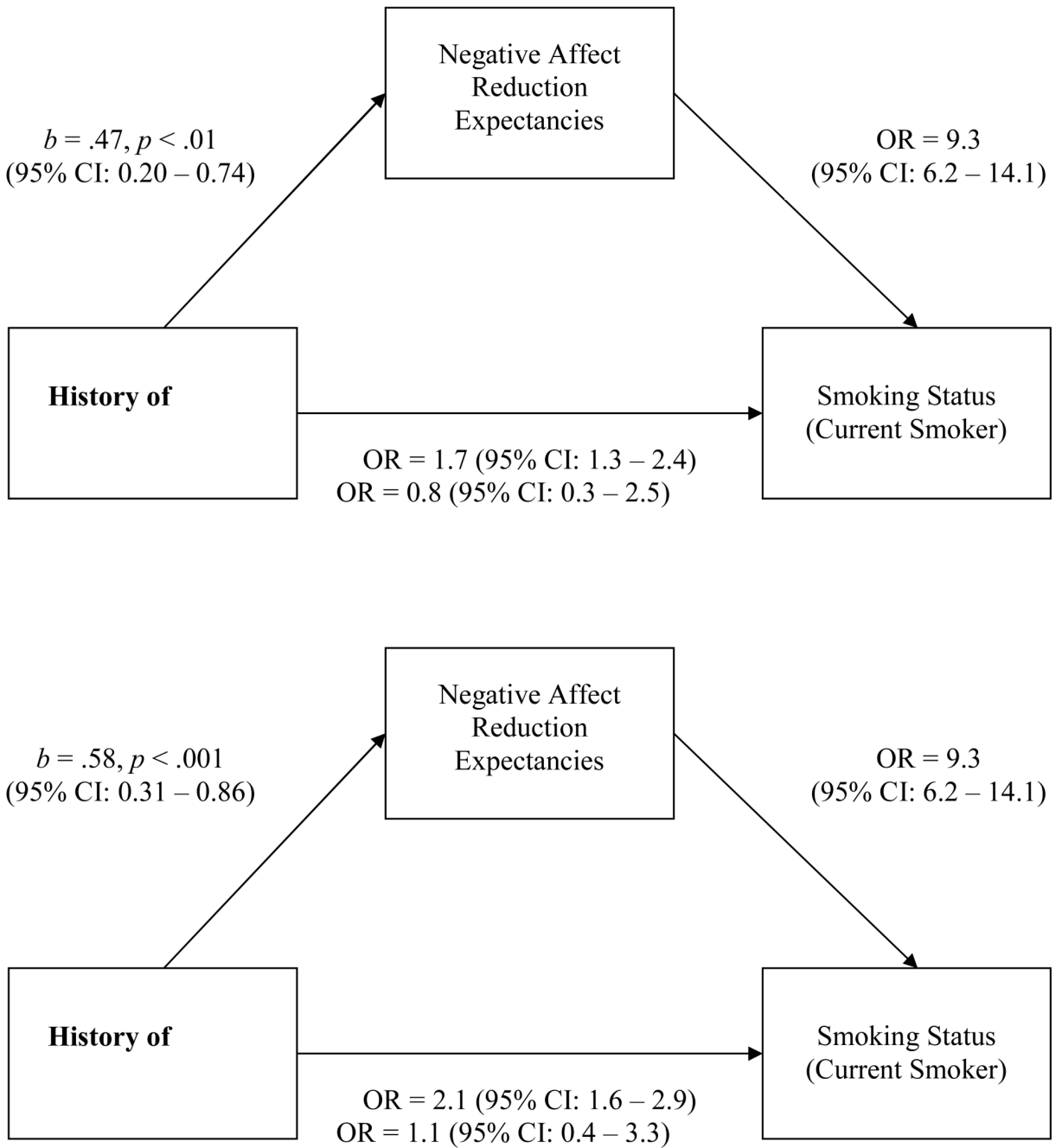
Figure 1.
Negative affect reduction expectancies as a mediator of the relationship between history of depression and smoking status (top panel), and between history of anhedonia and smoking status (bottom panel), for the total study sample. Statistics for the relationship between the independent variable and the dependent variable when the mediating variable is included in the regression model are presented in bold.

Figure 2.
Negative affect reduction expectancies as a mediator of the relationship between history of depression and smoking status (top panel), and between history of anhedonia and smoking status (bottom panel), in females only. Statistics for the relationship between the independent variable and the dependent variable when the mediating variable is included in the regression model are presented in bold.
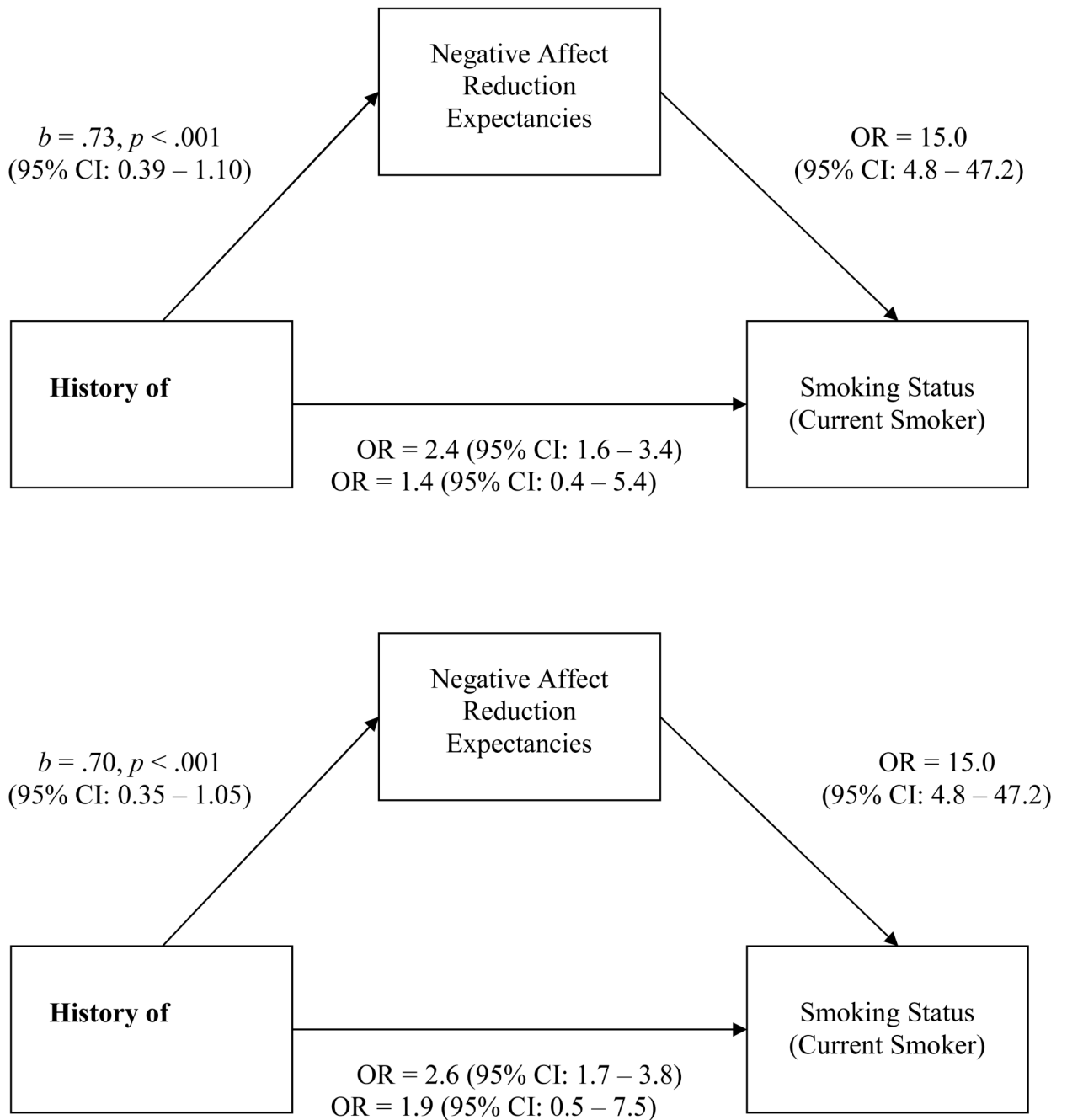
Negative Affect
Reduction
Expectancies

$b = .12, p > .5$
(95% CI: -0.33 – 0.58)

OR = 8.2
(95% CI: 4.9 – 13.5)

History of

Smoking Status
(Current Smoker)

OR = 1.1 (95% CI: 0.7 – 1.8)
OR = 0.3 (95% CI: 0.03 – 2.1)

Negative Affect
Reduction
Expectancies

$b = .45, p > .05$
(95% CI: -0.01 – 0.91)

OR = 8.2
(95% CI: 4.9 – 13.5)

History of

Smoking Status
(Current Smoker)

OR = 1.5 (95% CI: 0.9 – 2.5)
OR = 0.16 (95% CI: 0.02 – 1.7)

Figure 3.
Negative affect reduction expectancies as a mediator of the relationship between history of depression and smoking status (top panel), and between history of anhedonia and smoking status (bottom panel), in males only. Statistics for the relationship between the independent variable and the dependent variable when the mediating variable is included in the regression model are presented in bold.
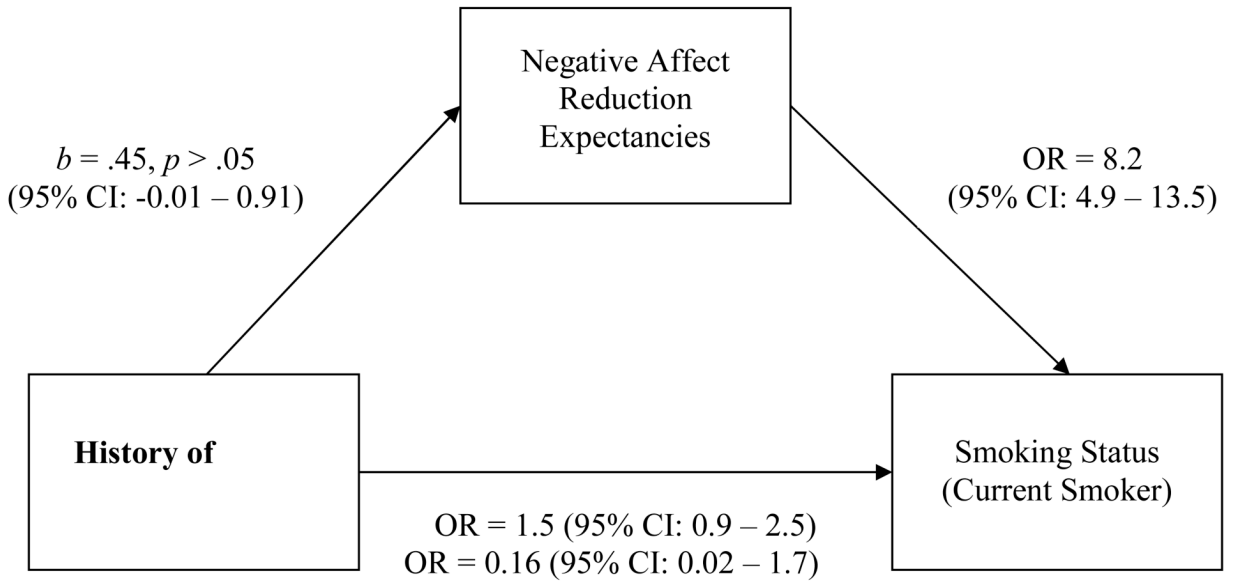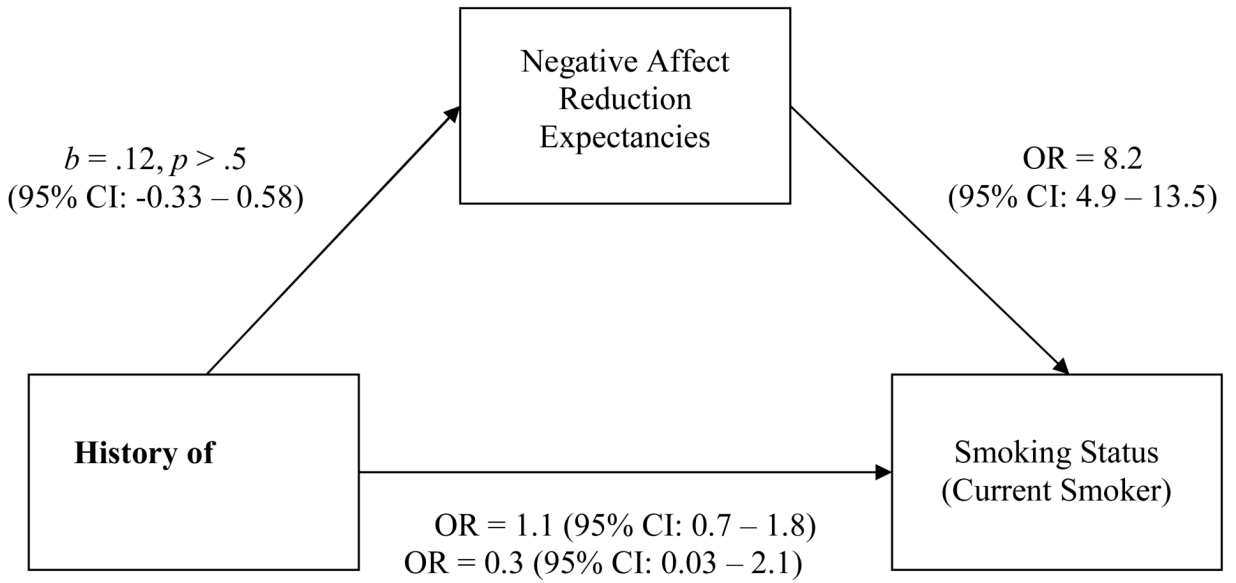
Table 1

Percent reporting depression or anhedonia by number of cigarettes smoked per day (CPD).

CPD	n	Depression (% Yes)	Anhedonia (% Yes)
None	851	26.1	23.9
< 5	214	29.9	30.8
6-10	56	41.8	38.2
11-15	31	32.3	38.7
16-19	10	60	60
20	20	40	27.8
>20	4	75	50

Note. n = sample size.

Table 2

Gender as a Moderator of the Relationship Between History of Depression (Model A) or Anhedonia (Model B) and Smoking Status: Results of Logistic Regression Analyses

Model	Step	Independent Variable	OR	95% CI	p
A	1	History of Depression	1.8	1.3 - 2.4	<.001
	2	History of Depression	1.8	1.3 - 2.5	<.001
		Gender	1.3	0.9 - 1.7	>.10
	3	History of Depression	5.1	2.1 - 12.7	<.001
		Gender	1.6	1.1 - 2.2	<.01
		Gender × History of Depression	0.5	0.2 - 0.9	<.05
B	1	History of Anhedonia	2.1	1.5 - 2.8	<.001
	2	History of Anhedonia	2.1	1.5 - 2.9	<.001
		Gender	1.2	0.9 - 1.6	>.10
	3	History of Anhedonia	4.4	1.7 - 11.2	<.001
		Gender	1.4	1.0 - 2.0	<.05
		Gender × History of Anhedonia	0.6	0.3 - 1.1	>.09

Note. Smoking status was coded as a dichotomous variable (Yes/No), with "No" selected as the reference group. OR = Odds Ratio. CI = Confidence Interval.