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Negative Affect Combines With Smoking Outcome Expectancies to Predict Smoking Behavior Over Time

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The present study examined whether the tendency to experience negative affective states combines with smoking outcome expectancies to predict smoking behavior over time. Participants were 121 young adults and resource people recruited from 3 alcohol and drug treatment programs and through community advertisements. Each participant completed 3 interviews over a 4-year period. Results indicated that dispositional negative affect and positive smoking expectancies were significantly correlated with smoking behavior both within and across time. Expectations of positive and negative reinforcement partially mediated negative affect's relation with smoking across time. Positive expectancies did not function as a moderator of negative affect's relation with smoking behavior. These results represent an important step in incorporating smoking outcome expectancies into multivariate models of smoking risk.

It has been noted that cigarette smoking is decreasing in the general population (Hughes, 1993). However, high rates of smoking are still found among individuals with especially compelling motives for nicotine use (Hall, Muñoz, Reus, & Sees, 1993). Management of negative affective states, such as depression, anxiety, and anger (Britt, 1996; Gilbert & Wesler, 1989; Hall et al., 1993; Russell, Peto, & Patel, 1974; Warburton, Revell, & Thompson, 1991), is one such motive. A number of studies have demonstrated a strong positive relationship between cigarette smoking and depressive disorders (Breslau, Kilbey, & Andreski, 1991, 1993; Glassman et al., 1990; Leftwich & Collins, 1994). Individuals who smoke are more likely to report depressive symptoms than nonsmokers (Pérez-Stable, Marín, Marín, & Katz, 1990), and depressed symptoms have been associated with smoking relapse (Glassman et al., 1990; Hall et al., 1993). The literature also suggests that there is an association between cigarette smoking and anxiety disorders (Breslau et al., 1991; Hughes, Hatsukami, Mitchell, & Dahlgren, 1986). Rates of nicotine dependence have been shown to be two times greater among individuals with an anxiety disorder compared with individuals without a psychiatric diagnosis (Gold, 1995).

The relationship between depression and anxiety and cigarette smoking has typically focused on the *social stress model* of substance use, which suggests that individuals engage in substance use as a means of coping with a variety of stressors, including family, school, peer, work, academic, or community events (Beman, 1995; Rhodes & Jason, 1990). Some researchers speculate that the use of drugs in response to stress may temporarily reduce feelings of anxiety and depression in individuals (Kassel & Shiffman, 1997; Sayette, 1999). However, as substance use becomes a major means of coping with stress, heavy and regular substance use tends to increase rather than decrease stress over time (Aneshensel & Huba, 1983; Brennan, Schutte, & Moos, 1999).

Many smokers report that they smoke more in response to negative affect, such as distress, sadness, and anger (Gilbert & Wesler, 1989; Russell et al., 1974). In fact, one of the more important factors in maintaining smoking behavior is the use of tobacco to regulate affect, particularly to cope with negative affective states (Brandon, 1994). In addition, more than half of all relapse-related crises are associated with negative affect (Bliss, Garvey, Heinhold, & Hitchcock, 1989; Shiffman, 1982; Shiffman et al., 1997).

Smoking Expectancy and Smoking Behavior

Outcome expectancies are typically defined as an individual's anticipation of a systematic relationship between events in some future situation (Goldman, Brown, & Christiansen, 1987). Expectancies can either promote or inhibit behavioral responses to certain

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events. A considerable body of literature exists describing the relationship between drug outcome expectancies and drug use behavior (Abrams & Niaura, 1987; Baker, Morse, & Sherman, 1987; Brandon & Baker, 1991; Brown, 1993; Cooper, Russell, & George, 1988; Goldman et al., 1987). Although most of the research in this area has focused on the expected consequences of alcohol use, research findings from the area of smoking expectancies are consistent with findings from alcohol studies. Specifically, there is clear evidence that heavier, more dependent smokers tend to hold more positive expectancies about the consequences of smoking than do lighter smokers or nonsmokers (Brandon & Baker, 1991). In addition, expectancies for positive outcomes (e.g., social facilitation, relaxation, mood enhancement) appear to be more related to the consumption of cigarettes than expectancies for negative outcomes (e.g., health consequences; Brandon, Juliano, & Copeland, 1999).

Negative Affect, Smoking Expectancies, and Smoking Behavior

In this study, we tested several hypotheses concerning how dispositional negative affect combines with the cognitive or learning risk factor of smoking outcome expectancies to predict smoking behavior over time. There are several ways these two factors may combine in the prediction of smoking behavior. Their contribution to smoking risk can be additive, with each factor having a unique relationship with smoking behavior. Outcome expectancies may also moderate the relationship between negative affect and smoking. A moderation relationship would indicate that individuals with high levels of negative affect would be more likely to smoke if they expected smoking to relieve negative affect. As Brandon et al. (1999) noted, there is some research evidence for both of these models, although the evidence for a moderation relationship is currently limited.

An additional possibility is that smoking expectancies play a mediational role in the relationship between negative affect and smoking. This is consistent with recent conceptualizations of the risk for substance use, which have posited that expectancies function as a mediator or buffer for other substance use risk factors (Flay & Petraitis, 1994; Goldman, Darkes, & Del Boca, 1999). Risk factors that are more distal to substance use behavior, such as negative affect, may exert their influence on the behavior by altering an individual's acquisition of expected reinforcement from engaging in the behavior.

Considerable research evidence exists showing that alcohol expectancies mediate the relationship between factors such as behavioral disinhibition (Henderson, Goldman, Coovert, & Carnevalla, 1994; Sher, Walitzer, Wood, & Brent, 1991), parental influences (Brown, Creamer, & Stetson, 1987; Brown, Tate, Vik, Haas, & Aarons, 1999; Smith & Goldman, 1990), and trait anxiety (Brown & Munson, 1987) with alcohol use. However, instead of exploring mediation, research on smoking expectancies has focused on demonstrating the direct, unique relationship between smoking expectancies and smoking behavior, over and above other risk factors (Brandon et al., 1999).

Individual differences in the tendency to experience negative affect can influence the acquisition of smoking expectancies in several ways. Individuals with high levels of negative affect may be more sensitive to the effect of smoking on affect (e.g., by means of a direct physiological effect, behavioral distraction, or both) and thus be more likely to develop the expectancy that smoking reduces negative affect. In both their vicarious and direct experience with smoking, individuals who experience increased negative affect may be more likely than others to notice and encode information concerning the influence of smoking on affect. Another possibility is that individuals with high levels of negative affect have a greater potential for reduction in negative affect from smoking. If those with high negative affect actually experience greater negative reinforcement (e.g., more relief from negative affect) than others, this would affect their expectancies, which would in turn affect later smoking behavior.

The Present Study

In the present study, we proposed several hypotheses of how the tendency to experience negative affective states combines with smoking outcome expectancies to predict smoking behavior over time. We tested three main hypotheses. First, we hypothesized that dispositional negative affect and positive smoking expectancies would be significantly correlated with smoking behavior. Second, we hypothesized that positive expectancies would function as a moderator of the relationship between negative affect and smoking. This hypothesis tested the idea that individuals with high dispositional negative affect who also hold strong positive expectancies may be more likely to act on these cognitions and smoke heavily. Finally, we hypothesized that expectations of positive and negative reinforcement mediated the relationship between negative affect and smoking behavior.

Method

Participants

Participants were 121 young adults and resource people from a longitudinal study of the long-term clinical course of adolescent alcohol and drug abuse (see Brown, Myers, Mott, & Vik, 1994). Ninety-eight percent of the resource people at the 4-year follow-up point (Time 1) were parents living with the young adult. The other 2% consisted of individuals who classified themselves as having another relationship with the young adult but who lived with them. Participants were recruited from three alcohol and drug treatment programs in metropolitan San Diego, California ($n = 67$) and through community advertisements in the same catchment area as the treatment programs ($n = 54$). Individuals recruited from the community were selected from volunteers to be comparable to the clinical sample on socioeconomic status and risk for substance involvement at the time of recruitment. Participants who completed the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) and the smoking supplement to the Customary Drinking and Drug Use Record (CDDR; Brown et al., 1998) at the 6- and 8-year follow-up points, respectively, and whose resource person (RP) had completed the Child Behavior Check List (CBCL; Achenbach & Edelbrock, 1983) at the 4-year follow-up point, were included in the present study.

The overall sample was 45% female and 55% male, with an average age of 19.69 ($SD = 1.50$, range: 16–23) at the 4-year follow-up point (Time 1). Eighty-five percent were Caucasian, 10% were Hispanic, 3% were African American, and 2% were Native American. The clinical and community samples were different in regard to gender (clinical: 66% male, community: 43% male), $\chi^2(1, N = 121) = 6.45$, $p < .05$; and age (clinical: $M = 16.13$, $SD = 1.17$; community: $M = 19.13$, $SD = 1.68$), $t(119) = 3.87$, $p < .01$; but not ethnicity, $\chi^2(5, N = 121) = 7.79$, *ns*.

Participants reported smoking an average of 39.73 cigarettes per week at Time 1 (SD = 58.00, range: 0–210), 47.12 cigarettes per week at Time 2 (SD = 63.16, range: 0–280), and 46.35 cigarettes per week at Time 3 (SD = 69.42, range: 0–320). Smoking rates at each time point indicated that 50.4%, 47.9%, and 47.1% of the sample were smokers at Times 1, 2 and 3, respectively. There were differences observed between the clinical and community samples, however, in cigarettes smoked per week (clinical: M = 74.82, SD = 57.11; community: M = 10.82, SD = 26.70), $t(119)$ = 7.59, $p < .01$. The two samples were not different on the CBCL, $t(119)$ = 1.09, *ns*. Because of these differences, we included both sample and gender as covariates in partial correlation analyses.

Measures

Negative affect. Dispositional negative affect was assessed at Time 1 using the Internalizing scale score from the CBCL (Achenbach & Edelbrock, 1983). The CBCL is a 113-item parent report questionnaire that assesses a variety of behavior problems and social competence. Overall, the CBCL consists of three social competence scales and nine problem behavior scales and has been extensively investigated with adolescent normative data available for a variety of clinical populations. The Internalizing scale score from the CBCL is calculated by summing the 9 items of the Withdrawn scale, the 9 items of the Somatic Complaints scale, and the 14 items from the Anxious/Depressed scale. Computation of the Internalizing scale also involved subtracting Item 103 (e.g., *sad*) from the aforementioned sum.

Smoking behavior. Smoking behavior was assessed at each time point using a smoking supplement to the CDDR (Brown et al., 1998), a measure with well-documented reliability and validity for use with adolescent populations. For the present study, quantity of cigarettes smoked per week was used as a measure of smoking behavior.

Smoking expectancies. Smoking expectancies were assessed at Time 2 and Time 3, using the 50-item SCQ (Brandon & Baker, 1991). This measure assesses four factors: negative consequences (e.g., health risks), positive reinforcement/sensory satisfaction (e.g., taste, relaxation), negative reinforcement/negative affect reduction (e.g., reduction of sadness and anxiety), and appetite–weight control. Participants respond to questions using a 10-point Likert scale (0 = *completely unlikely*, 9 = *completely likely*), with higher scores representing more positive smoking expectancies. The positive and negative reinforcement factor scores were used in all analyses.

Procedure

For each participant, an RP also agreed to participate in the study. Informed consent was obtained independently from all participants and RPs prior to their entry into the study. Each was individually paid for their participation. The RP was administered the CBCL at the 4-year follow-up (Time 1), and the participant was administered the SCQ and the smoking supplement to the CDDR at the 6- and 8-year follow-ups (Times 2 and 3), respectively.

Table 1
Within- and Across-Time Correlations Among Negative Affect, Expectancy of Positive Reinforcement From Smoking, Expectancy of Negative Reinforcement From Smoking, and Smoking Behavior

Measure	M	SD	1	2	3	4
			Time 2			
1. CBCL			—			
2. CDDR	47.12	63.16	.16* (.12)	—		
3. +SCQ	3.78	2.43	.22* (.20*)	.53** (.42**)	—	
4. −SCQ	3.51	2.63	.25** (.24**)	.43** (.37**)	.85** (.85**)	—
			Time 3			
1. CBCL			—			
2. CDDR	46.35	69.42	.24** (.21*)	—		
3. +SCQ	3.58	2.44	.24** (.22**)	.45** (.35**)	—	
4. −SCQ	3.53	2.55	.28** (.27**)	.32** (.28**)	.86** (.87**)	—
Across Time: CBCL (Time 1), +/−SCQ (Time 2), and CDDR (Time 3)						
1. CBCL	8.46	8.49	—			
2. CDDR	46.35	69.42	.24** (.22**)	—		
3. +SCQ	3.78	2.43	.22* (.19*)	.45** (.33**)	—	
4. −SCQ	3.51	2.63	.25** (.23**)	.37** (.30**)	.85** (.85**)	—

Note. CBCL = negative affect as measured with the Child Behavior Check List; CDDR = smoking behavior as measured by the Customary Drinking and Drug Use Record; +SCQ = expectancy of positive reinforcement from smoking as measured by the Smoking Consequences Questionnaire; −SCQ = expectancy of negative reinforcement from smoking; CBCL data were collected at Time 1 only. Partial correlations are in parentheses.
* $p < .05$. ** $p < .01$.

Results

Negative Affect, Smoking Expectancy, and Smoking Behavior

In Table 1 the correlations among negative affect, positive reinforcement/sensory satisfaction expectancies, negative reinforcement/negative affect reduction expectancies, and smoking behavior (number of cigarettes smoked per week) are presented. As hypothesized, negative affect and both positive and negative reinforcement expectancies from smoking were significantly related to smoking behavior. Partial correlations, controlling for both gender and sample, were also significant (see Table 1).

We then used regression equations to estimate the unique effects of negative affect and expectancies on smoking behavior. We estimated separate equations for positive and negative reinforcement expectancies and analyzed data both within time points as well as across time (Time 2–Time 3). These results indicate that expectancy had a significant unique relationship with smoking behavior over and above negative affect. Negative affect had a significant unique relationship with smoking behavior only at Time 3 (see Table 2).

Positive Expectancies as a Mediator of Negative Affect's Relation With Smoking

In Table 1 the correlations among negative affect, smoking expectancies, and smoking behavior over time that are required for mediation are presented. These results indicate a significant bivariate relationship among Time 1 negative affect, Time 2 expect-

Table 2
Regression Results: Effects of Negative Affect and Expectancies on Smoking Behavior

Time point	β	R^2
Time 2		
Negative affect	.05	
Positive reinforcement expectancies	.52**	.29
Negative affect	.05	
Negative reinforcement expectancies	.42**	.19
Time 3		
Negative affect	.14	
Positive reinforcement expectancies	.41**	.22
Negative affect	.16*	
Negative reinforcement expectancies	.28**	.13
Time 2–Time 3		
Negative affect	.15*	
Positive reinforcement expectancies	.42**	.23
Negative affect	.16*	
Negative reinforcement expectancies	.33**	.16

* $p < .05$. ** $p < .01$.

ancies, and Time 3 smoking behavior. We then used path analysis using EQS (Bentler & Wu, 1995) to test smoking expectancies at Time 2 as a mediator of the relation between negative affect at Time 1 and smoking behavior at Time 3. Again, we ran models separately for each of the two factors examined from the SCQ (positive reinforcement/sensory satisfaction and negative reinforcement/negative affect reduction). EQS provides both parameter estimates (βs) and a z test of the mediated (indirect) effect of the independent variables on the dependent variables through other variables in the model. In the present analyses, with only three variables, the indirect effect of negative affect on smoking behavior is through expectancy. Therefore, this z test provides a test of expectancy as a mediator of the negative affect–smoking behavior relation.

In Figure 1 and Figure 2 are presented the path diagrams for the hypothesized structural model estimating the relations among negative affect, expectancies, and smoking behavior. In the model examining the role of positive reinforcement expectancies (Figure 1), negative affect was found to have an indirect effect on smoking behavior through expectancy ($z = 2.10$, $p < .05$). This suggests that the relationship of negative affect with smoking behavior is partially explained by its relationship with the expectancy that smoking will result in positive reinforcement (e.g., taste, relaxation). Parameter estimates for the negative affect–smoking behavior relationship drop from .24 ($p < .01$), when these expectancies are not in the model, to .15 ($p < .05$) when expectancies are added to the model. Thus expectancies only partially mediate the negative affect–smoking relationship. Negative affect has a modest

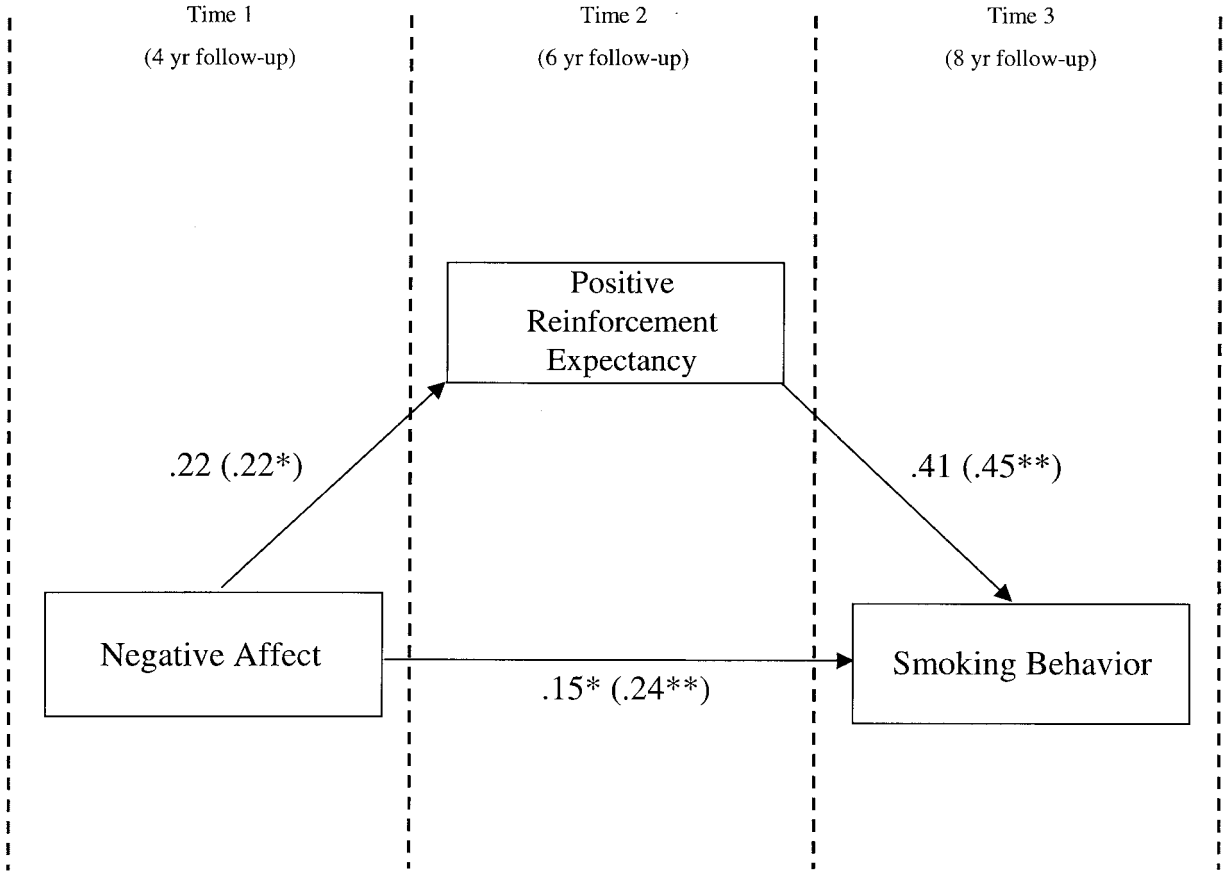

Figure 1. Path diagram estimating the relations among negative affect, positive reinforcement expectancies, and smoking behavior. yr = year. * $p < .05$. ** $p < .01$.

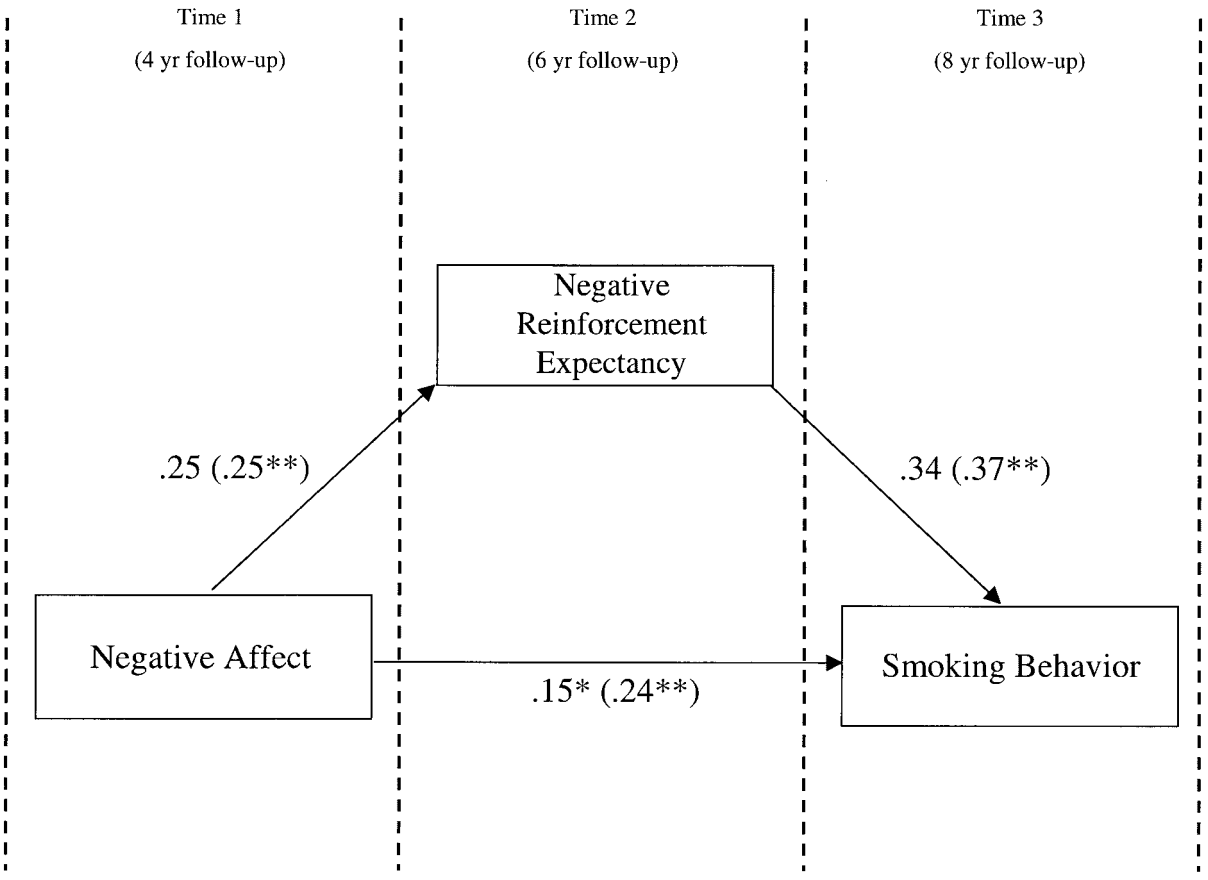

Figure 2. Path diagram estimating the relations among negative affect, negative reinforcement expectancies, and smoking behavior. yr = year. * $p < .05$. ** $p < .01$.

direct effect on smoking behavior as well as an indirect effect through positive reinforcement expectancies.

In examining the role of negative reinforcement expectancies (Figure 2), negative affect was also found to have an indirect effect on smoking behavior through expectancy ($z = 2.23$, $p < .05$). This suggests that the relationship of negative affect with smoking behavior is partially explained by the expectations that smoking will offer negative reinforcement (e.g., reduction of sadness and anxiety). As in the positive reinforcement expectancies model, parameter estimates for the negative affect–smoking behavior relationship drop from .24 ($p < .01$), when expectancies are not in the model, to .15 ($p < .05$) when negative reinforcement expectancies are added to the model. Negative affect is related to smoking behavior directly, as well as indirectly through negative reinforcement expectancies (see Figure 2).

Expectancy as a Moderator of Negative Affect's Relation With Smoking

We next tested positive expectancies as a moderator of the relationship between negative affect and smoking. Using hierarchical regression, we entered the main effects of expectancy and negative affect in the first step, with the interaction term (Expectancy × Negative Affect) entered in the second step. We ran analyses separately for Time 2 and Time 3, as well as for positive and negative reinforcement expectancies. Moderation effects were not significant. The one exception to this was at Time 3, when positive reinforcement expectancies moderated the relationship between negative affect and smoking, $t(119) = 2.02$, $p < .05$.

Discussion

The present study proposed a model of how one's tendency to experience negative affective states combines with smoking outcome expectancies to predict smoking behavior over time. Three hypotheses were tested: (a) that negative affect and positive smoking expectancies would correlate with smoking behavior, (b) that expectations of positive and negative reinforcement would mediate the relation between negative affect and smoking, and (c) that positive expectancies would function as a moderator of the relation between negative affect and smoking. Support was found for the first two hypotheses but not for the moderation hypothesis.

One's proneness toward experiencing negative affect was associated with levels of smoking-related expectancies across time points. Furthermore, expectations of positive and negative reinforcement were found to mediate the relationship between negative affect and smoking over time. This indicates that at least part of the commonly observed relationship between negative affect and smoking behavior can be explained by smoking expectancies. We have proposed several possible explanations for this. For

instance, individuals with high levels of negative affect may pay more attention to the effects of nicotine on mood or may have more ready access to information regarding these effects. It is also possible that individuals with high levels of negative affect actually experience more negative reinforcement (e.g., negative affect reduction) from smoking compared with individuals low in negative affect.

Both positive and negative reinforcement expectancies had unique relationships with quantity of cigarettes smoked; however, negative affect had a significant unique relationship with smoking behavior only at Time 3. This finding, coupled with the partial mediation results, might indicate that as a person ages (and the smoking behavior becomes more developed), negative affect becomes more proximally associated with smoking behavior, or else influences this behavior through factors other than expectancies. It is now widely accepted that smoking progresses through several stages, starting with the precontemplation, contemplation, and initiation stages, followed by sporadic/limited smoking, regular/infrequent smoking, and established/daily smoking (Flay, d'Avernas, Best, Kersell, & Ryan, 1983; Leventhal & Cleary, 1980; Stern, Prochaska, Velicer, & Elder, 1987; U.S. Department of Health and Human Services, 1994). In the earlier stages of smoking development, peer influences, self-image, or both, are important influences on smoking. By the final stage of development, however, smoking has become an integral part of self-regulation in a variety of situations (Mayhew, Flay, & Mott, 2000). At this stage, smoking regulates cravings in response to internal cues caused by changes in the blood levels of nicotine (i.e., physiological withdrawal symptoms). This may indicate an increase in the importance of physiological factors in the relationship between negative affect and smoking behavior. In this later smoking stage, cognitive factors, while still important, may play less of a role in explaining the negative affect–smoking relationship. Therefore, the present data suggest that as smoking progresses the relationship between negative affect and smoking behavior becomes more direct.

Positive expectancies were not found to moderate the relation of negative affect. This indicates that, given high positive expectancies for the effects of smoking, individuals who experience higher levels of negative affect are no more likely to act on that expectancy and smoke more heavily. Current research on this interaction effect is mixed (Brandon et al., 1999). In the present study, the one significant moderation effect was observed at Time 3, when positive reinforcement expectancies were shown to moderate the relationship between negative affect and smoking. This again may indicate a change in the risk process as smoking behavior progresses to increasing dependence. Further research should explore whether expectancies are more likely to moderate the negative affect–smoking relationship in the later stages of smoking dependence.

There are a number of limitations to this study. First, the measure we used to assess negative affect (the Internalizing scale score from the CBCL) is a retrospective measure obtained by an RP rather than from the adolescent. The use of an RP's report for one study variable and self-report for others introduces an additional source of method variance. Although parent ratings on the CBCL have been found to predict later self-report (Stranger, MacDonald, McConaughy, & Achenbach, 1996), it is possible that parents are not as accurate observers of a child's internalizing behavior as the child him- or herself. Future studies in this area should additionally use self-report measures designed to assess negative affect prospectively. Furthermore, we assessed expectancies using a self-report questionnaire. Although questionnaire measures for expectancies have good reliability and validity, they do not take advantage of recent advancements in expectancy assessment (Goldman et al., 1999).

Another limitation of the study is that not all study variables were assessed at all three time points. Because of this, our results establish the importance of negative affect in predicting later smoking expectancies and smoking behavior, but they do not account for changes in smoking expectancies or smoking behavior over time. This study, then, serves only as an important first step in improving an understanding of the relationship among negative affect, smoking expectancies, and smoking behavior over time. Future studies are needed to explore the relationship between negative affect and changes in smoking expectancies and behavior over time.

The sample for this study consisted of adolescents who were at high risk for substance involvement or who had previously been treated for substance abuse. As a result, the findings from this study may have limited generalizability. Furthermore, sample size limitations precluded testing hypotheses separately for these two groups. Instead, sample was used as a covariate, and this did not affect the support of study hypotheses. Nevertheless, this analytic strategy limits our understanding of any differences in the two groups in the interrelationship among negative affect, smoking expectancies, and smoking behavior.

We proposed a model of how the tendency to experience negative affective states combines with smoking outcome expectancies to predict smoking behavior over time. These findings are thought to be a first step in describing multivariate models that integrate smoking expectancies with other factors in the determination of smoking behavior.

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