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Emotion-based impulsivity, smoking expectancies, and nicotine dependence in college students

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Abstract

The aim of this study was to enhance our understanding of the relationship between affect-related dispositions to rash action, negative urgency (NU: the tendency to act rashly when in a negative mood), positive urgency (PU: the tendency to act rashly when in a positive mood) and level of nicotine dependence symptoms by examining how the two traits transact with affect-related smoking expectancies. Based on the Acquired Preparedness model of addictive behaviors, we hypothesized that the relationship between PU and level of nicotine dependence would be mediated by positive affect smoking expectancies. We also hypothesized that the relationship between NU and level of nicotine dependence would be mediated by negative affect reduction expectancies. We studied 139 college-aged smokers and found support for this model; positive affect expectancies for smoking mediated the relationship between PU and level of nicotine dependence symptoms. Negative affect reduction smoking expectancies mediated the relationship between NU and level of nicotine dependence. The clinical implications of this research suggest that prevention/intervention programs should include substance-free activities as reinforcement and as ways to deal with extreme positive and negative mood.

Keywords

emotion-based impulsivity; college students; nicotine dependence; smoking expectancies

Introduction

Approximately 22% of college-aged adults, ages 18 to 24 years, smoke cigarettes (Centers for Disease Control, 2009). Although young adults typically smoke fewer cigarettes per day and are less likely to be daily smokers compared to older adults (Johnston, O'Malley, & Bachman, 2001), research suggests that students who smoke a pack of cigarettes or less per week still report symptoms of nicotine dependence (Dierker et al., 2007). Therefore,

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studying factors that may be related to vulnerability or susceptibility to developing nicotine dependence in this population is warranted (Choi et al., 1997; Distefan, Gilipin, Choi, & Pierce, 1998).

Impulsivity

Impulsivity is one factor that is related to smoking (Bickel, Odum, & Madden, 1999; Doran, Cook, McChargue, & Spring, 2009; Perkins et al., 2008; Spillane, Smith, & Kahler, 2010). The term impulsivity is an overly broad construct and can be disassembled into its component constructs (Cyders & Smith, 2007; Evenden, 1999; Petry, 2001; Whiteside & Lynam, 2001). There are five different personality dispositions to engage in rash or impulsive action that have been found to be modestly correlated (Cyders & Smith, 2007; Cyders et al., 2007; Smith et al., 2007; Whiteside & Lynam, 2001), including sensation seeking, negative urgency (NU), positive urgency (PU), lack of planning, and lack of perseverance (Cyders et al., 2007; Whiteside & Lynam, 2001). Two of these dispositions to rash or impulsive action are emotion-based impulsivity traits and may be especially relevant to smoking given the important role that emotion plays in the development of nicotine dependence (Baker, Brandon, & Chassin, 2004). PU refers to the tendency to act rashly when experiencing positive affect, whereas NU refers to the tendency to act rashly when experiencing negative affect (Cyders et al., 2007; Whiteside & Lynam, 2001). Studies have examined the association between PU and NU and smoking behaviors (Billieux, Van der Linden, & Ceschi, 2007; Doran et al., 2009; Spillane et al., 2010). In a previous study (Spillane et al., 2010), PU was the only impulsivity-related trait associated with higher levels of nicotine dependence; it was positively related to level of nicotine dependence in a college student sample. In other samples, researchers have found that NU relates to processes thought to be central to the development of nicotine dependence (Billieux, Van der Linden, & Ceschi, 2007; Doran et al., 2009). For example, among four of the five traits (the study did not include a measure of PU), only NU was significantly associated with cigarette craving cross-sectionally (Billieux et al., 2007). Doran and colleagues (2009) studied four of the five traits (again without PU) and found that smokers high in NU and lack of perseverance reported greater increases in negative affect craving in response to cue exposure. In addition, in a study of 1813 5th graders, researchers found that negative urgency was strongly related to having smoked in the past six-months (Settles et al., 2012).

The goal of the current study was to enhance our understanding of the relationship between these emotion-based dispositions to impulsive action and level of nicotine dependence symptoms in a college student sample. While the studies mentioned thus far suggest an important role for emotion-based impulsivity in smoking, they do not provide information on the mechanisms through which positive or negative urgency influences levels of nicotine dependence symptoms. Smoking expectancies may play a role in the mechanism of the urgency-smoking relationship.

Smoking expectancies

Smoking expectancies are learned associations describing the perceived benefits or consequences of smoking (Brandon & Baker, 1991). Affect-related expectancies are expectations that smoking will have a positive impact on one's emotional state either by

taking away negative affect or by enhancing positive affect. To the extent that a smoker has learned that smoking may modulate these emotions, that individual will hold stronger expectancies for these forms of reinforcement from smoking and be more likely to smoke and continue to smoke. Smoking expectancies have been shown to differentiate lighter versus heavier smokers (Brandon & Baker, 1991) and relate to levels of nicotine dependence (Piper et al., 2008; Schleicher, Harris, Catley, Harrar, & Golbeck, 2008). Of particular interest to this study are affect reduction smoking expectancies, which refer to smoking to manage one's mood.

Impulsivity and expectancies: influence on smoking

Smoking expectancies have also been associated with the broad construct impulsivity (Doran, McChargue, & Cohen, 2007; Doran Schweizer, & Myers, 2011). In this study, we investigated one potential mechanism to explain how NU and PU related to level of nicotine dependence. The Acquired Preparedness (AP) model of addictive behaviors suggests that, as a function of individual differences in personality (NU and PU), individuals are differentially prepared to acquire high risk expectancies (Smith & Anderson, 2001). More specifically, individuals who act out in response to extreme emotional states are more likely than others to perceive such behaviors as reinforcing, and thus form expectancies for reinforcement from them. In the case of PU, these individuals may be more likely to learn that smoking is enjoyable and pleasurable. In the case of NU, these individuals may come to expect that smoking will reduce their overall negative affect and smoke in response to a negative mood.

Cross-sectional research has produced findings consistent with the possibility that this process contributes to the initiation of eating disordered behavior and drinking behavior in 5th graders (Combs, Pearson, & Smith, 2011; Gunn & Smith, 2010; Pearson, Combs, & Smith, 2010). In those studies, negative urgency was a risk factor for both types of problem behaviors, and eating disordered behavior was predicted by eating and dieting expectancies and drinking was predicted by alcohol expectancies.

Applying the AP model to smoking, Combs, Spillane, Caudill, Stark, and Smith (2012) found that in a sample of elementary school children, the relationship between PU and NU and smoker status was partially mediated by expectancies for reinforcement from smoking. Smith and Zapolski (2011) found that endorsement of the urgency traits in fifth grade children predicted the onset of smoking one year later, beyond the effects of pubertal onset. Broad impulsivity has been shown to predict higher positive reinforcement outcome expectancies, but not negative reinforcement outcome expectancies for smoking after 48 hours of smoking abstinence among nicotine dependent college students (VanderVeen, Cohen, Trotter, & Collins, 2008).

The Current Study

Based on the AP model, we propose that the relationship between the two emotion-based dispositions to rash action and level of nicotine dependence symptoms is mediated by smoking expectancies. Specifically, we hypothesized that 1) the relationship between PU and level of nicotine dependence symptoms will be mediated by positive reinforcement

smoking expectancies; and 2) the relationship between NU and level of nicotine dependence symptoms will be mediated by negative affect reduction smoking expectancies.

Method

Participants

The sample consisted of 131 participants: 70 female, 60 male, and 1 unknown who were recruited to participate in a study on smoking behaviors. Participants average age was 19 years ($SD = 1.8$). To be included in the study, participants had to report smoking cigarettes in the past month. Potential participants were recruited from Introductory Psychology courses from a large US Midwestern University and received course credit for their participation.

Procedure

Questionnaires were administered in a group format with approximately 25 people in each group. Informed consent was obtained independently from all participants. Following completion of the measures, participants were debriefed, thanked, and received course credit for their participation. All procedures were approved by the University of Kentucky's Institutional Review Board.

Measures

Fagerstrom Test for Nicotine Dependence—(FTND; Heatherton et al, 1991). The FTND measures symptoms of nicotine dependence on a six-item scale. Scores can range from 0 to 10, with higher scores indicating greater levels of dependence. Internal consistency estimate for this sample is .69.

UPPS - P Impulsive Behavior Scale—(UPPS-P: Lynam, Smith, Whiteside, & Cyders, 2006). The UPPS-P uses four-point likert type scales to assess five different dispositions to impulsive action. The five different components are: NU, PU, lack of planning, lack of perseverance, and sensation seeking. PU has been shown to be distinct from NU (Cyders & Smith, 2007, 2010). Only the PU and NU subscales were used in the current study based on our a priori hypotheses and results of prior work in this sample (Spillane et al., 2010). Internal consistency estimates in this sample were: NU (.88) and PU (.95).

Smoking Consequences Questionnaire—(SCQ; Brandon & Baker, 1991). Smoking outcome expectancies were measured using the SCQ (Brandon & Baker, 1991). The SCQ consists of four scales assessing Negative Consequences, Weight Control, Positive Reinforcement, and Negative Affect reduction expectancies. We used the Negative Affect Reduction Expectancies and Positive Reinforcement subscales. Items were rated on a 0 to 9 scale with respect to likelihood of occurrence of each consequence, and scales were computed using sums of scores. Internal consistency estimates in this sample were: Positive Reinforcement Expectancies (.96) and Negative Affect Reduction expectancies (.98). Desirability ratings were not assessed because prior research indicated that they provided limited predictive value over and above likelihood ratings (Brandon & Baker, 1991).

Results

Data analytic strategy

Analyses were conducted using PASW Statistics 17.0 (SPSS Inc, 2009). As a first step, we conducted preliminary analyses by examining the intercorrelations among gender, age, personality traits, smoking expectancies, and level of nicotine dependence.

Tests of mediation were conducted using the indirect effects method recommended by Preacher and Hayes. We used the bootstrapping method, which is recommended over the Sobel test for mediation because the Sobel test assumes (often incorrectly) that the product of the coefficients (e.g., independent variable (a) and mediator (b)) is normally distributed (Hayes, 2009; Preacher and Hayes, 2008). Although each coefficient is normally distributed, their product ($a*b$) is not, which leads to asymmetric confidence intervals, and may bias the statistical tests of significance. The bootstrapping method does not impose the assumption of normality on the data; it is a nonparametric resampling technique that empirically creates multiple approximations of the sampling distribution which reduces effects due to random sampling errors¹. The procedure uses point estimates and confidence intervals to estimate effects, and confidence intervals are bias-corrected and accelerated (including correction for median bias and skew). Confidence intervals not containing zero are interpreted as significant. For our purposes, we used a 95% confidence interval and 5000 bootstrapped samples to generate our results through the SPSS macro supplied by Preacher and Hayes (2008).

Following the recommendation of MacKinnon, Fairchild, and Fritz (2007), we also tested indirect effects when the uncorrected bivariate correlation between the predictor and the criterion was not significantly greater than zero. The assumption that a significant bivariate correlation needs to exist to proceed with mediation greatly under-powers tests of mediation because it ignores indirect effects that cancel one another out. In such a case, an indirect effect is said to occur when an independent variable predicts a second variable significantly, and that second variable predicts the criterion. If the product of those two effects is significantly greater than zero, the indirect effect is understood to be present.

Sample demographics

There were 131 participants (62% female; mean age = 19.0 years, $SD = 1.8$ years). The sample mean on the FTND (Heatherton et al., 1991) was 1.6 ($SD = 1.8$). Most participants smoked 10 or fewer cigarettes per day (87%) while the remaining reported smoking 20 or more cigarettes per day (13%).

Correlations between personality, smoking expectancies, and nicotine dependence

Table 1 presents the bivariate correlations among the study variables. As expected, PU and NU were moderately correlated ($r = .54$). PU was significantly related to nicotine dependence as measured by the FTND ($r = .32$), but NU was not ($r = .14$). Age and gender

¹We ran the same mediation analyses also controlling for age and gender, and the results were unchanged.

were not related to any of our test variables, so we did not include them as covariates in our analyses.

Primary Analyses

Mediational analyses—Tests showed that the relationship between positive urgency and smoking was significantly mediated by positive reinforcement smoking expectancies (CI: .01 - .19). Specifically, positive urgency explained 10.4% of the variance in level of nicotine dependence, and 12.8% of that variance was indirect through positive reinforcement smoking expectancies.

Tests of simple indirect effects showed that there was an indirect association from negative urgency to negative affect reduction expectancies to smoking (CI: .05 - .33). Specifically, negative urgency explained 7.3% of the variance in affect regulation expectancies, while affect reduction expectancies explained 15.2% of the variance in level of nicotine dependence. Table 2 provides point estimates and bootstrapped confidence intervals for both tests.

Discussion

Our results were consistent with the AP model cross-sectionally as applied to smokers. This was the first paper to report tests of the AP model in young adult, college smokers. We tested for the mediation of PU on smoking through positive reinforcement expectancies, and this mediation was significant. We also found evidence for an indirect association from NU to negative affect reduction expectancies to smoking: NU explained variance in negative affect reduction expectancies, which in turn explained variance in smoking, and the product of those two effects was significantly greater than zero.

Together, these findings provide initial support that people high on different affect-based impulsivity traits may be differentially prepared to learn about affect-related benefits of smoking, which in turn predisposes them to smoke more. Though this is of course a cross-sectional analysis, this is an important first step in establishing the validity of the model and supports the need to further explore this relationship longitudinally. However, others have found prospective support for the AP model as applied to alcohol in a group of young adults (Settles, Cyders, & Smith, 2010) and as applied to binge eating among early adolescents (Pearson, Combs, Zapolski, & Smith, in press).

While the college students in this sample were relatively light smokers with low levels of nicotine dependence symptoms, there is reason to believe that endorsement of even one symptom can affect quitting (DiFranza, Savageau, Fletcher et al., 2002). Further, this group of individuals represents a group of smokers who are vulnerable to developing nicotine dependence. In addition, according to the sensitization-homeostasis model (DiFranza & Wellman, 2005) the onset of a nicotine dependence symptom occurs at very low levels, then smokers increase their frequency of smoking until they reach daily smoking, and at that point they increase their cigarettes per day. Therefore, although these college students are at low levels of smoking with low levels of dependence symptoms they could be at risk for increasing their smoking and endorsing more nicotine dependence symptoms in the future.

Our results suggest that in particular positive and negative urgency may influence this process.

The findings described here should be understood in the context of the limitations of this research. First, our test of this model was cross-sectional and correlational. The AP model is a causal model: We did not test a causal model, nor did we test the temporal sequence of relationships implied in the model. However, there is good reason for the temporal order of variables implied by the AP model. Negative urgency is analogous to the impulsiveness facet of neuroticism on the NEO-PI-R measure of personality, and that measure has been shown to be substantially heritable (Jang, McCrae, Angleitner, Reimann, & Livesley, 1998) and therefore likely present before smoking-related learning or actual smoking initiation. Indeed, Smith and Zapolski (2011) found that endorsement of the urgency traits in fifth grade children predicted the onset of smoking one year later, beyond the effects of pubertal onset. In addition, studies have shown that higher endorsement of smoking expectancies predict escalation in smoking (Wahl, Turner, Mermelstein, & Flay, 2005). Therefore, the proposed sequence of trait predicting learning and then learning predicting behavior is consistent with prior research. However, although our results are consistent with the proposed sequence, our findings do suggest that longitudinal tests of this model are warranted.

A second limitation to this study was that participants were light to moderate smokers, with the majority of the sample smoking 10 cigarettes or less per day. However, studies have shown that the prevalence of smoking and nicotine dependence increase over the college years (Chassin et al., 1996; Sher et al., 1996; Jackson et al., 2000), which makes these first year students an informative age group to study smoking behavior (Dierker et al., 2007). Nonetheless, future research may also want to investigate the AP process with heavier smokers.

Third, although we found support for mediation of the relationship of both PU and NU and level of nicotine dependence by their respective affect-related expectancies, the amount of variance that they accounted for in this relationship while statistically significant was relatively of small magnitude. There are a few possible reasons for the relatively small magnitude of variance accounted for by both positive and negative affect related expectancies. There was a relatively low level of nicotine dependence in this group and therefore limited variability in this measure. Perhaps with more range in nicotine dependence scores there would be more variance to explain and the AP-based mediational process would prove to have effects of greater magnitude. In addition, although the reliability of the nicotine dependence symptoms measure was acceptable, it was a bit low, thus reducing the amount of systematic variance that could be accounted for by the predictors. Again, this could be the result of the light smoking participants in this sample.

Despite the study's limitations, the findings do have clinical implications for how emotion based impulsivity relates to level of nicotine dependence. Research aimed at developing interventions to mitigate the impact of both positive and negative urgency on nicotine dependence is warranted. One potential avenue is to target learned associations between affective states and subsequent behaviors. In young adults, that may include providing

substance-free reinforcements, alternatives that youth can engage in when they are in either a particularly positive or negative state. Over time, young adults who are likely to act rashly in response to intense negative or positive affect may learn how to act out in healthier ways engaging in substance-free activities.

In conclusion, the current study found cross-sectional support for a model identifying transactions between personality and psychosocial learning that appear to increase risk for nicotine dependence among college students. This AP model has also received cross-sectional support in relation to smoking onset among preadolescent children (Combs et al., 2012). Versions of the AP model describing risk for problem drinking and eating disorder symptoms have received both cross-sectional and longitudinal support (Combs et al., 2011; Gunn & Smith, 2010; Pearson et al., in press; Settles et al., 2010). Longitudinal tests of the model described in this paper should be conducted on college student smokers.

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Table 1
Intercorrelations Between Age, Gender, Personality, Expectancies, and Nicotine Dependence (N = 139)

	1	2	3	4	5	6	7
1. Age	--	-.00	-.06	-.10	-.07	.00	-.00
2. Gender		--	-.02	.05	.03	-.03	-.07
3. Negative Urgency			--	.54**	.12	.27**	.14
4. Positive Urgency				--	.18*	.35**	.32**
5. Positive reinforcement expectancies					--	.67**	.28**
6. Affect related expectancies						--	.39**
7. FTND							--

* $P < .01$

** $P < .001$

Table 2
Tests of Indirect Effects of smoking expectancies, positive and negative urgency, and FTND

Proposed Mediation	Point Estimate	95% Confidence Interval	
		Lower Limit	Upper Limit
Negative Urgency → Negative Affect Reduction → FTND	.1613	.0507	.3406
Positive Urgency → Positive Reinforcement → FTND	.0683	.0100	.1903

Note. Confidence intervals are bias-corrected and accelerated; they include correction for median bias and skew. Confidence intervals not containing zero are interpreted as significant.