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Associations between ADHD Symptoms and Smoking Outcome Expectancies in a Non-Clinical Sample of Daily Cigarette Smokers

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Abstract

Background and Objectives—Smoking outcome expectancies for positive reinforcement (PR; beliefs that smoking produces desirable outcomes) and negative reinforcement (NR; beliefs that smoking alleviates negative affect) are modifiable cognitive manifestations of affect-mediated smoking motivation. Based on prior data and theory, we hypothesized that NR and PR expectancies are associated with ADHD symptom levels in a non-clinical sample of cigarette smokers.

Methods—Daily cigarette smokers (N=256) completed self-report measures of ADHD symptoms and smoking outcome expectancies. Cross-sectional associations of overall ADHD symptomatology and the ADHD symptom dimensions of inattention (IN; difficulty concentrating and distractibility) and hyperactivity impulsivity (HI; poor inhibitory control and motor activity restlessness) with PR and NR smoking outcome expectancies were examined.

Results—Higher levels of overall, IN and HI ADHD symptoms were positively associated with NR smoking expectancies after statistically controlling for anxiety, depression, alcohol/drug use problems, nicotine dependence and other smoking expectancies. Although neither HI nor IN symptom dimensions exhibited empirically unique relations to NR expectancies over and above one another, the collective variance across IN and HI was associated with NR expectancies. PR expectancies were not associated with ADHD symptoms.

Discussion and Conclusions—While PR and NR expectancies may be important etiological influences in the overall population of smokers, NR outcome expectancies appear to be disproportionately expressed in smokers with elevated ADHD symptoms. Cognitive manifestations of NR motivation, which may be modifiable via intervention, are prominent in smokers with elevated ADHD symptoms.

Scientific Significance—Beliefs that smoking alleviates negative affect may underlie ADHD-smoking comorbidity.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

Keywords

Smoking; ADHD; Outcome Expectancies; Smoking Reinforcement

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) symptoms are positively associated with increased risk for cigarette smoking, nicotine dependence and relapse following cessation.^{1–3} The relation between ADHD symptom levels and smoking extends across both symptom dimensions of ADHD—inattention (IN; i.e., impaired levels of concentration and distractibility) and hyperactivity-impulsivity (HI; i.e., poor inhibitory control and motor activity restlessness)⁴—and generalizes across subclinical levels of ADHD symptoms among smokers with symptomatology that does not surpass the threshold for a *DSM* ADHD diagnosis.^{4, 5} Understanding the mechanisms linking variation across the continuum of ADHD symptomology and smoking may inform smoking cessation treatment efforts for the sizeable population of adult smokers who experience ADHD symptoms.⁶

Beliefs individuals hold about the anticipated consequences of smoking (i.e., smoking outcome expectancies) are key cognitive processes that underlie smoking motivation⁷ and are associated with greater nicotine dependence and increased likelihood of smoking escalation.⁸ Two types of smoking outcome expectancies, positive reinforcement (PR; i.e., the belief that smoking increases positive affect and produces desirable outcomes) and negative reinforcement (NR; i.e., the belief that smoking suppresses negative affect and withdrawal symptoms) putatively influence smoking behavior through affect regulation.⁹ In this central construct of addiction, PR reflects the desire to *attain* appetitive states while NR reflects the desire to *avoid* aversive affect states.¹⁰

Individuals with ADHD demonstrate increased reward learning and subjective mood-enhancing effects when smoking,^{11, 12} and experience more severe withdrawal symptoms and increased negative affect during tobacco abstinence.^{13, 14} A recent ecological momentary assessment study found that adult smokers clinically diagnosed with ADHD were more likely to smoke when they were experiencing increased negative emotional states, and that smoking decreased negative affect and ADHD symptoms.¹⁵ Thus, affective experiences while smoking may lead smokers with elevated ADHD symptoms to have stronger NR and PR expectancies.

Nicotine has cognitive-enhancing effects that may ameliorate the disinhibition, inattention and deficits in executive functioning¹⁶ associated with ADHD.¹¹ Consequently, an important indirect benefit for smokers with elevated ADHD symptoms is that smoking may help alleviate frustration, distress and other negative affective states that smokers experience when attempting to cope with their ADHD symptoms. These indirect benefits could promote the development of beliefs that smoking reduces negative affect,¹⁷ (i.e., NR outcome expectancies) in smokers with elevated ADHD symptoms. Evidence that ADHD is associated with self-identified NR and PR expectancies would be an important finding for treatment development because self-identified conscious beliefs about smoking are modifiable via cognitive and behavioral interventions.^{11, 18} Such evidence would indicate

that interventions that target the modification of NR and PR expectancies may particularly aid smoking cessation treatment outcomes for smokers with elevated ADHD symptoms.^{2, 11}

Evidence suggests the two symptom dimensions of ADHD, IN and HI, may differentially impact smoking across the developmental timeline.¹⁹ IN symptoms are related to smoking quantity and nicotine dependence in adolescents,²⁰ but are not positively associated with the escalation of nicotine dependence in adulthood.²¹ In adult smokers with ADHD, HI symptoms are associated with stronger cigarette craving,²¹ increased nicotine dependence⁴ and a broad array of withdrawal symptoms.^{6, 14, 21} Given the role of PR and NR expectancies in maintaining nicotine dependence,¹⁰ increased nicotine dependence in adulthood may be more prominently associated with HI (relative to IN) ADHD symptoms, and the association of ADHD symptoms with both PR and NR expectancies might be stronger for HI than IN symptoms.

The current cross-sectional study of non-treatment seeking adult daily smokers tested the hypothesis that overall ADHD symptom severity would be positively associated with both PR and NR smoking outcome expectancies. Given possible differences in the relative role of HI (vs. IN) symptoms in smoking motivation, we expected HI symptoms to be more consistently associated with both PR and NR smoking outcome expectancies than IN symptoms. Therefore we compared unadjusted and adjusted associations between ADHD and NR/PR expectancies over and above several possible confounders.

ADHD is associated with anxiety, depression,²² drug use, alcohol use¹ and nicotine dependence.²³ Since each of these characteristics are also positively associated with stronger smoking expectancies,²⁴ an additional aim was to examine the relations between ADHD symptoms and smoking outcome expectancies after statistically controlling for these covariates—determining if the link between ADHD symptoms and smoking outcome expectancies is specific to ADHD per se or explained by behavioral pathology or more severe smoking patterns. We further examined whether relations were incremental to the endorsement of other smoking outcome expectancies (e.g., beliefs that smoking controls weight) to account for the possibility that relations could be explained by a link between ADHD and a generalized belief that smoking has powerful effects on every type of outcome, rather than a specific belief in smoking's PR or NR effects.

METHODS

Participants

This article is a secondary analysis of baseline data from a study investigating the effects of tobacco deprivation in daily smokers. Participants were non-treatment seeking smokers recruited from the Los Angeles area via online advertisements and fliers. Inclusion criteria were: at least 18 years of age, regular cigarette smoking for at least two years (10 or more cigarettes per day), breath carbon monoxide level ≥ 10 ppm and fluency in English. Exclusion criteria included: a current *DSM-IV* diagnosis of non-nicotine substance dependence, depression or psychosis, pregnancy or use of psychoactive medications, tobacco products other than cigarettes or nicotine replacement therapy.

Of the 377 smokers recruited, 5 declined to participate and 116 were ineligible (57% due to low CO levels, 20% due to psychiatric exclusions, 15% due to planning to quit or reduce smoking, 5% due to regular cigar use, and 3% due to psychiatric drug use), leaving a total sample of 256 participants. Participants were paid \$15 to complete the baseline session. The University of Southern California Institutional Review Board approved the protocol, and all participants provided informed consent.

Procedure

Following a preliminary telephone eligibility screening, participants attended a baseline session in which they were assessed for eligibility with breath CO analysis and administration of the Structured Clinical Interview for *DSM-IV* Non-Patient Edition. Eligible participants continued with the remainder of the baseline session and completed all self-report questionnaire measures in paper format.

Measures

The Adult ADHD Self-Report Scale (ASRS)²⁵ is a 18-item measure of ADHD symptoms based on the Criteria A Symptoms of adult ADHD in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.²⁶ Prior research demonstrates that the ASRS has high internal reliability (Cronbach's $\alpha = .92$) and convergent validity with clinician-rated ADHD symptoms.²⁵ In addition to the total scale (i.e., the sum of all 18 items), the ASRS contains two 9-item subscales—IN (Cronbach's $\alpha = .89$; e.g., “How often do you have difficulty getting things in order when you have to do a task that requires organization?”) and HI (Cronbach's $\alpha = .85$; e.g., “How often do you feel restless or fidgety?”). Participants rated how frequently they experienced symptoms in the past 6 months on a five-point response scale from 1 (never) to 5 (very often). As in previous work, we utilized the ASRS continuous scores based on the sums to capture the entire continuum of ADHD symptomatology.²⁶

The Smoking Consequences Questionnaire (SCQ)⁷ assesses beliefs about the effects of tobacco use. Items are rated on a 7-point Likert scale ranging from 1 (not true of me at all) to 7 (very true of me). The measure is well-validated and widely-used in adult populations.²⁸ The primary outcomes in this study included the SCQ positive reinforcement (PR) subscale (Cronbach's $\alpha = .88$) that assessed positive affect enhancement and sensory satisfaction (PR; 15 items, e.g., “I enjoy the taste sensations while smoking”) and negative reinforcement (NR) subscale (Cronbach's $\alpha = .91$) that assessed negative affect reduction (NR; 12 items, e.g., “Smoking calms me down when I feel nervous”). The SCQ PR and NR subscales have been shown to be empirically distinct constructs, with high internal consistency and strong convergent relations to other measures of smoking motivation.⁸

The following a priori covariates were selected due to their association with ADHD symptomatology.¹

The Fagerström Test of Nicotine Dependence (FTND)²⁹ (Cronbach's $\alpha = .58$) is a well-validated, widely-used, 6-item self-report measure that assesses nicotine dependence severity on a scale of 0–10 with higher scores indicating higher levels of dependence.

The Mood and Anxiety Sensitivity Questionnaire–Short Form (MASQ-SF)³⁰ is a self-report measure of affective symptoms experienced during the previous week on a Likert scale from 1 (not at all) to 5 (extremely). We utilized the 17-item MASQ anxious arousal (AA) subscale (Cronbach's $\alpha = .89$), which assessed somatic tension, arousal and symptoms specific to anxiety, and the 22-item anhedonic depression (AD) subscale (Cronbach's $\alpha = .89$), which assessed low interest, pleasure, positive affect, and symptoms specific to depression. Sum scores were calculated for the scales, with higher scores reflecting greater emotional symptoms.

The Alcohol Use Disorders Identification Test (AUDIT)³¹ (Cronbach's $\alpha = .75$) was used to assess alcohol use problems. The AUDIT consists of 10-items scored for frequency on a four-point Likert scale 0 (never) to 4 (6 times a week or more), and has been shown to be correlated with self-report alcohol screening tests and biochemical measures of drinking.

The Drug Abuse Screening Test (DAST)³² (Cronbach's $\alpha = .91$) is a well-validated, 10-item screening instrument to assess non-alcohol, non-nicotine drug use and dependence. It consists of 10 yes/no self-report measures concerning drug use.

The SCQ⁷ also includes a negative consequences (NC) subscale, which assesses negative health consequences expected of smoking (Cronbach's $\alpha = .91$; e.g., “By smoking I risk heart disease and lung cancer”) with 18 items, and a weight control (WC) subscale, which assesses smoking-related appetite-weight control (Cronbach's $\alpha = .96$; e.g., “Smoking keeps my weight down”) with 15 items.

Data analysis

Preliminary analyses calculated descriptive statistics, correlations (Pearson's r), Cronbach's alpha internal consistency coefficients and examined distributional properties, skewness and kurtosis for all measures. The primary analyses involved a series of hierarchical linear regression models in which an ASRS index (or indices) served as the predictor(s) and either the SCQ NR or PR subscale score served as the outcome. There were four classes of models: (1) one with total ADHD symptom level as the sole predictor, (2) one with HI as the sole predictor, (3) one with IN as the sole predictor, and (4) one with both HI and IN as simultaneous predictors—to parse out covariance between HI and IN. Each model was tested in three stages: (1) unadjusted; (2) an adjusted model that included demographic (age, gender, ethnicity) and clinical (anxiety, depression, alcohol/drug problems, nicotine dependence severity) covariates; and (3) a fully adjusted model that included all covariates listed in stage 2 as well as the remaining three SCQ subscales (i.e., when SCQ-PR was an outcome, SCQ-NR, WC, and NC were covariates; when SCQ-NR was an outcome, PR, WC, and NC were covariates). In total, there were 4 classes of models $\times$ 3 stages of adjustment $\times$ 2 outcomes = 24 total models. Across all models, only two conceptually-discrete outcomes were tested; all predictors were conceptually redundant in part (e.g., HI, IN and total ADHD symptoms) or entirety (e.g., HI in unadjusted vs. adjusted model). All models were tested for collinearity. For the combined models, the R^2 and ΔR^2 change statistics associated with the effect of the collective variance when the ASRS IN and HI indices were entered as simultaneous predictors were reported.

The R^2 change statistics were obtained by comparing the R^2 between models that included only the covariates (Step 1) and models with all the covariates as well as the ASRS-HI and ASRS-IN (Step 2). Given our study design and the systematic absence of a small number of covariates, the missing indicator method³³ (MIM) was used to avoid listwise deletion of participant-level data due to missing data on two covariates (AUDIT and DAST) that were added midstream into participant accrual (N=45 participants with missing data on these variables). All regression models were tested as two-tailed in SAS using PROC REG (SAS Institute Inc., Cary, NC, 2014) with alpha level set to .05 and results for individual predictor parameter estimates reported as standardized regression coefficients (β s).

RESULTS

Preliminary analyses

Descriptive statistics, Cronbach's alphas and skewness and kurtosis for smoking outcome expectancies, ADHD indices and covariates are displayed in Table 1. The measures used in this study demonstrated good to excellent internal consistency (Cronbach's $\alpha = .75-.96$), with the exception of the FTND (Cronbach's $\alpha = .58$). The primary ADHD outcomes were quantified as continuous scores; for descriptive purposes we report that 9% of the sample (N=23) met or exceeded the recommended cut-off that results in the strongest concordance with a clinical diagnosis of ADHD (i.e., endorsed experiencing nine or more ASRS items in the past 6 months).²⁵ The MASRS score indicated that the average participant reported a mild level of ADHD symptom severity and the SD indicated that there was meaningful variability in symptom scores across the continuum of functioning. The SCQ subscales were all significantly correlated with one another, as were the ASRS total score and its symptom dimension subscales. All ASRS indices were significantly associated with anxious and depressive emotional symptomatology. In several cases, the SCQ-NR and SCQ-PR were significantly associated with substance use, nicotine dependence and demographic characteristics, supporting their inclusion as covariates (see Table 1).

Primary Analyses

For models described below, the variance inflation factor (VIF) ranged from 1.1 – 1.7, suggesting that collinearity did not bias effect estimates.

Individual models—Results from regression models demonstrate that the ASRS total score, HI and IN subscales were significantly associated with higher SCQ-NR scores (see Table 2). These associations remained significant in adjusted models controlling for covariates (e.g., ethnicity, gender, age, depression, anxiety, tobacco dependence, alcohol and drug use; PR, NC and WC expectancies for NR). In contrast, none of the ASRS indices were significantly associated with the SCQ-PR in any model (see Table 2).

Combined models—The combined models included both ASRS subscales as simultaneous predictors to partial out their covariance with one another (see Figure 1 for a graphical depiction of the fully-adjusted models). Baseline models with no covariates indicated that HI exhibited an empirically unique association with SCQ-NR scores over and above IN, but IN was not significantly associated with SCQ-NR over and above HI (see

parameter estimates [β s] for IN and HI in Table 3). The collective variance of both HI and IN accounted for 8% of the variance in NR expectancies (see R^2 in Table 3). The hierarchical analysis that included demographic and psychiatric/substance use covariates (Model set A, Step 1) accounted for 9% of the variance in SCQ-NR scores, with nicotine dependence (i.e., FTND) and female (vs. male) gender exhibiting empirically unique effects in the model. Adding IN and HI to Model set A (Step 2) accounted for an additional, significant 3% of the variance over and above the covariates (see R^2 change in Table 3), and the unique associations involving FTND and female gender persisted in this model over and above IN and HI. Model set B exhibited a similar pattern in which the set of covariates included demographic and psychiatric/substance use variables as well as other expectancy variables. IN and HI collectively accounted for a significant 1% of the variance but did not exhibit unique associations over and above one another. Female gender and smoking expectancy scales were unique predictors in these models (see Table 3).

Neither IN nor HI symptoms exhibited collective or unique empirical associations with SCQ-PR in any model (see non-significant R^2 and R^2 change estimates and β s for IN and HI; Table 3), though some of the covariates were associated with SCQ-PR.

DISCUSSION

The results of this study demonstrate that ADHD symptoms were associated with NR but not PR smoking outcome expectancies in adult smokers. The NR finding is in line with our predictions and prior data indicating that ADHD symptoms are associated with more severe negative affect symptoms during withdrawal.^{6, 13, 14} Our results concur with previous findings that higher negative affect (NA) increases the likelihood of smoking, and smoking is associated with reductions in negative affect in smokers clinically diagnosed with ADHD.¹⁵ Together, these findings raise the possibility that the experience of NA upon tobacco abstinence coupled with the relief of NA after smoking may encourage the development of conscious beliefs that smoking alleviates NA in smokers with ADHD symptoms—creating a cycle of NA, NR expectancies and smoking behavior that maintains tobacco dependence.

The indirect effects of NA relief through ADHD symptom reduction may also contribute to the link between ADHD symptoms and NR expectancies. Given evidence that smoking offsets cognitive impairment associated with ADHD via nicotine's effects on neural substrates underlying attention and inhibition,¹¹ the act of smoking may remove both frustration and other types of NA for smokers with elevated ADHD symptoms—resulting in the amelioration of symptom-related distress. This symptom-related distress amelioration hypothesis is conceptually specific to ADHD, and could explain why relations between ADHD symptoms and ADHD-NR in this study were robust after adjustment for mood, substance use and other smoking outcome expectancies. This hypothesis also concurs with the null relations between ADHD symptoms and PR expectancies found in this study, as nicotine-mediated symptom reduction would presumably promote relief of NA and other distressing states caused by ADHD symptoms, but not enhancement of PA.

The results demonstrate that the ADHD-NR expectancy link was robust after controlling for other types of smoking outcome expectancies, including expectations of PR, weight control, and negative consequences. This finding rules out the possibility that smokers with ADHD symptoms may overestimate smoking's effects on every type of outcome, or have a reporting bias that leads to increased endorsement of all beliefs. Thus, smoking cessation treatment efforts, such as cognitive behavioral interventions,¹⁸ that target NR expectancies per se may be an efficient approach (rather than addressing all types of pro-smoking expectancies) for the subpopulation of smokers with elevated ADHD symptoms.

Both HI and IN symptoms dimensions were associated with NR expectancies when considered separately, with similar effect magnitudes in most analyses. In the combined adjusted models that included both ADHD symptom dimensions, a different pattern was found. The significant R^2 and R^2 change statistics for the set of IN and HI symptoms in these models (Table 3) indicate that the cumulative variance across the two scales meaningfully contributes to the prediction of negative reinforcement expectancies. By contrast, the non-significant parameter estimates [β s] for IN and HI in these models suggest that unique variance associated with each specific symptom dimension on its own over and above one another does not contribute to the prediction of NR expectancies. Given this pattern (i.e., combined variance is predictive, but residualized, unique variance is not), it is likely that the collective (shared) variance between the two ADHD symptom dimensions accounts for individual differences in NR expectancies. Hence, a common underlying construct that contributes to increased overall severity of ADHD symptoms across both symptom types (HI and/or IN) may be contributing to stronger NR outcome expectancies in smokers with elevated ADHD symptoms.

Constructs such as generalized executive dysfunction (i.e., impairment in planning, future-oriented thinking, and/or organizational cognition) could give rise to IN symptoms, HI symptoms and NR expectancies.¹⁶ Individuals with deficits in these areas might be prone to becoming distracted and experiencing IN symptoms when charged with important tasks that require sustained attention. Similarly, deficits in executive functioning could also make individuals prone to impulsive or hyperactive behaviors that satisfy immediate desires rather than executing multi-step sequences to achieve long-term goals. Furthermore, individuals with such deficits might have difficulty developing and executing complex coping strategies to adaptively deal with negative affect, and hence may be more vulnerable to maladaptive reinforcement strategies such as smoking. Future research applying neurocognitive assessment to executive functioning and examining mediators of ADHD-expectancy relations may prove fruitful.

This study was limited by its cross-sectional design, which precludes causal inferences, and the utilization of a self-report measure of ADHD that does not yield precise clinical diagnoses. Limitations notwithstanding, these current data meaningfully extend previous research examining affective antecedents and consequences of smoking behavior in smokers with ADHD¹⁵ by demonstrating that NR mechanisms extend from behavioral and affective processes to conscious cognitive manifestations. ADHD symptoms collectively explained 8% of the variance in negative reinforcement expectancies, a medium-sized effect³⁴ that is similar in magnitude to associations between other smoking-related characteristics,

psychiatric comorbidities and ADHD symptoms.³⁵ It is likely that factors such as nicotine dependence, gender and other smoking outcome expectancies explain a significant portion of the variance in NR expectancies (Table 3). The collective evidence supports a broader theoretical model that spans affect, behavior and conscious cognition in which NR-mediated motivation may be an important factor in ADHD-smoking comorbidity. A key implication of this result for smoking cessation practice is that smokers with ADHD symptoms (who may lack emotional or behavioral psychopathologies) may benefit from assessment and clinical interventions that target conscious beliefs about smoking's NA-reducing effects. Cognitive behavioral interventions¹⁸ that challenge subjective beliefs that smoking is an effective method of coping with negative affect and teach healthy means of coping with emotions and thoughts without resorting to smoking may be especially beneficial for smokers with elevated ADHD symptoms.

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Figure 1.

Multiple Regression with ADHD HI and IN as Simultaneous Predictors

Note. Numbers next to single-headed arrows represent standardized regression coefficients. SCQ = Smoking Consequences Questionnaire; NR = Negative Reinforcement Subscale; PR = Positive Reinforcement Subscale; NC = Negative Consequences Subscale; WC = Weight Control Subscale; ASRS = Adult ADHD Self-Report Scale; HI = Hyperactivity-Impulsivity; IN = Inattention; MASQ = Mood and Anxiety Symptoms Questionnaire; AA = Anxious Arousal; AD = Anhedonic Depression; FTND = Fagerström Test for Nicotine Dependence; AUDIT = Alcohol Use Disorder Identification Test; DAST = Drug Abuse Screening Test; Ethnicity = Black; Gender = Female. * $p < .05$, ** $p < .01$, *** $p < .001$, † $p < .0001$.

Table 1

Intercorrelations, Descriptive Statistics and Demographics.

Scale	Skewness (Kurtosis)	Mean (SD) or % (N)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. SCQ-NR	-.16 (-92)	52.0 (20.4)	(.91)														
2. SCQ-PR	-.02 (-63)	68.3 (18)	.55 [†] (.88)														
3. SCQ-NC	-.33 (-37)	87.2 (21.2)	.27 [†] .12 [*] (.91)														
4. SCQ-WC	.67 (-9)	15.1 (10.3)	.39 [†] .20 [†] .23 [†] (.96)														
5. ASRS	-1.19 (.91)	3.3 (3.3)	.27 [†] .09	.14 [*] .13 [*] (.92)													
6. ASRS-IN	1.16 (.76)	1.7 (1.8)	.21 [†] .09	.09	.07	.89 [†] (.89)											
7. ASRS-HI	1.36 (1.30)	1.6 (1.8)	.27 [†] .07	.16 ^{**} .16 ^{**} .89 [†] (.85)													
8. MASQ-AA	2.36 (5.8)	21.8 (7.2)	.23 [†] .10	.18 ^{**} .18 ^{**} .52 [†] .45 [†] .48 [†] (.89)													
9. MASQ-AD	.21 (-47)	53.2 (14.5)	.10	-.09	.02	.10	.39 [†] .40 [†] .29 [†] .30 [†] (.89)										
10. AUDIT	1.44 (.14)	22.9 (38.8)	.07	.13 [*] -.02	-.07	.10	.06	.12 [*] .08	.01	(.75)							
11. DAST	1.49 (.26)	21.4 (38.9)	.04	.03	.11	.09	.07	.02	.10	.15 [*] .03	.31 [†] (.91)						
12. FTND	.06 (-5)	5.2 (1.85)	.27 [†] .24 [†] .12 [*] .16 ^{**} -.06	-.06	-.06	-.06	-.06	-.04	.02	.02	-.12 [*] .07	(.58)					
13. Age	-.54 (-65)	44.3 (11.1)	-.06	-.15 [*] .18 ^{**} .11	-.18 ^{**} -.13 [*] -.18 ^{**} -.04	-.02	-.20 [†] .07	.13 [*] -									
14. Black race/ethnicity	-.02 (-2.0)	50.6% (129)	.03	-.03	-.03	.05	-.03	-.04	-.01	-.03	-.06	-.05	-.06	.08	.26 [†] -		
15. Female gender	-.81 (-1.35)	31.3% (80)	.22 [†] -.03	-.03	.08	.12 [*] .06	.06	.00	.12 [*] .04	.03	-.14 [*] -.11	.02	-.06	.00	-		

Note. N = 256. SCQ = Smoking Consequences Questionnaire; NR = Negative Reinforcement; PR = Positive Reinforcement; NC = Negative Consequences; WC = Weight Control; ASRS = Adult ADHD Self-Report Scale; HI = Hyperactivity-Impulsivity; IN = Inattention; MASQ = Mood and Anxiety Symptoms Questionnaire; AUDIT = Alcohol Use Disorder Identification Test; DAST = Drug Abuse Screening Test; FTND = Fagerström Test for Nicotine Dependence. Values in parentheses represent Cronbach's α 's for measures.

* $p < .05$,

** $p < .01$,

*** $p < .001$,

[†] $p < .0001$

Table 2

ADHD Symptoms Predicting Smoking Expectancies in Individual Models

	SCQ-NR		SCQ-PR	
	$\tilde{\beta}_{unadj.}$	$\tilde{\beta}_{adj.}^a$	$\tilde{\beta}_{unadj.}$	$\tilde{\beta}_{adj.}^a$
ASRS Total	.27 [†]	.21 ^{**}	.14 [*]	.09
ASRS-HI	.27 [†]	.18 ^{**}	.12 [*]	.06
ASRS-IN	.21 [†]	.17 [*]	.11 [*]	.09

Note. N= 256. SCQ = Smoking Consequences Questionnaire; NR = Negative Reinforcement Subscale; PR = Positive Reinforcement Subscale. ASRS = Adult ADHD Self-Report Scale; HI = Hyperactivity-Impulsivity; IN = Inattention.

^a adjusted for MASQ-AA, MASQ-AD, AUDIT, DAST, FTND, Age, Ethnicity, Gender.

^b adjusted for MASQ-AA, MASQ-AD, AUDIT, DAST, FTND, Age, Ethnicity, Gender, SCQ subscales.

* $p < .05$,

** $p < .01$,

*** $p < .001$,

[†] $p < .0001$.

Table 3

Hierarchical regression analyses of ADHD HI and IN as simultaneous predictors

	Outcome: SCQ-NR				Outcome: SCQ-PR			
	Hierarchical Models A		Hierarchical Models B		Hierarchical Models A		Hierarchical Models B	
	Baseline Model	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1
MASQ-AA (β)		.19***	.10	.08	.02	.05	.04	-.01
MASQ-AD (β)		.07	.02	.10	.06	-.02	-.02	-.13*
AUDIT (β)		-.30	-.28	-.18	-.18	-.16**	.14*	.27
DAST (β)		.31	.28	.20	.18	.22***	.23 [†]	-.33
FTND (β)		.22 [†]	.23 [†]	.07	.08	-.15	-.16	.09
Age (β)		-.07	-.03	.04	-.02	.09	.10	-.12*
Ethnicity (β)		.03	.02	.02	.01	-.09	-.13	-.03
Gender (β)		-.26 [†]	-.25 [†]	-.23 [†]	-.23 [†]	.10	.05	.19**
SCQ-NR (β)				—	—			.57 [†]
SCQ-PR (β)				.45 [†]	.44 [†]			—
SCQ-NC (β)				.10*	.09			.01
SCQ-WC (β)				.25 [†]	.25 [†]			.003
ADHD-HI (β)	.22**	—	.13	—	.09	.03	.01	—
ADHD-IN (β)	.11	—	.09	—	.07	.11	.07	—
F^2	.08**	.19 [†]	.22 [†]	.49 [†]	.50 [†]	.01	.09***	.35 [†]
p^2			.03***		.01*		.01	.003

Note. N= 256. SCQ = Smoking Consequences Questionnaire; NR = Negative Reinforcement Subscale; PR = Positive Reinforcement Subscale. ASRS = Adult ADHD Self-Report Scale; HI = Hyperactivity-Impulsivity; IN = Inattention; Ethnicity = Black; Gender = Female.

Baseline Model = includes ASRS-HI and ASRS-IN as the sole simultaneous predictors.

Hierarchical Models A = Covariates in step 1 include MASQ-AA, MASQ-AD, AUDIT, DAST, FTND, Age, Ethnicity, Gender.

Hierarchical Models B = Covariates in step 1 include MASQ-AA, MASQ-AD, AUDIT, DAST, FTND, Age, Ethnicity, Gender and SCQ subscales.

Step 1 = Includes covariates.

Step 2 = ASRS-HI and ASRS-IN added to the model including the covariates.

ΔR^2 = change in fit by adding the set of ASRS-HI and ASRS-IN as predictors in Step 2 vs. Step 1.

* $p < .05$,
** $p < .01$,
*** $p < .001$,
† $p < .0001$.