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Dysphoria and smoking among treatment seeking smokers: the role of smoking-related inflexibility/avoidance

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Abstract

Background—Emerging data suggest that dysphoria is one facet of depression that is especially related to various aspects of cigarette smoking. However, it is presently unknown what emotional processes may account for these relations.

Objectives—In the current cross-sectional study, the impact of avoidance and inflexibility to smoking (AIS), a smoking-specific form of experiential avoidance, was tested on the relationship of dysphoria to four specific smoking processes that are key factors in cessation: perceived barriers to cessation, severity of problems during prior quit attempts, negative reinforcement smoking expectancies, and motivation to quit smoking.

Methods—Participants ($n = 465$) were treatment-seeking adult daily smokers. Relative indirect effects were subjected to bootstrap analyses to test direct and indirect effects of dysphoria on smoking processes.

Results—After controlling for gender, nicotine dependence severity, drinking problems, cannabis use, negative affectivity, tobacco-related medical problems, and AIS, dysphoria remained directly, positively related to perceived barriers and cessation problems. Additionally, dysphoria was indirectly, positively related to perceived barriers, cessation problems, negative reinforcement smoking expectancies, and motivation to quit indirectly through higher levels of AIS.

Conclusion—In the context of dysphoria, AIS may explain a wide range of clinically-relevant smoking processes.

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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

Anhedonia; avoidance; dysphoria; psychological inflexibility; smoking; tobacco

Introduction

Individuals with psychiatric conditions often struggle to quit smoking, which may contribute to the stagnation of smoking base rates in the United States (1,2). Among the various psychiatric conditions, major depressive disorder (MDD) is particularly important to study because it is highly prevalent in the general population, is associated with severe impairment (3–12), and nearly half of all current smokers suffer from MDD (13). Depressive symptoms appear to serve to maintain and even promote tobacco use and dependence (14), although MDD status does not always predict smoking outcomes (15). It is possible that certain elements of MDD and depressive symptoms play a larger role in smoking than others, which may obscure research that utilizes the MDD diagnosis or composite measures that amalgamate all depressive symptoms into a single index. Recent research suggests depressive symptoms are not unifactorial and that certain specific symptoms of depression load onto a common dysphoria dimension characterized by anhedonia, sadness, psychomotor disturbance, loss of self-esteem, cognitive difficulty, and worry (16). Dysphoria, which may reflect core affective, cognitive, and psychomotor features of depression, may be more related to smoking maintenance and relapse than other depressive symptoms such as appetite changes, sleep problems, irritability, fatigue, and social difficulties (17–19).

To illustrate, smokers with MDD with higher levels of dysphoria are less likely to remain abstinent relative to those MDD-positive smokers with lower levels of dysphoria (20). Anhedonia (a component of dysphoria) is predictive of poorer smoking cessation outcomes over and above other depression sub-dimensions, MDD history, anxiety or substance use disorder history, and level of nicotine dependence (17,19,21). Further, dysphoria increases during acute smoking withdrawal (22–25) and following a stress induction, smokers who are immediate rather than delayed relapsers experience greater increases in dysphoria-related features (25).

Notably, extant work has not yet explored processes that may impact the relation between dysphoria and smoking. Smokers with greater dysphoria may be vulnerable to heavier and more dependent smoking to alleviate dysphoria-related symptoms through smoking's affect- and arousal-modulating properties. In fact, there is a growing recognition that how one responds to negative affective states may play a central role in cognitive-affective smoking processes and cessation behavior (e.g. 26). For example, smokers with a greater ability to tolerate or withstand aversive somatic distress are less likely to lapse after a self-guided cessation attempt (27) whereas smokers with a lower threshold for tolerating such distress have shorter durations of smoking abstinence after attempting cessation (25,28,29). The latter group of smokers may be particularly prone to inflexibly seek out opportunities to escape, avoid, or reduce distressing states, and do so through smoking (30,31). This process has been termed as smoking inflexibility/avoidance (AIS: avoidance and inflexibility to

smoking) and is conceptualized as a smoking-specific form of experiential avoidance (30) reflecting the tendency to respond to thoughts (e.g. “I need a cigarette”), feelings (e.g. negative affect, boredom), and sensations (e.g. physical urges to smoke) with smoking, avoidance, and/or struggles to control such experiences without smoking. It is possible that smokers with high levels of dysphoria may be prone to AIS, given that dysphoria is associated with greater experiential avoidance more generally (32). Thus, higher AIS in dysphoric smokers could serve as a barrier to successful cessation, heighten symptoms experienced while quitting, and could promote expectations that smoking alleviates negative affect. Yet, it is unclear if dysphoria is related to AIS and whether AIS may, at least partially, account for observed relations between dysphoria and smoking-related vulnerability processes.

The current cross-sectional study sought to further understanding of the nature of the relation between dysphoria and smoking among adult treatment-seeking daily smokers. First, we examined whether dysphoria was related to a wide range of clinically-relevant smoking processes: negative reinforcement smoking expectancies, motivation to quit smoking, perceived barriers to cessation, and severity of cessation-related problems during prior quit attempts. Next, we tested the impact of AIS on the relations of dysphoria and these smoking processes. We hypothesized that dysphoria would be positively related to negative reinforcement expectancies, perceived barriers to cessation, cessation-related problems, and motivation to quit indirectly via higher AIS. The effects were expected to be evident above and beyond the variance accounted for by gender, severity of nicotine dependence, and tobacco-related medical problems, given that these variables are related both to dysphoria (33) and smoking (18,34). Cannabis use status and drinking problems were also included given that they are the substances that are most commonly used by smokers (35). Negative affectivity was also included as a covariate to test whether observed relations between dysphoria and smoking processes were specific to dysphoria rather than attributable to negative affectivity more broadly.

Methods

Participants and procedures

Participants ($n = 465$) were adult treatment-seeking daily smokers ($M_{age} = 36.6$, $SD = 13.58$; 48.5% female) who were recruited from the community (via flyers, newspaper ads, radio announcements) to participate in a large randomized controlled trial examining the efficacy of two psychosocial smoking cessation interventions (clinicaltrials.gov #NCT01753141). Inclusion criteria included daily cigarette use (average 8 cigarettes per day for at least 1 year), ages 18–65, and reported motivation to quit smoking of 5 on a 10-point scale. Exclusion criteria included inability to give informed consent, current use of smoking cessation products or treatment, past-month suicidality, and history of psychotic-spectrum disorders. The current study is based on secondary analyses of pre-treatment data. Only cases with complete data on all studies variables were included from all recruited participants ($n = 724$).

The racial/ethnic composition of the current sample was White (85.8%), African American (8.3%), Hispanic (2.4%), Asian (1.1%), and other (2.4%). Participants were well educated

with 74.0% indicating that they completed at least part of college. In terms of relationship status, 44.0% reported marital status as never married, 33.3% as married/cohabitating, 20.9% as divorced/separated, and 1.9% as widowed. The average daily smoking rate was 16.6 (SD = 9.92), with mean smoking initiation at age 14.9 (SD = 3.47) and regular smoking for an average of 18.3 years (SD = 13.35). Level of nicotine dependence was moderate (*Fagerström Test for Nicotine Dependence*: $M = 5.2$, $SD = 2.28$). The majority reported at least one previous quit attempt ($n = 432$; 92.9%), with an average of 3.4 (SD = 2.48) previous attempts. Over one-quarter (29.6%) reported a tobacco-related illness (heart problems, hypertension, respiratory disease, and/or asthma). Of note, 6.0% of the sample met criteria for a past-year (current) MDD or dysthymia, as assessed per the *Structured Clinical Interview-Non-Patient Version for DSM-IV* (SCID-I/ NP; 36).

Participants provided informed consent prior to participation and the study protocol was approved by the universities' Institutional Review Boards. Participants underwent a clinical interview and completed a computerized battery of self-report questionnaires.

Measures

Predictor

Inventory of Depression and Anxiety Symptoms (IDAS; 37) is a 64-item self-report measure in which respondents rate the degree to which they have experienced symptoms in the past two weeks from 1 (*not at all*) to 5 (*extremely*). The dysphoria subscale (10 items; possible range 10–50) assesses anhedonia, sadness, psychomotor disturbance, worthlessness, worry, cognitive difficulty. The IDAS has strong psychometric properties, including internal consistency, test-retest reliability, and convergent and discriminant validity (Watson et al. 2007) (16). Internal consistency for the Dysphoria subscale in the current study was excellent ($\alpha = 0.92$).

Acceptance and Inflexibility Scale (AIS; 38) is a 13-item self-report measure that assesses the link between internal triggers and smoking (smoking-related inflexibility/avoidance). AIS differs from expectancies in that expectancies refer to what one thinks will happen if one were to smoke (regardless of whether one in fact smokes to achieve the expected outcome) whereas the AIS asks respondents to consider how they respond to thoughts that encourage smoking (e.g. ‘‘I need a cigarette’’), feelings that encourage smoking (e.g. stress, fatigue, boredom), and bodily sensations that encourage smoking (e.g. ‘‘physical cravings or withdrawal symptoms’’). Example items include ‘‘How likely is it you will smoke in response to [thoughts/feelings/sensations]?’’, ‘‘How important is getting rid of [thoughts/feelings/sensations]?’’, and ‘‘To what degree must you reduce how often you have these [thoughts/feelings/sensations] in order not to smoke?’’. Items are rated from 1 (*Not at all*) to 5 (*Very much*), with higher scores reflecting more inflexibility/avoidance. The AIS has displayed good reliability and validity in past work (38,39) and in the present sample ($\alpha = 0.93$).

Criterion variables

Smoking History Questionnaire (SHQ; 25) is a self-report questionnaire used to assess smoking history (e.g. age of onset) and problematic symptoms experienced during past quit attempts (e.g. weight gain, nausea, irritability, anxiety). The SHQ was employed to describe the sample and to create a mean composite score of problems experienced during past quit attempts.

Smoking Consequences Questionnaire (SCQ; 40) is a 50-item self-report measure that assesses smoking expectancies from 0 (*completely unlikely*) to 9 (*completely likely*). The entire measure and its constituent factors have demonstrated sound psychometric properties (40–42). In the present investigation, the negative reinforcement/negative affect reduction subscale (SCQ-NR; e.g. “Smoking helps me calm down when I feel nervous”) was used; internal consistency was excellent ($\alpha = 0.93$).

Motivational Aspects of Smoking Cessation Questionnaire (MASC; 43) consists of 10 aspects of motivation to quit smoking (e.g. “I wish to quit smoking”, “I want more information about quitting smoking”) rated from 0 (*no, not at all motivated*) to 4 (*yes, very motivated*). The MASC has demonstrated good internal consistency and validity (43) and is related to number of serious quit attempts (44). The internal consistency of the MASC in the current sample was 0.86.

Barriers to Cessation Scale (BCS; 45) is a 19-item self-report measure on which respondents indicate from 0 (*Not a barrier or not applicable*) to 3 (*Large barrier*) the degree to which they identify with each barrier to smoking cessation (e.g. “Weight gain,” “Friends encouraging you to smoke,” “Fear of failing to quit”). Scores are summed and a total score is derived. The BCS has strong psychometric properties, including concurrent and predictive validity, internal consistency, and reliability (45). The internal consistency of the BCS in the present study was acceptable, $\alpha = 0.89$.

Covariates

Fagerström Test for Nicotine Dependence (FTND; 46) is a 6-item scale that assesses severity of nicotine dependence. Scores range from 0–10, with higher scores reflecting high levels of physiological dependence on nicotine. The FTND has adequate internal consistency, positive relations with key smoking variables (e.g. saliva cotinine), and high test-retest reliability (46,47). Internal consistency of the FTND in the present sample was 0.64.

A *medical history checklist* was used to compute a composite variable as an index of tobacco-related medical problems. Items in which participants indicated having ever been diagnosed (heart problems, hypertension, respiratory disease, and asthma; all coded 0 = no, 1 = yes) were summed and a total score was created (observed range from 0–3), with greater scores reflecting the occurrence of multiple markers of tobacco-related disease.

Alcohol Use Disorders Identification Test (AUDIT; 48) is a 10-item self-report measure developed to identify individuals with alcohol problems. Total scores range from 0–30, with higher scores reflecting more hazardous drinking. The psychometric properties are well

documented. In the present study, the AUDIT total score was used as a covariate in all analyses; internal consistency was good ($\alpha = 0.84$).

Marijuana Smoking History Questionnaire (MSHQ; 49) assesses cannabis use history and patterns of use. One item was used in the current study to determine status of marijuana use in the past 30 days: “Please rate your marijuana use in the past 30 days” (Responses range from 0 = *No use*, 4 = *Once a week*, to 8 = *More than once a day*). This item was dichotomously coded to reflect a marijuana use status variable (0 = *No use*, 1 = *Past 30-day use*).

Positive and Negative Affect Scale (PANAS; 50) is a self-report measure that asks participants to rate the extent to which they experience each of 10 different feelings and emotions (e.g. nervous) based on a Likert scale that ranges from 1 (*Very slightly or not at all*) to 5 (*Extremely*). The negative affect subscale was used in the present study; internal consistency of the negative affect subscale was acceptable, $\alpha = 0.90$.

Participant descriptives

Structured Clinical Interview-Non-Patient Version for DSMIV (SCID-I/NP; 36) is a clinician-administered diagnostic assessments of Axis I psychopathology. SCID-I/NP interviews were administered by trained research assistants or doctoral level staff and supervised by independent doctoral-level professionals. Interviews were audio-taped and a random selection of 12.5% of interviews was checked for diagnostic accuracy; no disagreements were noted.

Data analytic strategy

Analyses were conducted in PASW Statistics 21.0 (IBM SPSS Inc.). First, zero-order correlations among study variables were examined. Next, a series of models using PROCESS, a conditional modeling program that utilizes an ordinary least squares-based path analytical framework to test for both direct and indirect effects (51), were conducted to examine the impact of AIS on the relation between IDAS-Dysphoria and the criterion outcomes (SCQ-NR, MASC, BCS-Total, and severity of problem symptoms reported in the past). Gender, nicotine dependence (FTND), drinking problems (AUDIT), cannabis use status (per MSHQ), negative affectivity (PANAS-NA), and tobacco-related medical problems were included as covariates in the models AIS’s relations to smoking outcomes. All relative indirect effects were subjected to follow-up bootstrap analyses with 10 000 samples and a 95-percentile confidence interval (CI) was estimated, as recommended by Hayes (51) and Preacher and Hayes (52,53).

Results

See Table 1 for the descriptive data and the zero-order correlations. Dysphoria (IDAS-Dysphoria) was significantly and positively associated with female gender, alcohol use, negative affectivity, nicotine dependence, barriers to smoking cessation, and severity of problems experienced while quitting. AIS also was significantly, positively related to female gender, negative affectivity, and all criterion variables. Additionally, being female was

related to higher scores on the PANAS-NA, IDAS-Dysphoria, AIS, BCS, and severity of quit problems.

The conceptual indirect model is presented in Figure 1. Regression results for paths *a*, *b*, *c*, and *c'* are presented in Table 2, which correspond to each of the four models. The estimates of the indirect effects ($a*b_i$) are the paths that were tested (see Table 2). For smoking expectancies, the total effect model for SCQNR ($R^2_{y1,x}=0.216$, $df=7, 457$, $F=18.016$, $p<0.0001$) and the full model with AIS accounted for significant variance ($R^2_{M,x}=0.324$, $df=8, 456$, $F=27.365$, $p<0.0001$). The direct effect of IDAS-Dysphoria on SCQ-NR after controlling for AIS was non-significant. Regarding the test of the indirect effect, higher self-reported dysphoria was predictive of higher SCQ-NR scores, indirectly through higher levels of AIS.

The total effect model with MASC was significant ($R^2_{y2,x}=0.071$, $df=7, 457$, $F=5.015$, $p<0.0001$), but the total effect of dysphoria on MASC was non-significant. The full model with AIS ($R^2_{M,x}=0.093$, $df=8, 456$, $F=6.004$, $p<0.0001$) and the direct effect of dysphoria in terms of motivation to quit after controlling for AIS was non-significant. Regarding the test of the indirect effect, higher levels of dysphoria were predictive of less motivation to quit smoking indirectly through higher AIS.

For perceived barriers for quitting, the total effects model accounted for significant variance ($R^2_{y3,x}=0.231$, $df=7, 457$, $F=19.604$, $p<0.0001$) and the full model with AIS accounted for significant variance ($R^2_{M,x}=0.414$, $df=8, 456$, $F=40.314$, $p<0.0001$). The direct effect of IDAS-Dysphoria on barriers to smoking cessation remained significant after controlling for AIS ($p=0.039$). The indirect effect was estimated and revealed that reported levels of dysphoria were predictive of greater perceived barriers to smoking cessation, which occurred indirectly through higher levels of AIS.

In regard to severity of problems reported while quitting in the past, these analyses were conducted only on the sample of participants reporting 1 previous quit attempts (excluding the 6.9%; $n=32$ that reported never having made a previous attempt to quit smoking). Results indicated that the total effects model predicted significant variance in severity of quit problems ($R^2_{y4,x}=0.302$, $df=7, 424$, $F=26.194$, $p<0.0001$). The full model with AIS predicted significant variance in quit problem severity ($R^2_{M,x}=0.362$, $df=8, 423$, $F=30.028$, $p<0.0001$). The direct effect of dysphoria on quit problem severity, controlling for AIS, remained significant. The indirect effect was estimated and indicated that higher levels of self-reported dysphoria was predictive of greater severity of problems while quitting smoking, which occurred indirectly through greater levels of AIS.

Given that cross-sectional data is limited in its ability to test causality, further analyses evaluated alternative explanatory models, in which we reversed IDAS-Dysphoria and AIS for each of the four criterion variables (52). Tests of the indirect effects in these reversed models were estimated based on 10 000 bootstrap re-samples. Results of the reversed models were non-significant for smoking expectancies ($b=0.002$, $CI_{95\%}=-0.001, 0.005$),

motivation to quit ($b = -0.003$, $CI_{95\%} = -0.019, 0.010$), and perceived barriers to smoking cessation ($b = 0.18$, $CI_{95\%} = -0.001, 0.040$). However, the pathway of AIS in terms of severity of cessation problems was significant ($b = 0.002$, $CI_{95\%} = 0.001, 0.004$).

Discussion

Despite emerging evidence suggesting robust relations of dysphoria with smoking (17,18), little research has examined the affective processes that may serve an explanatory role in the dysphoria-smoking relation. This is the first known study to explicitly examine whether dysphoria is related to a variety of smoking processes indirectly via AIS. Results suggest that dysphoria is differentially related directly and indirectly to several smoking processes.

Regarding direct effects, dysphoria was directly related to barriers to smoking cessation and severity of problems during prior quit attempts after controlling for AIS. Dysphoria was indirectly related to perceived barriers for smoking cessation, quit problem severity, negative reinforcement smoking expectancies, and motivation to quit smoking indirectly via the tendency to respond with inflexibility/avoidance in the presence of aversive smoking-related thoughts, feelings, or internal sensations (AIS). Notably, these observed effects were evident above and beyond the variance accounted for by the covariates, including negative affect more broadly. Thus, the observed effects likely reflect that dysphoria-related symptoms per se relate to a range of smoking processes via AIS, and that this pathway is qualitatively unique from other known factors implicated in smoking and depression.

Given that cross-sectional data is limited in its ability to test causality, further analyses evaluated alternative explanatory models, in which we reversed IDAS-Dysphoria and AIS for each of the four criterion variables. The results of these models were generally consistent with the hypothesis that dysphoria may contribute to AIS, which in turn, is related to a variety of smoking processes. Interestingly, these findings also suggested that, at least with regard to the severity of problematic symptoms experienced in past quit attempts, the relation between dysphoria and AIS may be more complex and possibly reciprocal. To more fully explore the nature of the relation among these variables over time, future prospective modeling is warranted (54–56).

Given that the outcomes studied here are central to the smoking cessation process, these findings have clear clinical implications. Clinicians may consider assessing for dysphoria and AIS at pre-treatment to identify patients who may benefit from techniques to help them better manage their dysphoria and their AIS. In fact, smoking cessation intervention programs have been developed to specifically cultivate greater willingness for emotional distress tolerance/acceptance to address AIS, and emerging results suggest such interventions generally produce better clinical outcomes compared to standard care (e.g. 38,57,58). Our findings also note that dysphoric smokers with high AIS, despite more perceived barriers and problematic symptoms when quitting, are nonetheless more motivated to quit. Hence, smoking cessation practitioners may want to capitalize on the heightened motivation to quit while helping to offset some of the concomitant barriers that dysphoric patients may experience that could derail their quit attempts due to elevated AIS.

Results should be considered in light of limitations that suggest additional avenues for work in this area. First, the analyses are correlational, which precludes interpretations regarding the causal or temporal relations between dysphoria, AIS, and smoking processes. Second, we examined dysphoria as a continuous construct in light of data suggesting that greater dysphoria, regardless of whether those one meets clinical standards for MDD, are related to greater nicotine dependence (17). However, replication in a sample with a greater number of patients with MDD would be advisable. Third, our sample consisted of community-recruited, treatment-seeking daily cigarette smokers with moderate levels of nicotine dependence. Future studies may benefit by sampling from lighter and heavier smoking populations to ensure the generalizability of the results to the general smoking population. Finally, the current study employed self-report measures to assess the examined predictor, mediator, and outcome variables. Future research could benefit by utilizing multi-method approaches and minimizing the role of method variance in the observed relations.

Overall, the present study serves as an initial investigation into the nature of the association between dysphoria, AIS, and a relatively wide range of smoking processes among adult treatment-seeking smokers. Future work is needed to explore the extent to which AIS accounts for relations between dysphoria and other smoking processes (e.g. withdrawal, cessation outcome) and to further clarify theoretical models of emotional vulnerability and smoking, and to inform clinical assessment and intervention development/ refinement.

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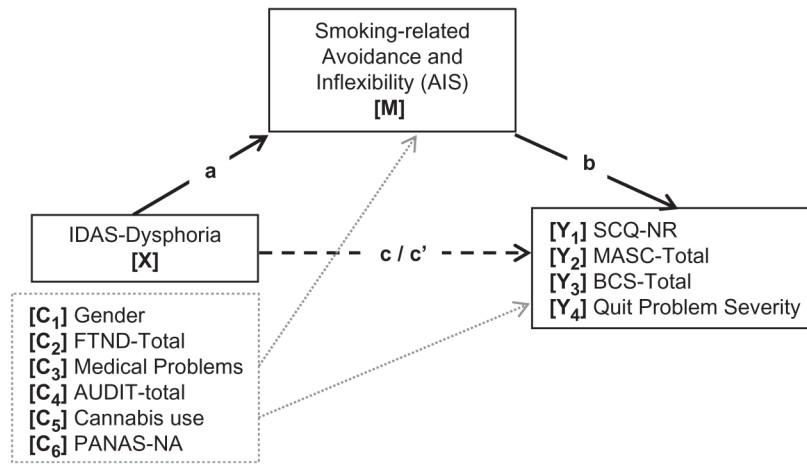


Figure 1. Proposed conceptual model. a = Effect of X on M; b = effect of M on Y_i; c = total effect of X on Y_i; c' = direct effect of X on Y_i controlling for M; a*b = indirect effect of M.

Table 1

Descriptive statistics and correlations for study variables (*n* = 465).

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender (female) ^a	1	-0.015	0.000	-0.104*	-0.061	0.135**	0.123**	0.183**	0.174**	0.055	0.223**	0.284**
2. FTND ^a		1	-0.021	-0.110*	-0.061	0.054	0.105*	0.255**	0.178**	0.219**	0.196**	0.179**
3. Medical Problems ^a			1	-0.117*	0.040	0.011	-0.028	0.058	-0.091*	0.004	0.006	0.016
4. AUDIT Total ^a				1	0.193**	0.243**	0.240**	0.037	0.166**	-0.117*	0.090	0.046
5. Cannabis use (Y) ^a					1	0.075	0.033	-0.066	0.004	-0.127**	-0.002	-0.109*
6. PANAS-NA ^a						1	0.764**	0.244**	0.374**	-0.054	0.371**	0.369**
7. Dysphoria ^b							1	0.329**	0.383**	-0.021	0.407**	0.420**
8. AIS ^c								1	0.468**	0.197**	0.582**	0.409**
9. SCQ-NR ^d									1	0.048	0.515**	0.424**
10. MASC ^d										1	0.079	0.092*
11. BCS-Total ^d											1	0.511**
12. Quit problems ^d												1
Mean (or <i>n</i>)	226	5.2	0.4	6.2	260	19.1	19.3	45.0	5.7	31.0	24.9	2.0
SD (or %)	48.5	2.28	0.62	6.02	55.8	7.06	7.81	10.73	1.78	7.11	11.0	40.67

* *p*<0.05;

** *p*<0.01;

^a Covariates;

^b Predictor;

^c Mediator;

^d Criterion Variables.

Gender = % listed are females (coded 0 = male; 1 = female); FTND = Fagerström Test for Nicotine Dependence – total score; Medical Problems = Tobacco-related medical problems as indicated by the a medical history form (observed range 0–3); AUDIT Total = Alcohol Use Disorders Identification Test; Cannabis use = Past 30 days cannabis use status per the Marijuana Smoking History Questionnaire (coded 0 = no use; 1 = past 30 day use); PANAS-NA = Positive and Negative Affect subscale; Dysphoria = Inventory of Anxiety and Depression – Dysphoria subscale; AIS = Acceptance and Inflexibility Scale – Total score; SCQ-NR = Smoking Consequences Questionnaire – Negative Reinforcement subscale; MASC = Motivational Aspects of Smoking Cessation Scale; BCS = Barriers to Cessation Scale – Total score; Quit Problems = Severity of problems experienced while quitting per the Smoking History Questionnaire; Columns numbers 1–12 correspond to the variables numbers in the far left column.

Table 2

Regression results.

Y	Model	b	SE	T	p	CI (lower)	CI (upper)
1	DYS→AIS (a)	0.410	0.091	40.510	<0.0001	0.231	0.588
	AIS→SCQ-NR (b)	0.061	0.007	80.541	<0.0001	0.047	0.075
	DYS→SCQ-NR (c')	0.017	0.014	10.177	0.240	-0.011	0.044
	DYS→SCQ-NR (c)	0.042	0.015	20.793	0.005	0.012	0.071
	DYS→AIS→SCQ-NR (a*b)	0.025	0.006			0.015	0.037
2	AIS→MASC (b)	0.114	0.033	30.476	0.0006	0.050	0.178
	DYS→MASC (c')	-0.031	0.065	-0.477	0.633	-0.159	0.097
	DYS→MASC (c)	0.016	0.064	0.242	0.809	-0.111	0.142
	DYS→AIS→MASC (a*b)	0.047	0.017			0.019	0.840
3	AIS→BCS (b)	0.489	0.041	110.947	<0.0001	0.409	0.570
	DYS→BCS (c')	0.168	0.081	20.068	0.039	0.008	0.328
	DYS→BCS (c)	0.369	0.091	40.049	0.0001	0.190	0.547
	DYS→AIS→BCS (a*b)	0.200	0.042			0.121	0.288
4	AIS→PROB (b)	0.017	0.003	60.33	<0.0001	0.012	0.022
	DYS→PROB (c')	0.019	0.005	30.553	0.0004	0.008	0.029
	DYS→PROB (c)	0.026	0.005	40.860	<0.0001	0.015	0.036
	DYS→AIS→PROB (a*b)	0.007	0.002			0.004	0.011

n = 465 in models of Y1-Y3; n = 433 in model of Y4 (excluded 32 participants that reported never having made a previous attempt to quit smoking). Path a is equal across all models; therefore, it presented only in the model with Y1 to avoid redundancies. The standard error and 95% CI for *a* are obtained by bootstrap with 10 000 re-samples. DYS (Dysphoria) is the independent variable (X), AIS (Smoking-related affective Inflexibility) is the mediator (M), and SCQ-NR (Negative reinforcement expectancies; Y1), MASC (Motivational Aspects of Smoking Cessation; Y2), BCS (Barriers to Smoking Cessation total score; Y3), and PROB (Severity of quit problems experienced; Y4), are the outcomes. CI (lower) = lower bound of a 95% confidence interval; CI (upper) = upper bound; → = affects.