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Associations of Functional and Dysfunctional Impulsivity to Smoking Characteristics

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Abstract

Objectives—Though the relation between impulsivity and smoking is well-documented, one model of impulsivity that has received little attention in the addiction literature separates impulsivity into two dimensions: functional impulsivity (tendency to make quick effective decisions) and dysfunctional impulsivity (tendency to make quick ineffective decisions).

Methods—This cross-sectional study examined relations of functional and dysfunctional impulsivity to smoking characteristics in 212 non-treatment-seeking daily smokers ($M = 15$ cig/day, $M =$ age 24 years, 53% female).

Results—Dysfunctional impulsivity exhibited small to medium sized positive associations with difficulty refraining from smoking in forbidden places, craving, and smoking without awareness. Functional impulsivity was inversely associated with a measure of cigarette craving. Other suggestive associations were found; however, these were not statistically significant after type-I error correction.

Conclusion—Though the overall predictive validity of these impulsivity constructs for explaining variance in smoking characteristics was relatively modest, the results suggest that conceptualizing impulsivity as a unitary construct indicative of a tendency to make quick decisions may mask heterogeneity within the impulsivity-smoking relationship. These findings suggest that high-dysfunctional impulsivity smokers may perhaps require more intensive interventions to dampen motivation to smoke. They also highlight the possibility that certain manifestations of impulsivity are not related with increased smoking behavior and may actually associate with reduced drive to smoke.

Keywords

smoking; dysfunctional impulsivity; functional impulsivity; Dickman

Introduction

Broadly defined, impulsivity reflects the tendency to lack conscious thought between an environmental stimulus and behavioral response to that stimuli (Claes et al., 2000).

Importantly, higher levels of impulsivity have been consistently associated with smoking characteristics, including smoking status, higher levels of tobacco dependence, and more

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severe cigarette craving (Billieux et al., 2007; Doran et al., 2009; Flory & Manuck, 2009). Recently, literature on smoking has focused on separating the broader trait of impulsivity into smaller sub constructs, with results suggesting that different facets of impulsivity may play different roles in smoking behavior (Billieux et al., 2007; Doran et al., 2009; Flory & Manuck, 2009).

While the majority of research portrays impulsivity as a detrimental trait which leads to negative health outcomes, Dickman's conceptualization suggests that not all aspects of impulsivity are detrimental to a person (Dickman, 1990). This theory illustrates impulsivity as composed of two sub constructs: dysfunctional impulsivity and functional impulsivity (Dickman, 1990). Dysfunctional impulsivity refers to the tendency to make quick decisions in situations in which it is not beneficial. This construct is similar to most definitions of impulsivity in which impulsivity is defined as a maladaptive trait characterized by acting without considering consequences of the action (Claes et al., 2000). An example of dysfunctional impulsivity would be making a large purchase with little or no consideration for alternative options or negative consequences of this behavior. By contrast, functional impulsivity refers to the tendency to make quick decisions in times when this cognitive style is beneficial (Dickman, 1990). A person with high levels of functional impulsivity would be able to quickly implement an effective conflict resolution strategy at the start of an argument to prevent it from escalating. In factor analyses of impulsivity scales, dysfunctional impulsivity loaded on a scale of premeditation and functional impulsivity loaded on scales of sensation seeking and urgency (Whiteside & Lynam, 2001).

To our knowledge, there has not yet been a study investigating the association of functional impulsivity and dysfunctional impulsivity to smoking. Yet, examining the pattern of associations between these two constructs and profiles of dependence is important for advancing theory on the etiology of smoking behavior. If functional and dysfunctional impulsivity are both shown to be positively related to more severe tobacco dependence, this would suggest that quick decision making (regardless of whether it is in adaptive or maladaptive contexts) is a core psychological process underlying the relation between impulsivity and smoking. Alternatively, if only dysfunctional impulsivity is associated with tobacco dependence characteristics, this finding would indicate that it is not just the speed of decision making that may influence smoking, rather it is the quality of decision making. Exploring the relation of functional and dysfunctional impulsivity to a wide array of smoking characteristics may not only shed light on whether impulsivity is related with dependence, but how impulsivity exerts its influence in smoking. For instance, if impulsivity is associated with smoking for negative reinforcement, this would indicate that impulsive persons may be prone to smoking because of its mood modulating effects. From a clinical perspective, investigating the predictive validity of these impulsivity measures for explaining variance in smoking characteristics, would suggest which facets of the impulsivity process: (a) need to be focused on in cessation programs; and (b) included in risk assessment batteries designed to identify those who may be at highest risk for tobacco dependence. It is particularly important to explore these factors among individuals in late adolescence to early adulthood, as neurodevelopmental changes which occur at during this age period are associated with increased impulsive behaviors and may heighten risk for tobacco dependence onset and exacerbation (Chambers, 2003; deBry & Tiffany, 2008). Impulsivity exhibited early on in life may also be a predictor for initiation of smoking later on in adolescence and impulsivity exhibited in adolescence is related to more frequent smoking in adolescence (Masse & Tremblay, 1997; Doran et al., 2011).

This study examines cross-sectional associations of trait functional and dysfunctional impulsivity with smoking characteristics in a sample of young adult non-treatment seeking smokers. In this initial study, we included a broad battery of smoking characteristics

presumed to be involved in the tobacco dependence process including: nicotine dependence severity and features, smoking dependence motives, and cigarette craving (Billieux et al., 2007; Flory & Manuck, 2009). We hypothesized that dysfunctional impulsivity would positively associate with profiles indicative of heavier and more dependent smoking, based on the notion that the tendency to make rash, maladaptive decisions without considering the consequences may extend to health behaviors, such as smoking. We also predicted that dysfunctional impulsivity would associate with the tendency to smoke outside of awareness (i.e. automaticity smoking motivation) and cigarette craving given the nature of the construct and prior findings (e.g., Doran et al., 2009). We did not propose hypotheses regarding the association between functional impulsivity and smoking characteristics, although we hypothesized that functional impulsivity would demonstrate a weaker and less consistent relationship with these variables in comparison to dysfunctional impulsivity, as we suspect that the speed of decision making (as reflected by functional impulsivity) may be less important than the quality of decision making in determining tobacco dependence.

Methods

Study participants and procedure

Data were collected from current smokers ($N=212$) enrolled at a U.S. university who were participating in a more extensive study of the cognitive effects of tobacco deprivation (Leventhal et al., 2008). Participants were recruited through fliers, class announcements, and e-mail listserv postings announcing the opportunity to participate in a study of cognition, emotion, and smoking. Potential participants were asked to participate if they: (1) reported normal vision; (2) were > 18 years old; and (3) reported smoking > 5 cigarettes per day for the past 2 years. Participants were considered ineligible if they: (a) planned to quit in the next 30 days; (b) were currently cutting down substantially on smoking; (c) currently used nicotine replacement; or (d) were able to read or speak Chinese (one of the cognitive tasks in the larger study required participants to rate Chinese ideographs which were intended to be novel).

The sample was 53.3% female with a total sample mean age of 24.3 ($SD=6.4$) and had been smoking for an average of 6.6 years ($SD=6.09$). Nine percent self-identified as African American, 15% Asian, 64% Caucasian, 7% Hispanic, and 3% Middle Eastern.

Participants responding to study announcements corresponded with research staff who provided additional information about the study and queried potential participants about eligibility criteria. Those who remained interested and met eligibility criteria were invited to attend an initial session where they completed informed consent, learned about study procedures, and completed questionnaires, including those listed below. Participants smoked normally prior to completing baseline questionnaires. Participants were compensated with course credit and a \$15 voucher redeemable at a department store. This study utilizes data from the baseline session only. The study was approved by the University's Institutional Review Board.

Measures

Dickman's Functional and Dysfunctional Impulsivity Inventory (Dickman, 1990)—The impulsivity inventory is a self-report measure containing 11 items which assess functional impulsivity and 12 items which assess dysfunctional impulsivity in true-false format. The questionnaire also includes 23 filler items, not used in analyses. The questionnaire has shown good psychometric properties in a variety of samples (Caci et al., 2003; Claes et al., 2000; Dickman, 1990). In our sample, the questionnaire had a Cronbach's α of .84 for dysfunctional impulsivity and .77 for functional impulsivity. Items assessing

functional impulsivity included: “I am good at taking advantage of unexpected opportunities, where you have to do something immediately or lose your chance.” Items which assess dysfunctional impulsivity included: “I often say and do things without considering the consequences.”

Fagerström Test for Nicotine Dependence (FTND; Heatherton et al., 1991)—

The FTND is a widely used and well-validated 6-item measure of nicotine dependence, which produces an overall severity score. Within the analyses, the individual items of the FTND, as well as the total score were assessed as outcome variables.

Wisconsin Inventory of Smoking Dependence Motives (WISDM; Piper et al., 2004)—

The WISDM is a 68-item, self-report scale that assesses 13 theoretically-distinct tobacco dependence motives in separate subscales. Each item is answered on a 7-point Likert scale ranging from 1 (“Not true of me at all”) to 7 (“Extremely true of me”). The subscales are: Automaticity (smoking without intention or awareness; Cronbach’s $\alpha = .91$), Loss of Control (perceived loss of volitional control over smoking; $\alpha = .86$), Craving (smoking in reaction to craving or experiencing strong or frequent urges to smoke; $\alpha = .86$), Tolerance (tendency to smoke increasing amounts over time in order to experience the desired effects; $\alpha = .82$), Affiliative Attachment (strong emotional attachment to smoking; $\alpha = .92$), Behavioral-Choice Melioration (smoking despite constraints on smoking or negative consequences or the lack of other reinforcers; $\alpha = .86$), Cognitive Enhancement (smoking to elevate cognitive function; $\alpha = .95$), Cue Exposure-Associative Processes (frequent encounters with nonsocial smoking stimuli or a strong perceived link between stimuli exposure and smoking; $\alpha = .80$), Negative Reinforcement (tendency to smoke to ameliorate a variety of aversive emotional states; $\alpha = .90$), Positive Reinforcement (tendency to smoke for a “buzz” or to enhance an already positive emotion; $\alpha = .87$), Social-Environmental Goads (frequent exposure to social contexts that either model or encourage smoking; $\alpha = .93$), Taste and Sensory Properties (smoking to experience the orosensory effects of smoking; $\alpha = .86$), and Weight Control (use of cigarettes to control weight or appetite; $\alpha = .92$) subscales. The WISDM scales exhibited excellent internal consistency and correspondence with self-report and biochemical dependence assessments in a prior study, and can be averaged to create a total WISDM score.

Questionnaire of Smoking Urges—Brief (QSU; Cox et al., 2001)—The QSU is a 10-item survey that assesses current cigarette craving. Since participants smoked normally prior to completing the questionnaire, it assessed craving that would be experienced on a typical day. Items were rated on a 6-point scale for each item ranging from 0 (strongly disagree) to 5 (strongly agree). As suggested by Toll et al., the QSU is composed of two factors. Factor 1 (items 1 and 6) assesses intention or desire to smoke and factor 2 (items 4, 8, and 9) assesses relief from negative affect and urgent desire to smoke (Toll et al., 2006). The brief version of the QSU has demonstrated excellent psychometric properties (Cox et al., 2001).

Wisconsin Smoking Withdrawal Scale—Craving Subscale (WSWS; Welsch et al., 1999)—

The WSWS-craving subscale is a 4-item subscale within the larger multisubscale WSWS withdrawal symptom check list designed to assess craving experienced so far that day. Items are each rated on a 5 point scale ranging from 0 (Strongly Disagree) to 4 (Strongly Agree). The WSWS has shown good internal consistency (Welsch et al., 1999).

Data analysis

Outcome variables included total FTND score as well as the individual FTND items, all 13 subscales of the WISDM as well as the WISDM total score, and craving as assessed by the QSU total score, QSU factor 1, QSU factor 2 and WSWS. For each outcome variable, 3 models were calculated: One model containing functional impulsivity as the sole predictor, one model containing dysfunctional impulsivity as the sole predictor, and one model containing both functional and dysfunctional impulsivity as predictors. Multivariate linear regression was used for continuous outcomes and logistic regression was used for categorical outcomes. All models controlled for sex, age, and race; data were standardized. Because this was the initial study of functional and dysfunctional impulsivity in smoking, we did not want to overlook any potential findings. Accordingly, all findings at the significance level of .05 were reported. However, a Holm correction (Holm, 1979) was used to adjust for multiple analyses within each group of outcomes (i.e., analyses consider the seven FTND indexes a family of tests, the fourteen WISDM indexes a family of tests, and the four craving scales a family of tests), and those analyses that did not retain significance after adjustment were interpreted with caution. All analyses were two-tailed and completed using SAS 9.2 (SAS, 2002-2008).

Results

Descriptive statistics for smoking behaviors are displayed in table 1. Mean dysfunctional impulsivity was 4.1 (SD=3.34) with a range of 0-12 and mean functional impulsivity was 6.1 (SD=2.94) with a range of 0-11. Both dysfunctional impulsivity and functional impulsivity exhibited skewness and were not normally distributed (Shapiro-Wilk p s < .0001). A log transform was used to correct for non-normality of the data. Results are presented in table 2 for functional impulsivity and table 3 for dysfunctional impulsivity; refer to these tables for standardized β s, unstandardized β s, p -values, odds ratios (OR s), and 95% confidence intervals (CI s). For linear regression models unstandardized B s and standard errors are presented from data prior to transformation; standardized β s and p -values are from transformed data. For logistic regression models OR s and 95% CI s are presented from data prior to transformation and p -values are from transformed data. Inferential statistics from untransformed data are provided for interpretation of the findings with the original scale of the impulsivity inventory. The transformed impulsivity scales were correlated at a level of .12 ($p = .09$).

Functional and dysfunctional impulsivity both exhibited significant associations with measures of craving, however, dysfunctional impulsivity was linked to higher craving while functional impulsivity was associated with lower craving. Dysfunctional impulsivity was positively associated with the QSU total scale, QSU factor 1, QSU factor 2, and the WSWS; all of these associations remained significant after Holm correction for multiple tests. Functional impulsivity was inversely associated with the QSU total scale, QSU factor 1, QSU factor 2 and WSWS; after the Holm correction, only the association with the WSWS held.

Dysfunctional impulsivity was positively associated with the total FTND score, smoking while ill, finding it difficult to refrain from smoking in places where it is forbidden, the overall WISDM, loss of control and automaticity. Only the associations with difficulty refraining from smoking where forbidden and automaticity retained significance after the Holm correction. Functional impulsivity was negatively correlated with behavioral choice melioration, cue exposure, cognitive enhancement and negative reinforcement; however, these findings were not significant after the α correction for multiple tests.

Discussion

The two subcomponents of impulsivity drawn from Dickman's model (Dickman, 1990) illustrated contrasting relationships with smoking characteristics in this study. Specifically, dysfunctional impulsivity was positively associated with certain smoking characteristics that are implicated in tobacco dependence, whereas functional impulsivity had an inverse relationship with some smoking characteristics. These findings suggest that conceptualizing impulsivity as a unitary construct indicative of a tendency to make quick decisions may mask heterogeneity within the impulsivity-smoking relationship. It also should be noted that both scales were not significantly associated with many of the smoking characteristics examined. Following Cohen's (1992) guidelines for effect size determination (small effect: $r = .10$, $\beta = .10$, $OR = 1.49$; medium-sized: $r = .30$, $\beta = .30$, $OR = 3.45$; large: $r = .50$, $\beta = .50$, $OR = 9.00$), the magnitude of the significant effects were small to medium effect sizes. Other studies of impulsivity and nicotine dependence in young adult populations have found similar results suggesting that trait impulsivity has a modest relationship with dependence criteria and characteristics (Chase and Hogarth, 2011).

While we found an inverse association between functional impulsivity and craving, all other findings for functional impulsivity were no longer significant after correcting for multiple analyses, suggesting that the relationship between functional impulsivity and aspects of nicotine addiction demonstrated in this study should be interpreted with caution. However, given that functional impulsivity was negatively associated with craving and the tendency to smoke for negative reinforcement, behavioral choice melioration, and cue exposure--associative properties, we tentatively speculate that smokers who are better able to make quick effective decisions may experience less craving to smoke on a daily basis, be less motivated to pursue smoking over other pleasant behaviors, less likely to smoke to suppress negative mood states, and less likely to smoke due to environmental and internal cues. Thus, clinicians may be able to capitalize on these protective influences when attempting to help smokers with high functional impulsivity quit smoking. Yet, replication of these results is warranted given that some of these effects did not remain after a significance correction.

Dysfunctional impulsivity was linked to higher total WISDM score and more severe daily craving, indicating that it may be linked to certain facets of nicotine dependence. Dysfunctional impulsivity was also positively associated with smoking without conscious awareness (WISDM-automaticity), loss of control, nicotine dependence as assessed by the FTND total score, smoking while ill, and having trouble abstaining from smoking in areas where it is not allowed. These associations suggest that those who are high in dysfunctional impulsivity have trouble controlling their smoking behavior and identifying or considering consequences of their actions (such as becoming sicker from smoking while ill or being cited for smoking in an area where it is illegal). Dysfunctional impulsivity also had a stronger association with QSU factor 2 than QSU factor 1, indicating that dysfunctional impulsivity may be associated more with craving due to negative affect and urgent need to smoke as opposed to desire to smoke. It is interesting that dysfunctional impulsivity had significant associations with two FTND items --- smoking while ill and trouble refraining from smoking in forbidden places--- while it did not have statistically significant associations with items tapping smoking heaviness or smoking in the morning. These findings are supported by a recent study by Chase and Hogarth in which the Barrett Impulsivity Scale-11 was found to associate with only two DSM symptoms of dependence---continued use despite problems and chain smoking (2011). These data suggest people high in dysfunctional impulsivity may have a specific subtype of nicotine addiction characterized by difficulty controlling smoking behavior, but not excessively heavy smoking (Piper et al., 2004). Accordingly, such smokers may need a cessation program tailored for

their needs, such as a program focusing on mindfulness to help enhance awareness and control over smoking behavior (Brewer et al., 2011).

There are limitations to this study. First, participants were university students who are younger in age and have a higher level of education than the general population of smokers; therefore the results may not be generalizable to more dependent, older smokers or those who wish to quit. Participants smoked normally prior to completing questionnaires, and craving was not assessed in conjunction with an environmental smoking cue. Therefore, the QSU and WSWs-Craving scales only measured craving as experienced normally by the participants, as opposed to craving during abstinence or some other context. The results may not generalize to situations of cessation or other contexts in which craving is markedly higher than usual. However, these results are useful as they portray the regular experience of smokers with different impulsive tendencies. Furthermore, all data were cross-sectional and cannot suggest that impulsivity caused an increase or reduction in smoking behavior (or vice versa). Data were solely collected from self-report measures, which leaves it unclear if common method variance influenced the impulsivity-smoking associations found. However, the findings showed a distinctive pattern in which the impulsivity constructs associated with certain characteristics but not others. If method factors, such as response biases, influenced the findings, we would have expected to yield correlations across all measures in a random fashion, which was not the case in this study. There were no biological indices of smoking, which would have been preferable. Also, we did not have any behavioral measures of impulsivity or other scales in the study, so we do not know if our findings are unique to this scale or generalizable to other conceptualizations of impulsivity. The study may have been underpowered to find associations with small effect sizes, particularly when considering a more stringent type-I error correction applied by the Holm correction. Finally, care should also be taken when interpreting results from analyses that did not correct for type-I error. However, it is unlikely that certain associations (e.g., the relation between dysfunctional impulsivity and craving) were chance findings as the p -values were relatively extreme ($p < 0.001$).

Limitations aside, this was the first study to apply Dickman's impulsivity inventory to smoking research. Though the overall predictive validity of the Dickman scales for explaining variance in smoking characteristics in this study was relatively modest, the disparate findings for functional versus dysfunctional impulsivity raise the interesting possibility that not all characteristics indicative of the tendency to make quick decisions relate to increased smoking behavior. Instead, it may be the quality of decision making (i.e., the tendency to make quick decisions without considering the consequences) rather than solely the speed decision making that may increase risk of more severe forms tobacco dependence. Furthermore, we found suggestive evidence that functional impulsivity may relate to reduced drive to smoke. Overall, this line of research may stimulate new approaches to studying the psychological correlates of smoking behavior.

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Table 1

Descriptive Statistics for Smoking Characteristics

Outcomes	<i>M (SD)/%</i>	<i>Range/N</i>
FTND		
Total Scale	3.9 (2.12)	0-9
Time of first cigarette of day		
Within 5 minutes	21.2%	45
6 - 30 minutes	28.3%	60
31-60 minutes	34.9%	74
After 60 minutes	15.6%	33
Find it difficult to refrain from smoking in forbidden places	40.6%	86
Would hate to give up first cigarette in the morning vs. all others	36.8%	78
Cigs/day (ordinal variable)		
10 or less	15.6%	33
11-20	72.2%	153
21-30	10.9%	23
31 or More	1.4%	3
Smokes most frequently in 1st hour of the day	25.5%	54
Smoke while ill	42.5%	90
WISDM		
Total Score	3.9 (1.03)	1.1-6.3
Affiliative Attachment	2.7 (1.61)	1-7
Automaticity	4.1 (1.65)	1-7
Loss of Control	3.7 (1.55)	1-7
Behavioral Choice-Melioration	3.3 (1.39)	1-6.9
Cognitive Enhancement	3.9 (1.70)	1-7
Craving	4.4 (1.49)	1-7
Cue exposure-associative Processes	5.0 (1.19)	1-7
Positive Reinforcement	4.2 (1.32)	1-7
Negative Reinforcement	4.5 (1.36)	1-7
Social-Environmental Goads	4.6 (1.83)	1-7
Taste and Sensory Processes	4.4 (1.24)	1-7
Tolerance	4.2 (1.60)	1-7
Weight Control	2.6 (1.71)	1-7
QSU Total (Craving)		
QSU Factor 1	2.1 (1.1)	0-5
QSU Factor 2	2.6 (1.55)	0-5
QSU Factor 2	1.2 (1.12)	0-5
WSWS Craving Subscale	2.1 (.93)	0-4

Note. *N* = 212, FTND = Fagerström Test for Nicotine Dependence, WISDM = Wisconsin Inventory of Smoking Dependence Motives, QSU = Questionnaire for Smoking Urges, WSWS = Wisconsin Smoking Withdrawal Scale. % and *N* presented for categorical variables. *M (SD)* and range presented for continuous variables.

Table 2

Associations between Functional Impulsivity and Smoking Characteristics

Outcomes	Predictor	
	Functional Impulsivity	
	Individual Model	Combined Model
FTND		
Total Scale, β , B (SE)	-.08, -.05 (.05)	-.10, -.06 (.05)
Time of first cigarette of day, OR (95% CI)	1.12 (.87, 1.45)	1.12 (.87, 1.45)
Find it difficult to refrain from smoking in forbidden places, OR (95% CI)	.89 (.66, 1.20)	.82 (.60, 1.11)
Would hate to give up first cigarette in the morning vs. all others, OR (95% CI)	1.16 (.85, 1.56)	1.14 (.84, 1.54)
Cigs/day (ordinal variable), OR (95% CI)	1.32 (.96, 1.80)	1.31 (.95, 1.80)
Smokes most frequently in 1 st hour of the day, OR (95% CI)	.87 (.63, 1.21)	.85 (.61, 1.19)
Smoke while ill, OR (95% CI)	1.00 (.75, 1.33)	.95 (.71, 1.28)
WISDM, β , B (SE)		
Total Score	-.11, -.03 (.02)	-.12, -.04 (.02)
Affiliative Attachment	-.04, -.02 (.04)	-.05, -.02 (.04)
Automaticity	-.06, -.03 (.04)	-.09, -.05 (.04)
Loss of Control	-.05, -.02 (.04)	-.06, -.03 (.04)
Behavioral Choice-Melioration	-.15 [*] , -.07 (.03)	-.16 [*] , -.07 (.03)
Cognitive Enhancement	-.14, -.07 (.04)	-.15 [*] , -.07 (.04)
Craving	-.11, -.06 (.04)	-.12, -.06 (.04)
Cue exposure-associative Processes	-.15 [*] , -.05 (.03)	-.16 [*] , -.05 (.03)
Positive Reinforcement	-.08, -.02 (.03)	-.09, -.03 (.03)
Negative Reinforcement	-.16 [*] , -.06 (.03)	-.17 [*] , -.07 (.03)
Social-Environmental Goals	.01, .01 (.04)	< -.01, <.01 (.04)
Taste and Sensory Processes	.03, .02 (.03)	.03, .02 (.03)
Tolerance	-.06, -.04 (.04)	-.08, -.05 (.04)
Weight Control	-.04, -.02 (.04)	-.05, -.03 (.04)
QSU Total (Craving), β , B (SE)		
	-.14 [*] , -.05 (.03)	-.17 [*] , -.07 (.03)
QSU Factor 1, β , B (SE)	-.13, -.07 (.04)	-.15 [*] , -.09 (.04)
QSU Factor 2, β , B (SE)	-.14, -.04 (.03)	-.17 [*] , -.06 (.03)
WSWS Craving Subscale, β , B (SE)		
	-.15 [*] , -.05 (.02)	-.18[*], -.06 (.02)

Note. $N = 212$, FTND = Fagerström Test for Nicotine Dependence, WISDM = Wisconsin Inventory of Smoking Dependence Motives, QSU = Questionnaire for Smoking Urges, WSWS = Wisconsin Smoking Withdrawal Scale. Individual model includes functional impulsivity as the sole predictor after adjusting for age, sex, and ethnicity. The combined model includes both functional and dysfunctional impulsivity as simultaneous predictors after adjusting for age, sex, and ethnicity. β = Standardized regression coefficient from linear regression model. B = Unstandardized regression coefficient from linear regression model. SE = Standard errors of unstandardized regression coefficient from linear regression model. OR = Odds ratio for logistic regression model. 95% CI = 95% Confidence Interval around Odds Ratio for logistic regression model.

Significant findings after adjusting for family-wise error with Holm correction are in bold type.

* indicates $p < .05$.

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Table 3

Associations between Dysfunctional Impulsivity and Smoking Characteristics

Outcomes	Predictor	
	Dysfunctional Impulsivity	
	Individual Model	Combined Model
FTND		
Total Scale, β , B (SE)	.14, .07 (.05)	.15 [*] , .08 (.05)
Time of first cigarette of day, OR (95% CI)	.99 (.76, 1.29)	.98 (.75, 1.28)
Find it difficult to refrain from smoking in forbidden places, OR (95% CI)	1.74^{**} (1.26, 2.39)	1.80^{***} (1.29, 2.50)
Would hate to give up first cigarette in the morning vs. all others, OR (95% CI)	1.18 (.87, 1.61)	1.04 (.75, 1.45)
Cigs/day (ordinal variable), OR (95% CI)	1.08 (.78, 1.49)	1.06 (.76, 1.48)
Smokes most frequently in 1 st hour of the day, OR (95% CI)	1.15 (.82, 1.60)	1.17 (.83, 1.63)
Smoke while ill, OR (95% CI)	1.37 [*] (1.01, 1.87)	1.38 [*] (1.02, 1.89)
WISDM, β , B (SE)		
Total Score	.16 [*] , .04 (.02)	.17 [*] , .05 (.02)
Affiliative Attachment	.11, .05 (.03)	.11, .05 (.04)
Automaticity	.25^{***}, .11 (.04)	.26^{***}, .11 (.04)
Loss of Control	.16 [*] , .05 (.03)	.17 [*] , .06 (.03)
Behavioral Choice-Melioration	.11, .04 (.03)	.13, .05 (.03)
Cognitive Enhancement	.07, .03 (.04)	.08, .04 (.04)
Craving	.09, .05 (.03)	.11, .05 (.03)
Cue exposure-associative Processes	.09, .04 (.03)	.11, .04 (.03)
Positive Reinforcement	.10, .04 (.03)	.11, .04 (.03)
Negative Reinforcement	.09, .03 (.03)	.11, .04 (.03)
Social-Environmental Goals	.13, .07 (.04)	.13, .07 (.04)
Taste and Sensory Processes	<.01, <.01 (.03)	<.01, <.01 (.03)
Tolerance	.13, .05 (.04)	.14, .06 (.04)
Weight Control	.08, .04 (.04)	.08, .04 (.04)
QSU Total (Craving), β , B (SE)		
	.26^{***}, .09 (.02)	.28^{***}, .10 (.02)
QSU Factor 1, β , B (SE)	.17 [*] , .10 (.03)	.19 [*] , .11 (.03)
QSU Factor 2, β , B (SE)	.26^{***}, .08 (.02)	.28^{***}, .08 (.02)
WSWS Craving Subscale, β , B (SE)	.24^{***}, .06 (.02)	.27^{***}, .07 (.02)

Note. $N = 212$, FTND = Fagerström Test for Nicotine Dependence, WISDM = Wisconsin Inventory of Smoking Dependence Motives, QSU = Questionnaire for Smoking Urges, WSWS = Wisconsin Smoking Withdrawal Scale. Individual models include dysfunctional impulsivity as the sole predictor after adjusting for age, sex, and ethnicity. The combined model includes both functional and dysfunctional impulsivity as simultaneous predictors after adjusting for age, sex, and ethnicity. β = Standardized regression coefficient from linear regression model. B = Unstandardized regression coefficient from linear regression model. SE = Standard error of unstandardized regression coefficient from linear regression model. OR = Odds ratio for logistic regression model. 95% CI = 95% Confidence Interval around Odds Ratio for logistic regression model.

Significant findings after adjusting for family-wise error with Holm correction are in bold type.

*
indicates $p < .05$

**
 $p < .01$

 $p < .001$.