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The influence of personality traits on smokers' affect, withdrawal and cessation intervention outcome

Yong Cui,

Department of Behavioral Science, The University of Texas MD Anderson Cancer Center

Rui Tang,

Department of Psychology, Southern Methodist University

Cho Y. Lam,

Department of Psychology, Rice University.

Paul M. Cinciripini, and

Department of Behavioral Science, The University of Texas MD Anderson Cancer Center

Jason D. Robinson

Department of Behavioral Science, The University of Texas MD Anderson Cancer Center

Abstract

The personality traits of harm avoidance (HA), novelty seeking (NS), and reward dependence (RD), as measured by the Tridimensional Personality Questionnaire (TPQ), have been linked to smoking behavior. The extent to which these traits are associated with smoking withdrawal and cessation outcome is unclear. We sought to address this question among 131 treatment-seeking smokers who were randomly assigned to either a smoking cessation treatment (four 30-min behavioral counseling sessions) or a control condition. We found that HA was positively associated with baseline depressive symptoms, baseline negative affect, and post-quit withdrawal, and negatively associated with positive affect at both baseline and post-quit. Additionally, we found that smokers with higher HA scores were more likely to be abstinent. NS was negatively associated with post-quit positive affect and positively associated with post-quit negative affect and withdrawal. RD was not found to be related to any outcome measures. Our findings suggest that, despite experiencing greater baseline and post-quit negative affect, smokers higher in trait harm avoidance are more likely to quit smoking. The treatment and theoretical ramifications of these findings are discussed.

Correspondence concerning this article should be addressed to Jason D. Robinson. jdrobinson@mdanderson.org. Mail: Department of Behavioral Science - Unit 1330, The University of Texas MD Anderson Cancer Center, PO Box 301439, Houston, TX 77230. Telephone: 1-713-792-0919; Fax: 1-713-794-4730..

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Keywords

Personality Traits; Tridimensional Personality Questionnaire; Smoking Cessation; Smoking Withdrawal; Abstinence

1. Introduction

To improve smoking cessation rates, increasing efforts have been devoted to tailoring intervention to target risk factors that may predispose smokers to cessation failure (Ziedonis et al., 2008). One potential set of risk factors are personality traits that influence motivational behaviors that may be important in the development and maintenance of smoking behavior. The Tridimensional Personality Theory is a framework that describes personality variants (Cloninger, 1987) that have been postulated to influence various behavioral disorders, including substance abuse (Howard, Kivlahan, & Walker, 1997; Wills, Vaccaro, & McNamara, 1994). Specifically, this theoretical framework identifies three personality traits: harm avoidance (HA, the tendency to inhibit behaviors that may lead to harm), novelty seeking (NS, the tendency to activate approach behaviors in response to novel stimuli or cues for potential rewards), and reward dependence (RD, the tendency to maintain behaviors that are associated with rewards).

1.1. TPQ Personality Traits and Smoking

1.1.1 Harm Avoidance and Smoking—HA has been found to be positively associated with smoking status. Daily smokers reported higher HA than never and former smokers, and more dependent smokers had higher HA scores than those less dependent (Etter, 2010). HA has been associated with smoking initiation risk, as Etter and colleagues (2003) found that HA scores were lower in never-smokers than in ever-smokers. In line with this finding, neuroticism, a personality dimension highly correlated with HA (De Fruyt, Van De Wiele, & Van Heeringen, 2000), was positively associated with lifetime diagnosis of nicotine dependence (Kawakami, Takai, Takatsuka, & Shimizu, 2000).

Some studies have found a relationship between HA and post-quit withdrawal symptoms, though the number of studies is few. Etter (2010) found that higher levels of HA predicted higher scores of depressed mood at 2-month post-quit. Related to this finding, smokers with higher HA reported more negative affect (NA) and urge to smoke to relieve distress in the condition of 12-h smoking abstinence compared to the ad libitum smoking condition (Leventhal et al., 2007).

1.1.2. Novelty Seeking and Smoking—NS has been positively associated with smoking status and acute withdrawal. Daily smokers were found to have higher NS scores than never smokers (Etter, 2010), and ever smoking was associated with higher NS scores than never smoking (Etter, Pelissolo, Pomerleau, & De Saint-Hilaire, 2003). NS was associated with smoking withdrawal in one study that found that smokers with higher NS reported greater levels of NA, withdrawal symptoms, and cigarette craving following 12-h smoking abstinence relative to smoking ab libitum (Leventhal et al., 2007). However, null

findings have been also reported, as neither NS nor HA were found to be related to smoking-cue- or stress-induced cigarette cravings in one study (Michalowski & Erblich, 2014).

1.1.3. Reward Dependence and Smoking—RD has been positively associated with smoking status and cue-elicited smoking. Current smokers reported higher RD than former smokers (Etter et al., 2003). Smokers with higher RD scores reported stronger craving for smoking in response to smoking- and stress-related cues (Michalowski & Erblich, 2014). However, RD was not associated with withdrawal induced by 12-h smoking abstinence (Leventhal et al., 2007).

1.2. Present Study

We used the Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987) to measure HA, NS, and RD among smokers who were enrolled in a clinical cessation study involving brief smoking cessation psychotherapy (Lam et al., 2012). Our first aim was to determine to what extent these personality traits would be associated with smoking-related baseline characteristics. Based on the findings that HA and NS were positively correlated with behavioral activation and inhibition, respectively, and that behavioral activation and inhibition were positively associated with positive affect (PA) and NA, respectively (Carver & White, 1994), we hypothesized that HA would be positively associated with NA and negatively associated with PA, while NS would show the opposite associations. We also hypothesized that both HA and NS would be positively associated with nicotine dependence severity. Secondly, we evaluated the influences of these personality traits on post-quit affect and smoking withdrawal over the course of cessation treatment. In light of HA and NS's positive associations with acute smoking withdrawal symptoms (Leventhal et al., 2007), we hypothesized that higher HA and NS scores would be associated with less PA and more NA and withdrawal effects during the cessation course. Because of the sparsity of previous research on RD and smoking, we did not have specific hypotheses related to RD in our first two aims. Finally, we sought to determine to what extent these personality traits would predict end-of-treatment abstinence status. Based on previous research linking trait neuroticism and relapse (Hooten et al., 2005), we hypothesized that smokers with less HA scores would be more likely to be abstinent.

2. Methods

2.1. Participants

Participants were recruited from the Houston metropolitan area. The major inclusion criteria were: 1) intending to quit smoking, 2) smoking intensity ≥ 10 cigarettes per day (CPD), and 3) expired carbon monoxide (CO) ≥ 8 ppm. The major exclusion criteria were: 1) on psychotropic medications, 2) having psychiatric disorders, 3) non-nicotine substance abuse, and 4) involved in any other cessation treatment.

All participants provided informed consent. Participants' eligibility was verified by telephone screen and in-person enrollment session. The parent clinical study was approved by the Institutional Review Board at The University of Texas MD Anderson Cancer Center.

The current study included 131 (female = 63) participants with an average age of 39.0 and smoking intensity of 20.9 CPD. Most were European (50%) or African (33%) American.

2.2. Procedures

Participants were randomly assigned to the intervention (n=79) or control (n=52) condition, though, due to a software problem, the groups were not randomized equally to the conditions. Nevertheless, these two groups did not differ in their baseline characteristics, such as age and gender.

All enrolled participants attended four laboratory sessions. Relative to the scheduled quit date (Day 0), the four sessions were on Day -5 to -4, Day 1-2, Day 3-5, and Day 10-14, respectively. Each session consisted of session questionnaires and CO verification, a picture viewing task, in which participants' physiological reactivity to emotional images was collected, and a 30-minute counseling session as the intervention treatment for the participants in the intervention group. Participants in the control condition continued to smoke and did not receive any treatment during the course of the study. The pertinent procedures and results have previously been reported in detail (Lam et al., 2012; Robinson et al., 2011).

The intervention outcome was continuous CO-verified abstinence status. Specifically, smokers who were able to maintain continuous abstinence during the 2-week post-quit period were coded as abstainers (n=24). Those who had relapsed or never quit were defined as non-abstainers (n=55).

2.3. Self-Report Questionnaires

We measured the personality traits of HA, NS, and RD using the TPQ (Cloninger, 1987), nicotine dependence using the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991), and PA and NA using the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Depressive symptoms were captured using the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) and smoking withdrawal symptoms using the Wisconsin Smoking Withdrawal Scale (WSWS; Welsch et al., 1999).

2.4. Statistical Analyses

All statistical analyses were conducted using SAS software (v9.4; SAS Institute; Cary, NC, USA). Participants' baseline characteristics were evaluated with descriptive procedures. All inferential statistical models included age, sex, and race as covariates where applicable. The significance level was set as 0.05.

The relationships between baselines measures were assessed using Pearson product-moment correlations. We conducted mixed models analysis to identify the influence of the TPQ traits on post-quit affect and withdrawal among smokers in the intervention condition (7 of the 79 smokers randomized to the treatment condition who did not attend any post-quit sessions were excluded from these analyses). The dependent variables were affect (e.g., PANAS) and withdrawal (WSWS), and the independent variables included TPQ trait scores and time (i.e.,

laboratory session). We examined the main effects of TPQ traits on these variables while controlling for time. Then, to examine whether affect and withdrawal may change differently over time during cessation as a function of personality traits, we included the interaction of TPQ scores and session in the mixed models. In addition, to adjust for any effects that were related to smoking/abstinence during treatment, these models included session-specific CO as a covariate. However, no significant meaningful interactions were found, so this paper only reports the main effects of TPQ scores on affect and withdrawal-related variables.

We conducted logistic regression to identify the extent to which TPQ personality traits may be associated with intervention outcome. The reference group was the non-abstainers, and the probability modeled was the likelihood of being an abstainer.

3. Results

3.1. Baseline Characteristics of TPQ, Smoking and Affect-related Variables

Table 1 lists the correlations among the scores of TPQ subscales (HA, NS, and RD), baseline smoking-related variables (CPD and FTND), and baseline affect-related variables (CES-D, PA, and NA) for all the participants ($n=131$). HA was significantly positively correlated with CES-D and NA, and negatively correlated with PA. RD was not significantly correlated with any other scores, while NS was only significantly positively correlated with NA.

3.2. TPQ Scores and Post-Quit Affect and Withdrawal

We examined the main effects of TPQ personality traits on affect and withdrawal-related variables over the treatment course using mixed models analysis. As shown in Table 2, there were main effects of HA indicating that it was negatively associated with PANAS PA scores and positively associated with CES-D and with some subscales of WSWS, including concentration difficulty, hunger, sadness, and sleep disturbance. Main effects of NS indicated that it was negatively associated with PANAS PA scores and positively associated with PANAS NA scores and WSWS Anxiety and Concentration Difficulty scores. There were no significant main effects for RD.

3.3. TPQ and Intervention Outcome

The logistic regression model using TPQ scores to predict intervention outcome (i.e., abstinence vs. non-abstinence) was significant: $\chi^2 (df = 7) = 15.05, p < .05$, with age, sex, and ethnicity being covariates. Subsequent analyses revealed that only HA was significantly associated with abstinence status (HA: $\chi^2 = 4.47, p < .05$). The estimated odds ratios for HA, NS, and RD were 1.11 (95% CI: 1.007 – 1.216), .942 (95% CI: .830 – 1.068), and .907 (95% CI: .780 – 1.054), respectively. Given that the probability modeled was being an abstainer, the odds ratio of HA suggests that higher scores of HA were more likely to be associated with abstinence.

4. Discussion

This study examined the relationships between HA, NS, and RD personality traits and smoking-related characteristics (e.g., affect and withdrawal) and intervention outcome. HA and NS were positively associated with NA and withdrawal symptoms and negatively associated with PA both at the baseline and during the treatment course. In addition, we found a positive association between HA and the likelihood of being abstinent.

Smokers with higher HA reported greater levels of precessation NA and depressive symptoms and lower levels of precessation PA. According to Cloninger's theory (Cloninger, Svrakic, & Przybeck, 1993), HA represents the tendency to avoid aversive stimuli. Pertinent to this conception, Reinforcement Sensitivity Theory (Gray, 1994) has similarly described a behavioral tendency in response to aversive stimuli termed behavioral inhibition. As expected, previous research has shown that HA and behavioral inhibition sensitivity (BIS) scores were highly correlated (Carver & White, 1994; Franken & Muris, 2006). The present findings of positive HA-NA and negative HA-PA relationships among smokers are an extension of previous research on the general population to the smoker population. In addition, our findings are consistent with the results obtained from another of our smoking cessation studies. Among a different sample of smokers, we found that higher BIS scores were associated with higher NA scores and lower PA scores at the baseline before they quit smoking (Cui et al., 2015). These data collectively suggest that smokers who have the tendency to avoid aversive stimuli generally experience more NA and less PA.

Contrary to our hypothesis, we found no associations between PA and NS and a positive association between NA and NS in smokers. Although we do not know if differential populations (i.e., general population vs. smokers) may account for the discrepancy, our finding of positive NA-NS association among the smokers appeared to be in accordance with previous research in the smoking field. In a previous study, Downey and colleagues (1996) found that smokers with attention deficit hyperactivity disorder, a disease commonly associated with impulsivity and several aspects of NS, were more likely to report NA, such as irritability and anxiety. In a different study, Leventhal and colleagues (2007) found that NS was associated with NA increases induced by 12-h abstinence. These findings suggest that smokers who report higher NS are more sensitive to NA-related experiences in general and in response to smoking abstinence.

Similar to our baseline findings, both HA and NS were found to be positively associated with more NA and smoking withdrawal and negatively associated with PA during the cessation treatment process. It should be noted that neither time (i.e., laboratory session) nor abstinence status moderated the relationships between TPQ scores and affective and withdrawal-related scores in these smokers. This lack of modulation of time and smoking abstinence suggested that TPQ scores, as stable personality traits, played a particularly predominant role in smokers' experiences of affective and withdrawal symptoms. However, our finding seems to be inconsistent with the results found by Leventhal and colleagues (2007). They found that higher NS was associated with more NA and smoking withdrawal induced by 12-h abstinence, which may lead to the hypothesis that abstinent smokers with higher NS would experience increased withdrawal in our sample. However, we did not find

such relationships. One possible explanation for this discrepancy may be due to our smokers reporting higher NS scores ($M=16.3$, $SD=5.5$) compared to their participants ($M=10.8$, $SD=3.5$). The relatively higher NS scores may predispose smokers to experience more NA and withdrawal in general, overshadowing any abstinence-induced modulation. Another possible cause of the discrepant results is the different lengths of abstinence. In Leventhal et al.'s paper, the abstinence was approximately 12 h, shorter than the time points (e.g., 1-2 days post-quit) where withdrawal was assessed in the current study. Lack of post-quit 12 h abstinence assessment time point makes us unable to compare our results directly with Leventhal et al.'s paper, and our longer lengths of abstinence may have introduced greater variability in abstinence-induced NA and withdrawal over time.

The most clinically relevant finding of the present study is that smokers with higher HA scores were more likely to achieve cessation success. Although speculative, the positive relationship between HA and smoking cessation may be mediated by social phobia and/or its related constructs. Previous research has indicated that HA is associated with social phobia (Kim & Hoover, 1996), and the social concerns aspect of anxiety sensitivity (closely related to social phobia and the fear of negative social evaluation) is negatively associated with early smoking relapse (Zvolensky et al., 2007; Guillot, Zvolensky, & Leventhal, 2015). Therefore, it is perhaps that smokers high in HA tend to be more averse to and thus motivated to avoid negative social feedback with regard to failing to maintain early abstinence. This hypothesis could be tested in a future smoking cessation study by assessing both HA and social phobia/anxiety sensitivity.

However, this finding is inconsistent with our hypothesis, which was based on a previous report that found that lower neuroticism predicted successful smoking cessation treatment (Hooten et al., 2005). Although the abstinence assessment methods (e.g., self-report vs. CO-verified) may contribute to the discrepant findings, one limitation of the current study was the relatively small sample size, which calls for future studies with larger sample size. In addition, future studies should extend the time window we studied (i.e., up to 2 weeks post-quit) to examine the relationships between personality traits and long-term abstinence (e.g., 6 and 12 months). Besides evaluating the effects of personality on long-term abstinence, it is also worth examining the extent to which personality traits may interact with cessation treatments to influence affect, withdrawal and abstinence, to determine whether individuals with certain personality traits respond better to certain cessation treatments.

To conclude, we found that TPQ personality traits, particularly HA and NS, were associated with baseline and post-quit affective and withdrawal experiences. More importantly, high HA predicted smoking cessation success. Future cessation studies may consider tailoring smoking intervention services based on individual's personality traits.

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Highlights

1. Smokers higher on harm avoidance had less baseline positive and more negative affect.
2. Smokers higher on harm avoidance had more smoking withdrawal during the quit process.
3. Harm avoidance was positively associated with end-of-treatment abstinence.

Table 1

Descriptive statistics and Pearson product-moment correlations of TPQ subscale scores and smoking-related and affective variables at baseline.

Measure	M	SD	HA	NS	RD	CPD	FTND	CES-D	PA	NA
HA	10.5	6.7	-	-.01	.02	.05	.15	.49**	-.48**	.31**
NS	16.3	5.5		-	.08	.10	.01	.01	-.08	.18*
RD	13.2	3.9			-	-.08	-.02	.02	.11	-.06
CPD	20.9	8.6				-	.53**	-.01	-.08	-.03
FTND	4.7	2.1					-	.18*	-.13	.19*
CES-D	8.2	7.1						-	-.42**	.63**
PA	14.8	4.6							-	-.22*
NA	35.6	7.6								-

Note: TPQ, Tridimensional Personality Questionnaire; HA, TPQ Harm Avoidance subscale; NS, TPQ Novelty Seeking subscale; RD, TPQ Reward Dependence subscale; CPD, Cigarettes Per Day; FTND, Fagerström Test for Nicotine Dependence; CES-D, Center for Epidemiologic Studies Depression Scale; NA, Positive and Negative Affect Schedule (PANAS) Negative Affect subscale; PA, PANAS Positive Affect subscale; M, Mean; SD, Standard Deviation.

* $p < .05$

** $p < .001$

Table 2

Associations between TPQ scores and affective variables over the cessation course, shown as estimates (standard error) of fixed-effects.

Variable	HA		NS		RD	
	Estimate	F _(1,68)	Estimate	F _(1,68)	Estimate	F _(1,68)
CES-D	.42 (.09) **	20.18	.18 (.13)	2.02	-.17 (.17)	1.01
PANAS NA	.07 (.09)	.69	.28 (.12) *	5.37	-.10 (.16)	.41
PANAS PA	-.55 (.12) **	22.81	-.37 (.16) *	5.71	.13 (.20)	.43
QSU	-.08 (.23)	.12	.20 (.31)	.41	-.26 (.41)	.41
WSWS Subscales						
Anger	.02 (.04)	.41	.08 (.05)	2.58	-.05 (.06)	.66
Anxiety	-.02 (.04)	.18	.12 (.05) *	5.32	-.09 (.07)	1.84
Concentration	.06 (.03) *	4.48	.14 (.04) **	13.82	.02 (.05)	.18
Craving	-.04 (.04)	.87	.07 (.06)	1.48	-.06 (.07)	.55
Hunger	.12 (.05) *	5.11	.04 (.07)	.34	.06 (.09)	.39
Sad	.08 (.04) *	4.12	-.01 (.05)	.01	-.03 (.07)	.15
Sleep	.20 (.06) *	11.50	.02 (.08)	.06	.18 (.11)	2.74
Negative Affect	.17 (.12)	2.05	.30 (.16)	3.37	-.14 (.21)	.45

Note: HA, Harm Avoidance; NS, Novelty Seeking; RD, Reward Dependence; PANAS, Positive and Negative Affect Schedule; NA, Negative Affect; PA, Positive Affect; QSU, Questionnaire of Smoking Urges-Brief Form; WSWS, Wisconsin Smoking Withdrawal Scale

* $p < .05$

** $p < .001$. The standard errors of the estimates are given in the parentheses.