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Impulsivity moderates the relationship between previous quit failure and cue-induced craving

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HIGHLIGHTS

- The effects of trait impulsivity on past quit failures and cue-induced cigarette craving responses were examined.
- Exposure to smoking cues elicited significant craving reactions.
- Smokers who reported shorter past quit attempts exhibited significantly higher levels of cue-induced craving.
- This effect was particularly pronounced among smokers who reported high levels of trait impulsivity.

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ABSTRACT

Introduction: Poor inhibitory control has been shown to be an important predictor of relapse to a number of drugs, including nicotine. Indeed, smokers who exhibit higher levels of impulsivity are thought to have impaired regulation of urges to smoke, and previous research has suggested that impulsivity may moderate cue-induced cigarette cravings. To that end, we conducted a study to evaluate the interplay between failed smoking cessation, cue-induced craving, and impulsivity.
Methods: Current smokers (n = 151) rated their cigarette cravings before and after laboratory to exposure to smoking cues, and completed questionnaires assessing impulsivity and previous failed quit attempts.
Results: Findings indicated that shorter duration of previous failed quit attempts was related to higher cue-induced cigarette craving, especially among smokers with higher levels of impulsivity.
Conclusions: Results underscore the importance of considering trait impulsivity as a factor in better understanding the management of cue-induced cravings.

Cigarette smoking is the number one preventable cause of death in the U.S. and abroad (U.S. Department of Health & Human Services, Public Health Service, & Office of the Surgeon General, 2014; World Health Organization, 2015). One prominent explanation for difficulty in quitting smoking is the ubiquitous presence of smoking-related cues in the environment that trigger strong, difficult-to-resist, cravings to smoke (Tiffany, 1990). Considerable evidence has shown that cue-induced cravings can be reliably modeled under laboratory conditions (Carter & Tiffany, 1999). As just one example, Erblich and Bovbjerg (2004) found that exposure to both imaginal and in vivo smoking cues delivered to smokers under laboratory conditions elicited robust self-reported cravings to smoke.

Less well established, however, is the relationship between smoking cessation failure and these cue-induced cravings. Few studies actually examine relations between laboratory cue-induced craving and cessation outcomes, and those that do have yielded mixed results. For example, Waters and colleagues (Waters et al., 2004) found that cue-induced craving was predictive of poorer smoking cessation in a prospective study, but only among smokers randomized to receive nicotine patch treatment. Our group (Erblich & Bovbjerg, 2004) found in a retrospective study that shorter durations of previous failed quit attempts were related to elevated cravings in response to in vivo, but not imaginal, smoking cues in a sample of current smokers. Another study (Shadel et al., 1998) found no association between cue-induced cravings and cessation in a group of self-quitters. A recent study (Conklin et al., 2015) found that cue-induced cravings were related to decrease latency to smoke and increased smoking topography measures during an ad lib smoking opportunity immediately following a cue exposure. These seemingly disparate results raise the possibility that additional factors need to be considered when evaluating the relationship between cessation failure and cue-induced cravings.

Accumulating evidence has pointed to the importance of trait impulsivity in the genesis and maintenance of addictive behaviors. Impulsivity is a multifaceted phenomenon characterized by the overvaluation of

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immediate gratification, poor behavioral inhibition, and sensation-seeking (de Wit, 2008). The possibility that impulsivity is related to cue-induced craving has been investigated in a series of studies by Doran and colleagues, with mixed results (Doran, Spring, & McChargue, 2007, 2009; Doran, Cook, McChargue, & Spring, 2009; Doran, Cook, McChargue, Myers, & Spring, 2008). In addition, recent behavioral and neurobiological studies suggest that trait impulsivity may potentiate craving reactions to smoking cues (Bourque, Mendrek, Dinh-Williams, & Potvin, 2013; Papachristou, Nederkoorn, Corstjens, & Jansen, 2012). The possibility that impulsivity moderates the relationship between craving and cessation, however, has yet to be investigated. Indeed, it is tempting to speculate that the lack of inhibitory control characteristic of impulsive individuals would make environmental smoking cues and their attendant cravings particularly difficult to resist, resulting in increased risk of relapse. Recent theoretical conceptualizations of the impact of impulsivity on smoking and other drug use are consistent with this possibility. According to Mitchell (2004), trait impulsivity may operate at multiple levels, including potentiating sensitivity to rewarding stimuli, as well as creating difficulty resisting smoking and drug use behavior in the face of motivationally salient emotions, such as cravings. Similarly, Belin, Belin-Rauscent, Murray, and Everitt (2013) have recently argued, based on neurobiological evidence, that trait impulsivity is characterized by impaired executive control over maladaptive habits during motivational states, resulting in a maladaptive stimulus–response pattern.

Based on these theoretical and empirical considerations, we aimed to evaluate the role of impulsivity on failed cessation attempts and cue-induced craving in a cross-sectional study. Specifically, we hypothesized that 1) higher levels of trait impulsivity will be related to elevated cue-induced cravings, 2) shorter durations of previous failed quit attempts will be related to higher cue-induced cravings, and, 3) relations between previous unsuccessful quit attempts and cue induced craving would be particularly strong among smokers with higher levels of trait impulsivity. Given recent findings linking impulsivity to tonic levels of cigarette craving (Mathew, Burris, Froeliger, Saladin, & Carpenter, 2015), as well as conceptualizations of the role of impulsivity in addiction (Mitchell, 2004), we also explored the possibility that impulsivity would predict increased baseline levels of craving in our sample.

1. Method

1.1. Participants

Adult smokers (n = 151) were recruited to a study of smoking behavior by advertisements (for a smoking study) placed in and around an urban medical center in New York City. All participants qualified for a current DSM-IV (American Psychiatric Association, 1994) diagnosis of nicotine dependence by endorsing a minimum of 3 of 7 criteria during a structured interview at screening. Qualifying smokers for this study were required to smoke at least 10 cigarettes per day for at least 5 years. To reduce sources of heterogeneity in smoking behavior associated with sample characteristics, participants were excluded if they reported: 1) current treatment for smoking cessation, 2) a history of other substance abuse, or 3) a history of hospitalization for mental illness.

1.2. Measures

1.2.1. Demographic and smoking questionnaire

Participants completed questionnaires assessing basic demographic information (e.g., age, gender, education, income, race/ethnicity [freeform self-report], marital status) and personal smoking history (e.g., age at initiation, cigarettes per day, years smoked). In addition, participants completed a face-valid item assessing the duration of their most recent quit attempt (# of days remained abstinent).

1.2.2. Fagerstrom test of nicotine dependence (FTND)

The FTND is a six-item instrument that measures the strength of participants' dependence. The instrument has documented reliability and validity (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) and has been used extensively in the literature. Cronbach's alpha in the current sample was 0.48, somewhat lower than the alpha of 0.64 reported in an initial psychometric investigation (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

1.2.3. Impulsivity

The Impulsive Sensation Seeking Scale (ISS) of the Zuckerman–Kuhlman Personality Questionnaire is a validated, frequently used self-report measure of impulsivity. The scale has 19 items and evidences excellent psychometric properties (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). Cronbach's alpha in the current sample was 0.80, indicating good internal consistency.

1.2.4. Cigarette craving questionnaire

Improving on the use of single-item craving assessments, and following the recommendations of Kozlowski and colleagues (Kozlowski, Mann, Wilkinson, & Poulos, 1989; Kozlowski & Wilkinson, 1987) that craving be assessed using multiple descriptors (e.g., crave, urge, desire), this brief, 5-item, 0–100 instrument is designed specifically to make rapid assessments of craving during experimental manipulations. The instrument has been used as an outcome measure in previous reports by us (Erblich, Boyarsky, Spring, Niaura, & Bovbjerg, 2003) and others (Hutchison, LaChance, Niaura, Bryan, & Smolen, 2002). The instrument was administered immediately prior to and following each stimulus, so that a change score could be calculated as a measure of cue-induced craving. The instrument evidenced high levels of internal consistency (Cronbach's alpha = 0.96–0.97) at all administrations.

1.3. Procedures

Potential participants who responded to advertisements were screened via telephone to determine eligibility. The study was described over the phone, and if eligible, participants were scheduled for a study session. Ninety percent of eligible respondents were enrolled in the study.

During the study session, participants completed questionnaires and were exposed to neutral and smoking cues. Consistent with methods in previous studies (e.g., Doran et al., 2007; Erblich & Bovbjerg, 2004; Erblich et al., 2003), participants smoked one cigarette immediately before beginning the study procedures. This method was employed because pilot studies in our lab had revealed that deprived smokers consistently reported very high levels of prestimulus craving, effectively preventing the detection of cue-induced craving effects (unpublished data). For the smoking cue, participants were presented with their cigarette box, asked to remove one cigarette, and hold it for 90 s. For the neutral cue, they were presented with a stapler and asked to hold it for the same amount of time. Cigarette cravings were measured immediately before and after each cue exposure. To avoid possible carryover effects (Heishman, Lee, Taylor, & Singleton, 2010; Sayette, Griffin, & Sayers, 2010), participants were exposed to the neutral cue first, followed by the smoking cue. In addition, participants viewed a nature video for 3 min between the two presentations. This nature video (Coral Sea Dreaming, DVD International) has been shown to help return participants undergoing experimental laboratory challenges to a resting state (Piferi, Kline, Younger, & Lawler, 2000). Upon completion of the study, participants were thanked for their participation, offered referrals for smoking cessation interventions, and paid an honorarium of $50 for their time.