



Associations between nicotine dependence, anhedonia, urgency and smoking motives



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HIGHLIGHTS

- Mediated and moderated relationships between urgency, anhedonia, smoking motives, and nicotine dependence were explored.
- Tolerance, craving, cue exposure and positive reinforcement mediated the relationship between urgency and dependence.
- Anhedonia moderated the relationship between urgency and dependence.
- Targeted variables, along with age, student status, and gender, accounted for 65% of the variance in nicotine dependence.

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ABSTRACT

Models of nicotine dependence have suggested that the association between urgency, a subconstruct of impulsivity, and smoking behaviors may be mediated by motivations. Motives that are driven by expectations that smoking will relieve negative affect or increase positive affect may be especially salient in persons who have depression symptoms such as anhedonia. Support for associations between symptoms of depression, urgency, and addiction has been found for alcohol dependence, but empirical analysis is lacking for an interactive effect of urgency and depression symptoms on nicotine dependence. The current study investigated relationships among the urgency facet of impulsivity, anhedonia, smoking motives, and nicotine dependence with secondary analyses of a sample of 1084 daily smokers using simultaneous moderation and multiple mediation analyses. The moderation analysis revealed that although urgency was significantly associated with smoking at average or higher levels of anhedonia, it was unrelated to smoking when few anhedonia symptoms were endorsed. Further, multiple mediation analyses revealed that the smoking motives of craving, cue exposure, positive reinforcement, and tolerance significantly mediated the relationship between urgency and nicotine dependence. Results suggest that models of alcohol addiction that include an interactive effect of urgency and certain symptoms of depression may be applied to nicotine dependence. Examination of the multiple mediational pathways between urgency and nicotine dependence suggests directions for intervention efforts.

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1. Associations between nicotine dependence, anhedonia, urgency and smoking motives

Impulsivity has been linked to severity of nicotine dependence (Pang et al., 2014), to higher levels of craving after a period of nicotine abstinence (VanderVeen, Cohen, Cukrowicz, & Trotter, 2008), smoking to relieve negative affect (Doran et al., 2006), and to faster smoking relapse following a cessation attempt (Doran, Spring, McChargue, Pergadia, & Richmond, 2004). Conceptualized as a multidimensional

personality construct, impulsivity remains somewhat stable from childhood to adulthood (Caspi & Silva, 1995). The defining feature of impulsivity is acting on impulse without first thinking through the consequences of behaviors or decisions. Greater impulsivity has been associated with problem behaviors in childhood, risky decision making during adolescence, and addictive behaviors during adolescence and adulthood (de Wit, 2008).

Whiteside, Lynam, Miller, and Reynolds (2005) used factor analysis to identify four specific dimensions of impulsivity in a young adult sample: urgency, sensation seeking, lack of perseverance, and lack of premeditation. Urgency reflects the tendency to respond rashly and without thought to cravings and temptations especially in the context

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of negative emotions including anger and distress (Whiteside et al., 2005). Of the four dimensions of impulsivity identified, urgency has appeared to be especially predictive of nicotine dependence: Higher levels of urgency have been found to be predictive of higher levels of cravings (Billieux, Van der Linden, & Ceschi, 2007), of increased risk of being a daily smoker (Lee, Peters, Adams, Milich, & Lynam, 2015), and of nicotine dependence severity (Pang et al., 2014).

Although individuals higher in urgency are more likely to develop nicotine dependence, additional predictors include motivations acquired through experience (Doran, McChargue, & Cohen, 2007; Pang et al., 2014; VanderVeen et al., 2008; Vinci, McVay, Copeland, & Carrigan, 2011). Associations between urgency, emotions, and motivations have been established within the alcohol dependency literature. For example, drinking to cope and negative urgency were both found to mediate the relationship between depression and alcohol problems (Gonzalez, Reynolds, & Skewes, 2011). An interactive relationship such as this has not been confirmed for nicotine dependence. The current study employed simultaneous moderation and multiple mediation analyses to investigate relationships among urgency, anhedonia, smoking motives, and nicotine dependence. We expected that anhedonia would moderate the relationship between urgency and nicotine dependence, with this relationship mediated through smoking motives.

1.1. Moderational links between urgency and nicotine dependence

Within the alcohol dependence literature, relationships have been found between depression symptoms and urgency. For instance, Gonzalez et al. (2011) found urgency to partially mediate the relationship between depression and alcohol problems. The authors surmised that negative affect associated with depression impaired short-term decision making processes, leading to problematic drinking associated with affective relief. A similar study investigating the association between depression, impulsivity, and alcohol problems found that sensation seeking, lack of premeditation, and lack of perseverance had an interaction effect in which they enhanced risk for alcohol problems only at specific levels of these impulsivity variables. Only negative urgency had an overall main effect in predicting the level of alcohol problems (King, Karyadi, Luk, & Patock-Peckham, 2011). Despite research that supports complex relationships between depression symptoms and urgency in alcohol dependence, there has been little application of this model to nicotine dependence.

Smoking may be used by individuals with depression to both relieve negative emotions and to enhance positive emotions. For instance, individuals with a history of depression showed more mood enhancement when smoking a cigarette after a positive mood induction than individuals without a history of depression (Spring et al., 2008). Two types of depression symptoms have been found to predict nicotine use in young adults: negative affect and anhedonia (Audrain-McGovern, Rodriguez, Rodgers, & Cuevas, 2010; Schleicher, Harris, Catley, & Nazir, 2009). Anhedonia in depression is defined as decreased interest or pleasure in activities that were formerly enjoyable (American Psychiatric Association, 2013). Both anhedonia and depressed mood impact smoking motivation (Leventhal, Piper, Japuntich, Baker, & Cook, 2014). However, anhedonia appears to be specifically linked to smoking motivation aimed at increasing enjoyment of activities and enhancing positive affect (Audrain-McGovern et al., 2010; Cook, Spring, & McChargue, 2007). In a study comparing the predictive power of anhedonia and depressed mood on smoking cessation outcomes, anhedonia was found to predict smoking cessation failure when controlling for depressed mood, while the reverse was not found to be true (Leventhal et al., 2014). Anhedonia is also more exclusive to depression than other symptoms such as negative affect, which have a high degree of overlap with anxiety disorders (Watson et al., 1995). It is also more related to smoking motivation due to urgency to increase positive affect and decrease negative affect (Leventhal, Waters, Kahler, Ray, & Sussman, 2009).

The current study focused on investigating the moderating role of anhedonia. Limiting our focus to the absence of positive emotions, as opposed to a more inclusive perspective on both anhedonia and negative affectivity, provided a more clear differentiation between the conceptualization of urgency and depressive symptomology. We expected to find that anhedonia amplified the associations between urgency and nicotine dependence.

Individuals differ in what motivates them to initiate nicotine use and to continue its use. Piper et al. (2004) identified 13 distinct, but overlapping, smoking dependence motives based on addiction theory and validated through confirmatory factor analysis. These motives reflect alternative ways people choose to respond to internal states and to the external environment. Motives related to smoking initiation may also differ from those associated with long-term dependence. Three motives (i.e., social goals, cue exposure, and taste) were classified as early-emergent smoking motives and were associated with lighter nicotine use (Piper et al., 2004). Individuals whose smoking is contingent on the smoking of others or specific situations may be motivated by *social goals* while those who appreciate the taste or feel of cigarettes may be motivated by *taste*. *Cue exposure* reflects an associative process during which nonsocial smoking cues come to elicit the desire to smoke. Cue-exposure has been associated with higher levels of craving due to negative affect in individuals higher in urgency (Doran, Cook, McChargue, & Spring, 2009).

Other motives (i.e., craving, automaticity, choice, cognitive enhancement, attachment, and tolerance) were classified as late-emergent due to an exponential negative linear increase with heaviness of nicotine use (Piper et al., 2004). For instance, an emotional *attachment* to smoking and cigarettes takes time to develop as does smoking without awareness or intentions, characteristic of *automaticity*. Further, choosing to smoke despite awareness of negative consequences (i.e., behavioral *choice*), frequent *cravings* for nicotine, and the need for increasing amounts of nicotine to achieve the desired effects (i.e., *tolerance*) were also associated with long-term heavy use of nicotine. Smoking to improve attention or focus (i.e., *cognitive enhancement*) followed this late-emergent pattern (Piper et al., 2004).

A third group of motives, including loss of control, negative reinforcement, and positive reinforcement, were similar to late emergent motives in regards to heaviness of use, but lacked a significant linear coefficient (Piper et al., 2004). Individuals motivated by *negative reinforcement* may use nicotine to cope with negative emotions while those motivated by *positive reinforcement* use nicotine to enhance positive emotions or to achieve a 'high'. Others may feel that they have lost *control* over their behavior and are unable to regulate their nicotine intake. Impulsivity has been associated with higher positive and negative reinforcement motives, especially in younger smokers; however these same motivations may also result in continued use due to increased problems with cessation (Doran et al., 2007). In a mediation analysis by Pang et al. (2014), both positive and negative urgency were found to be predictive of severity of nicotine dependence; however, both types of urgency were completely mediated by positive and negative reinforcement motives. Therefore, individuals with high levels of urgency were more motivated to smoke due to greater expectancies that smoking would create affect modulation.

1.2. Current study

The current study explored relationships between nicotine dependence, anhedonia, smoking motives, and urgency based on secondary analyses of data from a study that investigated the potential to reduce smoking through the use of behavioral economics (MacKillop et al., 2012). We chose to focus on urgency due to previous findings that urgency was associated with increased cravings (Billieux et al., 2007) and higher levels of nicotine dependence (Pang et al., 2014; Spillane, Smith, & Kahler, 2010). Consistent with the findings of Pang et al. (2014) we expected that smoking motives would mediate the relationship between

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