Exploring a First-Order Factor Structure within a Measure of Smoking Motives: Examining Evidence for an Affect Regulation Smoking Motive Factor

by

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Abstract

Smoking is a leading cause of death, yet a large number of people continue to smoke. While nicotine dependence is accepted as a motivator, other factors play a role too. The purpose of this study was to explore smoking motivation to determine if distinct smoking motives condense into a smaller number of higher-order factors, with one possibly related to affect regulation (e.g. Neuroticism). The sample consisted of 200 adults (age: *M*=33.26, *SD*=10.41) including Caucasian (n = 163), African American (n = 14), Asian (n = 17), and Latino (n = 4). Males made up 61% of the sample; 39% were female. Participants completed self-report measures tapping nicotine dependence, smoking motives, personality factors, Neuroticism facets, and stress. As expected, two factors were extracted in the exploratory factor analysis; one related to affect regulation. Both factors were associated with nicotine dependence. Counter to expectations, Neuroticism was unrelated to the affect regulation factor. Exploratory analyses suggested this may be due to the high level of dependent smokers in our sample. Dependence level may play a role in the relationship between smoking motives and personality and it may be that in smokers with higher levels of dependence, physiological nicotine dependence masks individual differences such as personality traits and non-physical motivations. The limitations of the study are discussed, as are implications for future research in this area.

Keywords: smoking, motivation, dependence, WISDM, personality, affect regulation

Chapter I

Introduction

Smoking is a common behavior leading to considerable health concerns worldwide. Smoking is a preventable risk factor for diseases, disability, and more (The World Health Organization, 2002). Currently, smoking is the sixth leading cause of death. While dangerous, smoking is relatively common (Center for Disease Control and Prevention [CDC], 2011). The World Health Organization (2013) reported that 6 million people worldwide die from smoking each year. Approximately 45.3 million Americans smoke (CDC, 2011) and it has been estimated that over a billion people in the world currently smoke (e.g., Golestan, Hamsan & Abdullah, 2015; Zvolensky, Taha, Bono, & Goodwin, 2015). The fact that, on the one hand, the dangers of smoking seem to be fairly well detailed and, on the other hand, a large number of individuals continue to smoke speaks to the strength of smokers motivation to continue smoking. The widespread use of tobacco products, likely involves an interaction between physical, behavioral, and psychological factors. There is considerable interest in understanding why people start smoking, and continue rather than stop. In short, there is considerable interest in understanding the motivation to smoke.

Several studies examine factors that contribute to the maintenance of smoking behaviors. Much of this work has focused on identifying the physiological mechanisms

that contribute to physical dependence and withdrawal symptoms (Straub, 2012; Schachter, 1977).

Other researchers have extended their focus beyond the physical mechanisms and considered the subjective experience of dependence (Piper et al., 2004; Smith et al., 2010; Rosa et al., 2014). For example, withdrawal symptoms may cause one smoker to feel sluggish while leading another to feel keyed up. Thus, the experience of dependence can vary across individuals giving rise to a range of subjectively experienced motivations for smoking and vulnerability to cultural, environmental, and social cues (Piper et al., 2004; Smith et al., 2010; Rosa et al., 2014). Finally, a number of researchers have looked at individual difference characteristics which may contribute to smoking behavior. The majority of these focused on the roles of affect regulation and self-regulation variables in maintaining smoking behaviors (Lujic, Reuter, & Netter, 2005; Brown, Carpenter, & Sutfin, 2011; Darlow & Lobel, 2012; Berlin, Singleton, Pedarriosse, Lancrenon, Rames, Aubin, & Niaura, 2003; Stromberg, Nichter, & Nichter, 2007).

The focus of the present study is fourfold. First, we examine if a widely used measure of smoking motivation, the Wisconsin Inventory of Smoking Dependence Motives (WISDM; Piper, Piasecki, Federman, Bolt, Smith, Fiore, & Baker, 2004) which contains numerous smoking motivation scales will condenses down to a smaller number of factors. In short, we expect that though smoking motivation can be conceptualized subjectively in terms of many motivation, ultimately the motivation to smoke will come from a smaller number of sources. Second, we expect that these factors will be related to measures of physical nicotine dependence (e.g. Fagerström Test for Nicotine

Dependence -Revised [FTND-R]; Korte, Capron, Zvolensky, & Schmidt, 2013). Third, we expect at least one of these factors to be linked to personality traits involving affect regulation (e.g. Neuroticism factor and facets) and or self-regulation (e.g., Conscientiousness). Finally, we expect to find that relationships between nicotine dependence and affect regulation variables and self-control variables will be at least partially explained by subjective motives for smoking.

Smoking

Smoking is a common method of substance use behavior that leads to considerable health concerns worldwide. It is a preventable risk factor for diseases and disability (The World Health Organization, 2002) and is currently the sixth leading cause of death. While dangerous, smoking is relatively common (Center for Disease Control and Prevention [CDC], 2011); the World Health Organization (2013) reported that 6 million people worldwide die from smoking each year. Approximately 45.3 million Americans smoke (CDC, 2011) and it has been estimated that over a billion people in the world currently smoke (e.g., Golestan, Hamsan & Abdullah, 2015; Zvolensky, Taha, Bono, & Goodwin, 2015). The fact that, on the one hand, the dangers of smoking seem to be fairly well detailed and, on the other hand, a large number of individuals continue to smoke, speaks to the strength of smokers motivation to continue smoking. The widespread use of tobacco products likely involves an interaction between physical, behavioral, and psychological factors. There is considerable interest in understanding why people start smoking, and continue rather than stop. In short, there is considerable interest in understanding the motivation to smoke.

A wide range of studies examine factors that contribute to the maintenance of smoking behaviors. Much of this work has focused on identifying the physiological mechanisms that contribute to physical dependence and withdrawal symptoms (Straub, 2012; Schachter, 1977). Other researchers have extended their focus beyond the physical mechanisms and considered the subjective experience of dependence (Piper et al., 2004; Smith et al., 2010; Rosa et al., 2014). For example, withdrawal symptoms may cause one smoker to feel sluggish while leading another to feel keyed up. Thus, the experience of dependence can vary across individuals giving rise to a range of subjectively experienced motivations for smoking and vulnerability to cultural, environmental, and social cues (Piper et al., 2004; Smith et al., 2010; Rosa et al., 2014). Finally, a number of researchers have looked at individual difference characteristics which may contribute to smoking behavior. The majority of these focused on the roles of affect regulation and self-regulation variables in maintaining smoking behaviors (Lujic, Reuter, & Netter, 2005; Brown, Carpenter, & Sutfin, 2011; Darlow & Lobel, 2012; Berlin, Singleton, Pedarriosse, Lancrenon, Rames, Aubin, & Niaura, 2003; Stromberg, Nichter, & Nichter, 2007).

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Nicotine Dependence and Smoking Motivation.

Several themes appear repeatedly in the smoking literature; the most notable being the addictive power of nicotine and cigarettes. The main focus of research has, for a long time, been on identifying physiological mechanisms that contribute to physical dependence, and it is widely accepted that nicotine plays a role in the draw of tobacco products (Straub, 2012; Schachter, 1977). Nicotine also serves to facilitate use in those who continue smoking. Nicotine is a stimulant that arouses the sympathetic nervous system (SNS); catecholamines, serotonin, corticosteroids, and cortisol are released by these chemicals causing the SNS to relax skeletal muscles and activate dopaminergic pathways. The latter is known to produce reward sensations, which are subjectively experienced as a form of visceral pleasure. Dopaminergic activity has also been linked to nicotine cravings. When levels become low, the individual craves nicotine which will boost dopaminergic levels in the bloodstream.

The physiological changes that occur from nicotine use and result in maintenance of smoking are often referred to as the nicotine-titration model (Straub, 2012; Schachter, 1977). The nicotine-titration model explains smoking as the result of physical

dependence, whereby smokers adjusts smoking behaviors to maintain a steady level of nicotine in their bodies.

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Finally, a number of researchers have looked at individual difference characteristics which may contribute to smoking behavior. The majority of these focused on the roles of affect regulation (Lujic, Reuter, & Netter, 2005; Brown, Carpenter, & Sutfin, 2011; Darlow & Lobel, 2012; Berlin, Singleton, Pedarriosse, Lancrenon, Rames, Aubin, & Niaura, 2003; Stromberg, Nichter, & Nichter, 2007). The affect management model suggests that smoking behaviors may become habitual via operant conditioning mechanisms (Straub, 2012) This model is not in conflict with dependence-based models, such as the nicotine-titration model; rather, it seeks to extend the manner in which dependence motives can be activated and are subjectively experienced. This approach assumes that smoking helps some individuals regulate their internal emotional states. By increasing stimulation and promoting feelings of relaxation smoking brings on positive emotional states. The onset of pleasurable emotional states may serve to positively reinforce smoking behaviors. Similarly, when individuals smoke in response to stress, negative events, or boredom, the physiological changes brought on by smoking may decrease the experience of negative emotions, such as anxiety, guilt, and fear (Straub, 2012). Thus, the decrease in negative emotion brought on by smoking behavior

may serve to negatively reinforce smoking. Indeed, McEwen, West, and McRobbie (2008) reported that pleasure, stress relief, and boredom relief are the main reasons people claim to smoke. Several studies reported emotional regulation as a smoking motivation in college students (Brown, Carpenter, & Sutfin, 2011; Darlow & Lobel, 2012; Levinson, Campo, Gascoigne, Jolly, Zakharyan, & Tran, 2007). Further, smoking has been found to be a means of controlling feelings associated with depression and anger (Berlin, Singleton, Pedarriosse, Lancrenon, Rames, Aubin, & Niaura, 2003; Stromberg, Nichter, & Nichter, 2007). Consequently, a profile of high Neuroticism has been linked to smoking (Terracciano & Costa, 2004; Munafo, Zetteler, & Clark, 2007; Hamsan, & Abdullah, 2015; Goodwin & Hamilton, 2002), in large part due to the emotional dysregulation associated with neurotic traits.

The experience of physiological dependence and subjectively experienced affect regulation is perhaps most observable in how individuals manage nicotine withdrawal symptoms. Withdrawal from smoking is known to bring about negative emotional states (Zvolensky et al., 2015). Avoiding withdrawal symptoms, such as cravings, anxiety, and negative affect, is simultaneously an attempt to regulate one's subjective affective experience; this too maintains smoking behaviors (Lujic et al., 2005). Similarly, smoking can be used as a form of self-medicating for mood or anxiety, often as a form of affect control in which smoking helps cope with negative affect (Lujic et al., 2005; Zvolensky et al., 2015). In this case, smoking may be a means to regulate negative emotions triggered by external (e.g., stress) or internal (e.g., depression) cues. Even if smoking is initially motivated by the need to regulate internal emotional experiences or responses to external stressors, over time the continued smoking lends itself to nicotine dependence,

with withdrawal symptoms that serve as internal cues and sensitivity to cigarette-related stimuli which may serve as external cues (e.g., seeing others smoke triggers cravings).

Both the nicotine-titration and affect regulation models for smoking described above assume that individuals are motivated to continue smoking even in the face of evidence that such behavior will ultimately prove problematic for them. It is possible that while physical, psychological, and behavioral factors interact to produce smoking behavior, the subjective experience of the motivation to smoke may vary across smokers. Said differently, there are likely individual differences in terms of the specific subjectively experienced motives that lead each person to smoke. Studying motivations to smoke is important to understanding why people smoke. Understanding why a given individual smokes may have implication for guiding interventions to aid in cessation. This position has spawned considerable research that includes two key factors: 1) nicotine dependence and 2) broader motivations for smoking.

Understanding and Quantifying Nicotine Dependence and Smoking Motivation. Historically, the measurement of the motivation to smoke has focused heavily on assessing nicotine dependence (Smith, Piper, Bolt, Fiore, Wetter, Cincirpini, and Baker, 2010). Two approaches to smoking dependence are medico-psychiatric diagnostic understanding (e.g. American Psychiatric Association, 2000) and physical-dependence models (e.g. Fagerström, 1978). The medico-psychiatric approach is dichotomous in nature, viewing individuals as either dependent or not (e.g. DSM-5; American Psychiatric Association, 2013). Typically, criteria for dependence are established as indicating dependence. An individual is said to be dependent if a certain

number of criteria are met. For example, the DSM-5 lays out the following criteria: A) larger quantities of tobacco are used over a longer period than intended, B) tolerance for nicotine, and C) withdrawal symptoms upon cessation. A person who meets two of the 11 sub-items of those criteria is considered to have Tobacco Use Disorder. This approach tends to be more frequently employed to identify heavy smokers in a population. This approach fails to elaborate on why they are dependent and does not provide distinctions beyond "mild", "moderate", or "severe" specifiers.

The physical-dependence approach, which is largely based on the medico-psychiatric approach, considers dependence as a continuum along which individuals who smoke fall. A person who smokes can be said to show a low, mild, moderate, and high degree of dependence. Self-report measures in this approach tend to simply convert the medical criteria for establishing dependence into self-report items that participants can endorse or reject. Items are then counted or summed, with those endorsing more items expected to possess higher levels of physical dependence. Thus, while this approach differs from the strict medico-psychiatric approach in terms of viewing dependence as a dimensional construct, it makes use of the medico-psychiatric approach to determine indicators of dependence. The most widely used measures of nicotine dependence are the Fagerström Test for Nicotine Dependence (FTND: Heatherton, Kozlowski, Frecker, & Fagerström, 1991) and the Fagerström Test for Nicotine Dependence -Revised (FTND-R: Korte, et al., 2013). Both of these measures are revised versions of the Fagerström Tolerance Questionnaire (FTQ; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

The FTND and FTND-R have been the most commonly used tool for assessing Nicotine Dependence. The tests include items that are related to physical dependence. Like most measures of physical dependence, the FTQ, FTND, and FTND-R assesses indicators of nicotine dependence. Each of the measures includes items that focus on withdrawal symptoms, frequency of use, and use in the face of harm. For example, the most widely used current version, the FTND-R inquires about difficulty resisting cravings (e.g., Do you find it difficult refrain from smoking in places where it is forbidden [e.g., Church, Library, etc.]), ability to discontinue when there is danger (e.g., Do you smoke even if you are sick in bed most of the day?), and frequency (How many cigarettes a day do you smoke?). In short, these measures focus less on the factors that lead an individual to smoke and place greater emphasis on measuring indicators that an individual is dependent on cigarettes (e.g., How soon after waking do you smoke your first cigarette).

Studies have generally found these measures to have adequate psychometric properties (e.g., Heatherton, Kozlowski, Frecker, & Fagerström, 1991), though it is fairly clear that the changes to the item scoring that were included in the FTND-R have resulted in a more reliable and internally consistent measure of nicotine dependence (Korte, Capron, Zvolensky, & Schmidt, 2014). Dependence scores with this measure have been linked to a number of smoking related constructs. For example, dependence, as measured by the FTND, has been linked to mood in male college students (N = 137: McChargue, Cohen, & Cook, 2002), urgency and impulsivity (N = 131: Spillane, Combs, Kahler, & Smith), and denial of risk of smoking during pregnancy (N=406: Tombor, Urban, Berkes, & Demetrovics, 2010).

While nicotine dependence is typically considered a dimensional construct, research also indicates that there are levels of dependence. Both the FTND and FTND-R can be used to categorize smokers in terms of level of dependence. For example, the FTND-R separates smokers into low dependence (FTND-R $\leq$ 2), mild dependence (FTND-R of 3-4), moderate dependence (FTND-R of 5-7) and high dependence (FTND-R > 8; Rios-Betonia, Snedecor, Pomerleau, & Pomerleau, 2008). It has also been proposed that a score of 4 of lower can be considered low-to-mild dependence while 5 or higher can be considered moderate-to-high dependence (Moolchan, Radzius, Epstein, Uhl, Gorelick, Cadet, & Henningfield, 2002). XXX

Some Criticisms of Medico-Psychiatric Approaches to Nicotine Dependence. While research with nicotine dependence measures has vastly advanced the field, this approach is not without criticism. For example, some have criticized nicotine dependence measures, such as the Fagerström tests, on psychometric grounds, noting limited internal consistency (coefficient alpha < .61: Piper, Piasecki, Federman, Bolt, Smith, Fiore, & Baker, 2004), though this seems to have been largely resolved in the most recent revision of the measure, the FTND-R (Korte, Capron, Zvolensky, & Schmidt, 2014). The dependence model and its measures, including the FTND and FTND-R specifically, have also been criticized for inconsistency in predicting outcomes (Piper, McCarthy, Bolt, Smith, Lerman, Benowitz et al., 2006). Again, however, evidence supporting these claims is mixed. Finally, some critics have criticized the Medico-Psychiatric approach in terms of its theoretical underpinnings; arguing that measures such as the FTND and FTND-R are overly reliant on the physical aspect of dependence and

give insufficient attention to other factors that can contribute to nicotine dependence. Of the three criticisms, this third has garnered the largest amount of attention.

The medico-psychiatric approach to nicotine dependence emphasizes and measures indicators of nicotine dependence, but tends to neglect other factors, such as non-physical motives, smoking expectancies, and attitudes about smoking (Piper et al., 2004). While nicotine dependence can explain the persistence of why individuals continue to smoke despite health risks, understanding more specific motivations for smoking may be helpful for identifying individual differences among smokers that may be useful for treatment (Piper et al., 2004). This also requires an understanding of how smoking dependence is typically defined. Said differently, the medico-psychiatric approach tends to define dependence in terms of stable products of dependent behavior (e.g., the need to smoke upon waking). Thus, the model conceptualizes smoking behavior as the end product of dependence. Others (E.g,. Piper et al., 2004) argue that there may be a number of reasons individuals smoke, and all of them may contribute to dependence. Such models typically accept the notion that physical dependence is a cause of smoking behavior, while also suggesting that other factors (e.g., environmental cues; social and cultural expectations; attitudes about smoking) also play a role. A number of measures for assessing constructs related to dependence have been developed. Examples include the Positive Beliefs About Smoking Measure (Hale, Perrotte, Baumann & Garza, 2015) and the Social Smoking Situations Scale (Racicot & McGrath, 2015). None of these measures, however, are as widely used as the FTND and FTND-R. In most cases such measures were developed to meet the specific requirements of individual studies.

Further, most are variations on smoking history questions. Some encompass broader concepts as well.

While there are multiple models in literature, they share key features; they accept physical dependence in playing a role in driving smoking behaviors, assert that dependence is driven by multiple internal and external factors, suggest that individual differences in the subjective experience of dependence lead to difference conscious motivations (e.g. Piper et al., 2004), and posit that cognitive (e.g. beliefs), cultural (e.g., norms), behavioral, and situational factors may also contribute to dependence and/or serve to enhance physical dependence.

Measuring Dependence through Multifaceted Motives: The Wisconsin Inventory of Smoking Dependence Motives.

In an attempt to measure the dimensional nature of smoking, Piper et al. (2004) developed a model based on a theoretical approach that assumes that multiple, semi-independent factors underlie dependence. The Wisconsin Inventory of Smoking Dependence Motives (WISDM) model views dependence as the interconnection of internal states, external contexts, and internal disposition to respond to situations and states with substance use (i.e., smoking behaviors). The model proposes that there are numerous, discrete, and subjectively-experienced motivations that give rise to smoking behavior. The wider the number of motives one has and the more intensely one experiences these motives is an indicator of dependence in this model.

Based on this approach, the Wisconsin Inventory of Smoking Dependence Motives-68 (WISDM-68; Piper et al., 2004) measure was constructed. The WISDM-68 takes a multifactorial, dimensional approach to assessing smoking motivation. This approach assumes that there are multiple, independent factors that may underlie dependence. It also assumes that physical dependence can be subjectively experienced in different ways (e.g., craving for stimulation vs. craving for relaxation) and it considered non-physical factors and triggers. Piper et al. (2004) explain that internal states and external contexts do not define dependence. Rather, dependence involves the interconnection of internal states, external contexts, and internal disposition to respond to situations and states with substance use. Thus, the theory underlying the WISDM-68 is that there are multiple independent motives that underlie smoking behavior. These may include internal states, habitual behaviors, external incentives, contextual cues, physiological dependence, and social motivations. The multifaceted nature of motivation for use has been demonstrated for other types of substances (Piper et al., 2004). In the development of the WISDM-68, smoking dependence was assessed in terms of the strength of drug seeking following motivational pushes. The goal was to develop a broad measure of smoking dependence that would allow inferences to be made about dependence, especially compulsive use, withdrawal, and relapse, the three main aspects of dependence, on the basis of subjectively experienced motives. This was accomplished by reviewing literature and interviewing experts in the field in order to develop 13 motive scales (Piper et al., 2004).

The WISDM-68 contains more subscales tapping smoking motivation than any other measure. It measures 13 smoking motives (Affiliative Attachment, Automaticity,

Loss of Control, Behavioral Choice/Melioration, Cognitive Enhancement, Craving, Cue Exposure/Associative Processes, Negative Reinforcement, Positive Reinforcement, Social/Environmental Goads, Taste, Tolerance, and Weight Control) with 68 items encompassing a wide range of theoretically derived smoking motives. We briefly review each of these below.

The Affiliative Attachment subscale of the WISDM is based on the idea that emotional attachment to a substance may arise from the impact the substance has on the social affection systems (Panksepp et al., 1978; Panksepp et al., 2002).

The Automaticity subscale focuses on how automaticity motivates smoking by establishing the action-consequence process of administering the substance and experiencing the positive consequences as an automatic process (Tiffany, 1990; Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), one that may function outside of awareness of intention.

The Cognitive Enhancement subscale focuses on two mechanisms: nicotine use is experienced as enhancing cognitive abilities, and/or nicotine use is experienced as suppressing the negative cognitive side effects of withdrawal (Baker, Brandon, & Chassin, 2004). This motivation may be particularly prominent in specific populations, such as individuals with ADHD (Molina & Pelham, 2001).

Craving motivates smoking and is related to the severity of physical dependence (Piper et al., 2004) and plays a large role in the conflict between using and not using a

substance. It has been connected to structures such as the anterior cingulate cortex (Curtin et al., 2006) which may play a role in the urges to use a substance.

The Cue Exposure/Associative Processes subscale is based on the understanding of conditioned responses whereby cues are associated with the desirable consequences of smoking and by conditioning, start to activate motivational processing that motivate an individual to desire smoking, and/or to act on that desire. This is linked to the dopaminergic system that provides incentive for reward (Robinson & Berridge, 1993).

The Loss of Control subscale is related to Automaticity motivation, but extended to explain the way in which a dependent smoker feels as though they have lost control over their substance use. It refers to the way in which a smoker feels as though they have lost volition (Baker, Conti, Moffit & Caspi, 2009). Though automaticity provides one mechanism through which this process can occur, there are several others. This subscale attempts to tap an individual's sense that he or she cannot control or stop his or her smoking behavior.

The Affective Enhancement motive incorporates both positive and negative reinforcement understanding of substance use, and was created to combine the Positive Reinforcement and Negative Reinforcement subscales of the WISDM-68 for the brief version, the WISDM-37. The negative reinforcement aspect refers to substance use being motivated by the desire to minimize negative affect from withdrawal or life stressors, and may be understood to be driven by the amygdala (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). The positive reinforcement aspect refers to substance use being motivated by the desire to increase positive mood, such as to experience a high, even when negative

mood is not present, and may be related to the nucleus accumbens (Breiter et al., 1997; Breiter et al., 1999).

The Social and Environmental Goads subscale assesses the motivation that comes from social cues that encourage drug desire or use (Panksepp et al., 1978; Aftanas & Golosheykin, 2005).

The Taste and Sensory Properties subscale reflects motives derived from research showing that gustatory and sensory cues were important to smoking motivation (Rose et al., 1984; Rose et al., 1985). Research has shown that smokers may have PTC haplotypes that make them less able to taste bitterness (Wooding et al., 2004; Cannon et al., 2005). Those who can taste bitterness are less likely to identify with smoking for the taste of it (Rose & Corrigall, 1997).

The Tolerance motive refers to an increase in intensity and/or frequency of use of a substance due to an increase in clearance and tolerance of the substance within the body. This may be related to nicotine metabolism or distributional tolerance in the brain of an individual (Malaiyandi et al., 2006; Siu, Wildenauer, & Tyndale, 2006).

Weight Control as a motivation for smoking is based on research that shows that nicotine may lower body weight set-point, and that this may encourage nicotine use (Schwid, Hirvonen, & Keesey, 1992). This is particularly prominent in individuals who wish to lose weight. Nicotine may affect the hypothalamic weight regulatory centers (Baker, Conti, Moffit, & Caspi, 2009)

Initial psychometric studies into the scale properties of the WISDM-68 subscales high internal consistency (Cronbach's alpha $\geq .87$, Piper et al. 2004) for these scales.

One criticism and downside of the WISDM-68 is the length. Smith et al (2010) developed and validated a brief version, the Wisconsin Inventory of Smoking Dependence Motives-37 (WISDM-37; authors). The brief measure, consisting of 37 items and 11 subscales, retained the subscales of its father scale, the WISDM-68, except for the exclusion of the Behavioral Choice/Melioration subscale. Further, the Positive Reinforcement and Negative Reinforcement scales were merged into a single subscale termed "Affective Enhancement." The decision to merge these two scales into a single scale was based on factor analysis in which Positive and Negative Reinforcement loaded onto the same factor. It was hypothesized that increasing pleasure and diminishing distress may not be meaningfully distinct to smokers, with improved mood as the goal outcome despite differing paths.The distinction should not be permanently discarded, however, and requires more research.

Validation of the WISDM Model and Measures. The WISDM was designed and validated to be used to make inferences about dependence based on the assessment results (Piper et al., 2004) and although the WISDM measures are new, both measures have been found to be useful and stable in measuring smoking motives across a diverse population of smokers. For example, both WISDM-68 and WISDM-37 scales show significant correlations with the Fagerström Test for Nicotine Dependence and with cigarettes smoked per day (Ma et al., 2012).

Support for the model has also been provided by research examining the psychometric structure and factor structure of the WISDM measures. Initial Factor Analytic results for WISDM-68, psychometrics and validity data.

To assess the psychometric adequacy of the WISDM-37 subscales, Smith et al. (2010) used data from two randomized clinical trials (African American and white treatment seeking smokers) and a longitudinal observation study of non-treatment-seeking smokers (N = 399, 608, 453, respectively) to demonstrate that the WISDM-37 scales achieved adequate internal consistency. All scales achieved a coefficient alpha of .70 or above. Furthermore, the subscales of the WISDM-37 were found to have correlations exceeding .87 with their respective WISDM-68 scales. In fact, the average correlation between WISDM-68 and WISDM-37 scales was .97, showing a very high level of agreement. Concurrent validity and predictive validity indicated that both the WISDM-37 and WISDM-68 tapped into the same constructs and were both roughly equal in terms of predicting various outcomes. Smith et al. (2010) concluded that the WISDM-37 is acceptable as a replacement for the longer WISDM-68.

Following the initial validation of the WISDM-37, subsequent studies further demonstrated the psychometric adequacy of WISDM-37 scales. Ma, Li, and Payne (2012) found that the WISDM-37 had adequate psychometric properties for assessing African Americans and European American smokers (N=2522) with Cronbach's alpha ranging from .67 to .88 for all subscales. Vajer et al (2011) found similar results in an internet-based sample of treatment-seeking Hungarian smokers (N=720) with internal

consistencies of the subscales ranging from .67 to .90 and found the motives to be linked to smoking heaviness and tobacco dependence symptoms.

Bacio, Guzman, Shapiro, and Ray (2014) used the WISDM to help understand the importance of motives in differences in cessation attempts between non-Hispanic Black (N=155) and White (N=159) daily smokers. They found that Black and White smokers showed similar smoking patterns. However, they found that Black smokers reported more failed quit attempts and lower endorsement of motives related to Negative Reinforcement, Positive Reinforcement, and Taste subscales of the WISDM (Bacioo, Guzman, Shapiro & Ray, 2014).

Fagan and colleagues (2015) compared motives between menthol and non-menthol cigarette users in multiethnic samples using a lab-based study (N=186). Using multiple regression analysis, they found that menthol smokers reported more difficulty refraining in forbidden places, scored higher on the Social/Environmental Goals subscale of the WISDM, and were more likely to have tried quitting in the past year, but less likely to have multiple attempts (Fagan et al., 2015).

Refining the WISDM model: Is there support for a One- or Two-Factor Model? After the initial development of the WISDM-68, research suggested that variance in the 13 motives could be largely attributed to two underlying factors Primary Dependence Motives (PDM) and Secondary Dependence Motives (SDM). This is somewhat counter to the early initial WISDM model that proposed that all forms of motivation would contribute to an overarching dependence motives (Piper et al., 2004). While initial factor analytic work supported the notion of an overarching dependence

motive, more recent factor analytic work has supported a two-factor model involving PDMS and SDMs (Baker et al., 2009; Piasecki et al., 2011; Piper et al., 2008).

Piper et al (2008) have modified the WISM model based on research indicating two factors. They now view Automaticity, Craving, Loss of Control, and Tolerance as core motives for smoking that contribute to long-term nicotine use and dependence. These motives are referred to as PDMs. At both the PDM factor and PDM scale levels, these motives have been found to be related to other dependence measures, heavy use of tobacco, relapse, craving, and more dependence-related issues (Baker et al., 2009; Piasecki et al., 2011; Piper et al., 2008). The remaining motives in the WISDM were named Secondary Dependence Motives (Piper et al., 2008). While the PDM are considered primary to dependence and heavy use, the SDM are considered important in understanding situational smoking and initiation (Piper et al., 2008; Piasecki et al., 2011).

The utility of the two-factor WISDM model has been shown in a handful of studies. Initially, Piper and colleagues (2009) attempted to demonstrate that PDMs in the WISDM model incrementally improved the prediction of smoking-related behaviors and outcomes beyond that accounted for by traditional nicotine dependence measures. In this study, they explored tobacco dependence and cessation outcomes in newly or previously diagnosed adults (N = 1,504). PDMs were linked to traditional measures of nicotine dependence. Diagnostic status, however, was not associated with smoking heaviness or FTND scores, but it was associated with PDM scores. Individuals scoring higher on PDMs tended to more frequently engage in smoking behaviors. While this study was

useful in demonstrating the value of the PDM factor in relation to the FTND model of dependence, it did little to show the benefits of differentiating PDM from SDM.

In contrast to the Piper et al., (2009) study, Piasecki, Piper, Baker and Carter (2011) explored the utility of PDMs and SDMs for predicting smoking outcomes in college smokers participating in a two diary studies (Ns = 50 and 88). PDM scales from the WISDM-68 (i.e., Automaticity, Craving, Loss of Control, and Tolerance) were associated with the frequency of the report for habitual/automatic smoking in diaries. Furthermore, they found that PDM Factor predicted being a daily smoker, nicotine dependence, and smoking for habitual/automatic reasons. On the other hand, SDM scales (Affiliative Attachment, Behavioral Choice/Melioration,Cognitive Enhancement, Cue Exposure/Associative Processes, Negative Reinforcement, Positive Reinforcement, Social/Environmental Goals, Taste/Sensory Processes, and Weight Control) accounted for unique variance (when co-entered with PDM) in the tendency to smoke due to situational or instrumental motives, such as controlling emotions. This was one of the first studies to show that both PDMs and SDMs have unique associations with smoking-related events and outcomes.

The value of differentiating PDMs from SDMs was also demonstrated in a study by Cook and colleagues (2012). These researchers examined associations between WISDM-68 subscales and alcohol use, smoking cessation, and tobacco dependence (N=1,504). They found that non-drinkers and infrequent drinkers were more likely than moderate drinkers to endorse PDMs for smoking. Binge drinkers were more likely to endorse SDMs. The authors suggested that smoking cessation difficulties encountered by

non-drinkers and infrequent drinkers may be related to motives that reflect the primary/core features of dependence, while binge drinkers struggle to quit smoking due to environmental and social motives/goals. A similar study by Shiffman, Dunbar, Scholl, and Tindle (2012) examined levels of PDMs and SDMs in a sample of 218 daily smokers and 252 non-daily smokers. They found that daily smokers endorsed more PDMs, while non-daily smokers endorsed more SDMs. The findings of both studies are consistent with the revised two-factor WISDM model in suggesting that there are motivations that are heavily linked to dependence (i.e., PDMs) and secondary motives (i.e., SDMS) that, while linked to dependence, may also play a role in understanding non-dependent smoking behaviors and/or the role of other factors in triggering non-dependent smoking behaviors. This latter aspect of the WISDM model has much in common with a separate line of research that has found links between chronic issues with affect dysregulation, self-control problems, and smoking behavior and dependence.

As noted above, Piper and colleagues (2004) have argued that motivation for smoking may be impacted by factors other than dependence, such as one's dispositions and propensities towards various behaviors, experiences, and responses. Further, some motivations for smoking (e.g., SDMs) may be more related to situational factors or individual differences than others (e.g., PDMs). These exists a large literature on individual differences in personality and smoking behaviors that has emerged to a large extent separately from research on physical nicotine dependence and smoking motivation. This research, however, does align with the two-factor WISDM model in suggesting that affect- and self-regulation traits can contribute to the development and/or maintenance of nicotine dependence.

Personality and Smoking Motives

One approach to studying dispositions is the study of personality. Personality is an enduring combination of traits in an individual and has been accepted as a determinant of how each individual behaves (Terracciano & Costa, 2004). It is a cumulative set of traits that persist through life (Caspi, 2000) and incorporate environmental factors and genetic factors (Levy, Nikolayev, & Mumford, 2005). Of note, personality is expected to have a direct relationship with motivation.

Personality has been studied in relation to a variety of motives, including sociocultural motives (McClelland, 1988) and religious motivation (Gebauer, Bleidorn, Gosling, Lamb, & Potter, 2014). With regards to substances and addictions, various personality features have been associated with a variety of addictive behaviors (Isaak, Perkins, & Labatut, 2011; Mushquash, Stewart, Mushquash, Cameau, & McGrath, 2014). For example, in a study assessing the relationship between personality traits and drinking motives in Canadian Aboriginal youth (N=191), Mushquash and colleagues (2014) found that anxiety sensitivity traits of personality predicted drinking motivated by a desire to conform, sensation seeking/impulsivity traits both predicted drinking for enhancement, and hopelessness was associated with the motivation to use alcohol as a coping resource. Personality is an important determinant of a person's lifestyle choices and behavior, so studying personality in relation to health behaviors, such as smoking (ie.; Zvolensky, Taha, Bono, & Goodwin, 2015), is important. Thus, it is of little surprise that personality has been studied in relation to the motivation to smoke.

There are many approaches to studying personality (e.g., Eysenck, 1947, 1967) and several validated measures for quantifying personality, such as the the Minnesota Multiphasic Personality Inventory (MMPI; Butcher, Dahlstrom, Graham, Tellegen, & Kreammer, 1989) and the Personality Assessment Inventory (PAI; Morey, 1987). The MMPI has also been used to predict aspects of tobacco use, such as tobacco abstinence (Ames et al., 2005). Both the MMPI and the PAI, however, were developed for use in clinical settings. As such, they are heavily focused on examining aspects of personality associated with psychiatric conditions. This may, in some cases, limit their utility for studying behaviors that occur commonly in non-psychiatric settings. Other theories of personality, particularly those arising from social psychology, have been developed for use in non-clinical settings. These measures may be particularly useful for studying common behaviors, such as smoking.

The Five Factor Model of personality (FFM: Digman, 1990; McCrae & John, 1992) is the most frequently used and most widely studied approach to personality today. It has been utilized in both clinical and non-clinical settings alike. It is based on the understanding that five main factors of personality exist, and each individual can be ranked on each of them. It is currently regarded as the most common framework of understanding personality in psychological sciences (Maples, Guan, Carter, & Miller, 2014). The model was created by analyzing natural language, and creating a hierarchy of personality in which 5 main factors exist: Openness to New Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

The Extraversion factor relates to the sociability and assertiveness of a person. The Openness to Experience factor accounts for creativity, openness to new ideas, and adventurous tendencies of a person. The Agreeableness factor refers to the level of compliance and cooperation of a person's behavior (Zvolensky et al., 2015). The Neuroticism factor refers to the amount of negative emotion proneness within an individual (Zvolensky et al., 2015). Higher levels of the trait are related to a higher tendency to experience negative emotion, respond poorly to stress and minor frustrations, and interpret non-threatening situations as threatening. Such individuals may be more likely to worry, be unstable in their emotionality, and insecure in various aspects of life (Matthews, Deary, & Whiteman, 2003; Elliot & Thrash, 2002). The Conscientiousness factor refers to self-discipline and organization tendencies of a person (Zvolensky et al., 2015). A meta-analysis by Bogg and Roberts (2004) found that traits related to Conscientiousness were negatively associated with health risk behaviors and positively related to healthy behaviors.

While numerous studies support the division of personality traits into five factors, it has also been demonstrated that each of the five factors can be broken into facets. Within each personality factor, lower order facets exist. Consensus on the nature of these facets has been debated for quite some time (Maples et al., 2014). Costa & McCrae (1991, 1995) developed and validated a measure of personality, the NEO PI-R, that simultaneously assesses the five factors and provides scales tapping six lower order facets for of each factor. This has become a widely accepted FFM measure.

Following the theoretical basis of the NEO PI-R (Costa & McCrae, 1991; 1995), the International Personality Item Pool was developed, containing thousands of items in order to provide a free-to-use, customizable personality measures for those wishing to assess the factors and facets of personality. Within the IPIP, a measure exists that is intended to mimic the NEO PI-R in order to measure the same construct without the cost (IPIP-NEO, Hendriks, 1997; Goldberg, 1999).

The Five-Factor Model, Smoking Behaviors, and Nicotine Dependence. Since personality has been linked to the motivation to engage in addictive behaviors (Isaak, Perkins, & Labatut, 2011; Mushquash et al. 2014), it is of little surprise that it has been studied in relation to smoking behavior and nicotine dependence (e.g. Ames et al., 2003; Welch & Poulton, 2009; Nieva et al., 2011; Zvolensky et al., 2015). While cross-sectional studies have explored all five factors of the FFM have in relation to smoking behaviors and nicotine dependence, the Neuroticism and Conscientiousness factors have been shown to be of the most importance (Terracciano & Costa, 2004; Munafo, Zetteler, & Clark, 2007). A profile of high Neuroticism and low Conscientiousness has been consistently linked to smoking (Terracciano & Costa, 2004; Munafo, Zetteler, & Clark, 2007; Hamsan, & Abdullah, 2015; Goodwin & Hamilton, 2002). The personality factor most associated with affect-dysregulation, Neuroticism, and the one linked to self-regulation, Conscientiousness, seem to play the most prominent role with regards to smoking behaviors and nicotine dependence (Terracciano & Costa, 2004; Golestan, Hamsan, & Abdullah, 2015; Goodwin & Hamilton, 2002). Malouff, Thorsteinsson, and Schutte (2006) conducted a meta-analysis of 25 of studies of the relationship of the Five-Factor model and smoking. Their meta-analysis concluded that a profile of high

Neuroticism and low Conscientiousness were related to smoking. This study also found that low agreeableness was a risk factor for smoking, but this finding was less consistent across studies.

From its inception, research into personality and smoking has focused heavily on Neuroticism due to its link to affect-dysregulation and risk for psychopathology (Costa & McCrae, 2013) and difficulty resisting temptation (Mischel, 2008). Cherry and Kiernan (1976) conducted a longitudinal study on 2,753 people starting at age 16 and following them into their 20s; Neuroticism scores were related to higher likelihood of starting smoking. In a more recent 10-year longitudinal study of adults (N=2,101), Zvolenski, Taha, Bono, and Goodwin (2015) found that Neuroticism was linked to the increased likelihood of any cigarette use during one's lifetime, an increased risk of progressing from occasional to daily smoking, and increased risk for persistent smoking (though adjusting for demographics, anxiety, and depression lowered the significance of the results). The finding that Neuroticism is associated with progression and maintenance of smoking behaviors offers some evidence that negative affect is important to smoking. Given that those high in Neuroticism are more likely to experience negative mood states (e.g., anxiety; depression) and are more vulnerable to stress fits with a model of smoking motivation that argues that affect regulation or enhancement may be a driver of smoking behaviors. Similarly, those high in Neuroticism may be more likely to smoke to control negative affect, lessen distress, and avoid withdrawal symptoms (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Gonzales, Zvolensky, Vujanovic, Leyro, & Marshall, 2008).

Conscientiousness has also been shown to associate with smoking behaviors. In Zvolensky et al.'s (2015) 10-year longitudinal study Conscientiousness was associated with a decreased likelihood of any lifetime cigarette use, decreased risk of progression to daily use, and decreased likelihood of persistent smoking. Zvolensky and colleagues (2015) note that those high in Conscientiousness have the ability to delay gratification, are less likely to take risks, and desire achievement, all of which may serve as protective factors reducing the risk for smoking. With regards to smoking, Terracciano and Costa (2004) suggested that one's level of Conscientiousness may be as or more important than one's level of Neuroticism. Conscientiousness has been found to be the strongest of the five factors in predicting health risk behaviors (Terracciano & Costa, 2004). Thus, an individual who is prone to stress and vulnerable to negative emotion (i.e., he or she is high in Neuroticism) who nonetheless is able to regulate impulses, engages in deliberation, and is self-disciplined (i.e., high in Conscientiousness) may be able to find alternative means for coping with distress other than smoking. It has been suggested that Neuroticism may be related to smoking behaviors in those individuals who had low Conscientiousness (Malouf et al., 2006). For example, Terracciano and Costa (2004) examined if combinations of traits within an individual relate to smoking. Consistent with expectations, current-smokers scored higher on Neuroticism and lower on Conscientiousness when compared to never-smokers. Former-smokers differed from current- and never-smokers for Neuroticism and Conscientiousness. These findings were consistent with the Eysenck Diathesis-Stress Theory in linking Neuroticism to smoking, but extended to model by demonstrating the importance of Conscientiousness as a moderator.

While a number of studies have examined the association of factor scores with nicotine dependence and smoking behavior, relatively few have explored how personality facets are involved. This is unfortunate as facet level data may be useful in generating a more nuanced understanding of how personality traits are linked to smoking and nicotine dependence. For example, Terracciano and Costa (2004) found the Immoderation facet of Neuroticism to be related to smoking (Terracciano & Costa 2004), leading them to conclude that individuals who have difficulties resisting temptation and managing cravings would be more susceptible to becoming smokers. Facet level research also suggests that links between Conscientiousness and smoking are due to difficulties resisting cravings, need for stimulation, lack of consideration of consequences, and low self-discipline. Golestan et al. (2015) found that Self-Efficacy, a facet of Conscientiousness in the NEO PI-R, IPIP-NEO, and IPIP-J, acted as a moderator between smoking and Neuroticism, emphasizing the intermingling of Neuroticism and Conscientiousness in smoking behaviors. Such finding highlights the need to pay attention to facets and Maples et al. (2014) have called for facet-level studies focusing on smoking.

As shown by the summary of past literature, research has shown that higher levels of Neuroticism are often related to risky health behaviors, including smoking (Sutin et al., 2010). Further, Conscientiousness may prove a protective factor that limits risk in some ways (Zvolenski et al,. 2015). These findings are somewhat aligned with the WISDM models two-factor model that suggests that the internal capacity for affect- and self-regulation may impact vulnerability to nicotine dependence and relate to smoking motivation. This study was interested in using Neuroticism, a factor related to emotional

dysregulation, to assess relationships between emotional/affect regulation and smoking behaviors. Those who experience higher levels of chronic negative mood (Neuroticism) and have limited capacity to resist temptation (Conscientiousness) are likely at highest risk. Of course, one's ability to regulate affect and avoid temptation may also be impacted by factors external to the individual. On such factor that has been linked to smoking and smoking dependence is stress.

Stress and Smoking

While Neuroticism is a trait related to affect and often tied to smoking behaviors, stress is a state that can have similar results.Stress has been cited as a motivation for smoking behaviors (McEwen et al., 2008) and a category of smokers referred to as stress smokers who use smoking to relax can be identified (Rosa et al., 2014). Several definitions and understandings of stress have come to be accepted, and the definition affects the measurement of stress. Cohen and Lichtenstein (1990) cite several definitions of stress, including those that assess appraisal/perception of stressful stimuli, aversive events, biological responses, behavioral responses, or affective responses.

One definition of stress references stress as a disruption in the homeostasis of an individual, whereby a stimulus affects the arousal within the individual's system. Acknowledging the constantly changing and adjusting nature of the human body, the concept of allostasis was introduced to alter the understanding to include the acknowledgement (Goldstein & Kopin, 2007). The Lazarus transactional approach to understanding stress shifts the focus to the individual's cognitive appraisal of the stressful stimuli. If an individual perceives a situation as threatening, they are more likely to feel

stress than if they appraise it as challenging (Cohen, Kamarck, & Mermelstein, 1983). A number of self-report measures of stress now exist based on these models. Many of them have been linked to smoking behaviors and nicotine dependence.

Regulating stress is also a crucial motivator (Black, Sussman, Johnson, & Milam, 2012). This is particularly prevalent in adolescents and young adults, who experience more stressors and more negative affect than children and older adults (lack et al., 2012). Smoking has been shown to promote both stimulation and relaxation simultaneously, and can be used to reduce overstimulation and understimulation alike. Thereby, it can be used as a coping mechanism to alleviate negative affect (understimulation) and stress (overstimulation: Black et al., 2012). Black and colleagues (2012) mentioned that relaxation was cited as the most common motive for smoking by adolescents. Another study in primary care showed that 72% of adolescents cited this motive (Black et al., 2012). A dose-response relationship of using smoking to cope with stress was suggested by results showing that perceived stress was higher in experimenters than never-smokers. Other studies found that subjective stress was associated with predictions of smoking behavior increases, and that stress was related to smoking onset for non-smokers (Black et al., 2012).

Stress is often cited as a motivation for smoking, for the purposes of self-medication and relaxation, but a bidirectional relationship has also been suggested. Using a Perceived Stress Scale measure and assessing the relationship between stress and smoking, Cohen and Lichtenstein (1990) explained that stress and negative affect often motivate people to smoke, and that relapse during cessation is often attributed to stressful

experiences or negative moods, but also found that stress decreased as time remaining abstinent from smoking increased. Furthermore, increase in stress was found to be associated with relapse. The bidirectional relationship of smoking and stress may come as a surprise to smokers who feel that stress would overwhelm them if they quit smoking, so psychoeducation about the likelihood of stress decreasing with successful abstinence is important.

Stress is implicated as a big motivating factor in maintenance of smoking habits. Stress causes nicotine to be cleaned from the body at a faster rate, driving the smoker to use more tobacco (Straub, 2013, pp 267-273). Furthermore, stress as a motivator to smoke is reported by smokers (McEwen et al., 2008), and some smokers may fall into the category of stress smokers, who smoke to alleviate stress and induce relaxation (Rosa et al., 2014).

The Present Study

Despite the researched and accepted health risks, over a billion people worldwide and millions of people in the United States continue to smoke cigarettes (World Health Organization, 2013; Golestan, Hamsan & Abdullah, 2015; Zvolensky, Taha, Bono, & Goodwin, 2015). With the risks associated with smoking, research is interested in what motivates smoking behavior. Addressing the physical motivations of dependence as well as psychological/mental motivations is important in getting a multidimensional understanding of smoking behaviors. The WISDM-37 suggests 11 distinct smoking motives, Affiliative Attachment, Automaticity, Loss of Control, Cognitive Enhancement, Craving, Cue Exposure/Associative Processes, Affective Enhancement,

Social/Environmental Goads, Taste, Tolerance, and Weight Control (Smith, Piper, Bolt, Fiore, Wetter, Cincirpini, and Baker, 2010). A wide range of research suggests affect regulation is an overarching motive for smoking (Straube, 2010; Lujic et al., 2005). A potential way in which the research literature would suggest that affect is a prime motivator of smoking behavior, and the smoking motive literature would suggest 11 distinct motives, is that these 11 motive subscales may produce a higher-order factor associated with affect regulation.

Neuroticism has been consistently linked to smoking behaviors and nicotine dependence (Malouff et al., 2006; Terracciano and Costa, 2004; Golestan, Hamsan, & Abdullah, 2015; Goodwin and Hamilton, 2012; Zvolensky et al., 2015). In fact, Neuroticism has been linked to smoking specifically for affect management (Gonzales et al., 2008). Smoking motives have also been shown to be linked to smoking behaviors and nicotine dependence (Piper, McCarthy, Bolt, Smith, Lerman, Benowitz, Fiore, and Baker, 2008; Piper, Piasecki, Federman, Bolt, Smith, Fiore, and Baker, 2004; Smith et al., 2010). Though Neuroticism and smoking motives have both been frequently shown to be associated with smoking behaviors and nicotine dependence, few studies have explored the relationship between the two. This is unfortunate, as personality factors have been shown to be predictive of a wide variety of motives (Gebauer, Bleidorn, Gosling, Lamb, & Potter, 2014; Isaak, Perkins, & Labatut, 2011; Mushquash, Stewart, Mushquash, Cameau, & McGrath, 2014; McClelland, 1988). Given that Neuroticism is associated with deficits in affect regulation (Zvolensky et al., 2015, Matthews, Deary, & Whiteman, 2003), one would expect Neuroticism to be associated with smoking motives tapping affect dysregulation. Thus, higher levels of Neuroticism likely contribute to the

development of smoking motives related to affect regulation. If this assumption is true, we would expect the relationship between Neuroticism and nicotine dependence to be partially mediated by affect regulation smoking motives. One very important personality factor, Conscientiousness, has been shown to be a protective factor for smoking behaviors (Terracciano and Costa, 2004; Malouff et al., 2006; Zvolensky et al., 2015). As such, it is important to examine the potential impact of Conscientiousness on relationships between smoking motives and ND. Perceived stress has been shown to be associated with Neuroticism (Brouwer, van Schaik, Korteling, van Erp, & Toet, 2015) and smoking behaviors (Cohen and Lichtenstein, 1990) and is therefore useful to consider in exploring smoking motivation.

To date, no studies have explored the direct relationships between Neuroticism facets and smoking motives. This study was designed to facilitate specificity in exploring personality and smoking by assessing lower-order facets of Neuroticism and Conscientiousness and relating them to smoking motives as defined by the WISDM.

Hypothesis 1

We predict that a factor analysis of 11 WISDM-36 smoking motives will condense them down to a smaller number of higher order factors.

Hypothesis 2

We predict that there will be at least one higher order factor strongly related to affect regulation (i.e. Neuroticism).

2a. At least one higher order factor will be significantly related to IPIP-J Neuroticism.

2b. At least one higher order factor will be significantly associated with the Immoderation facet of IPIP-J Neuroticism.

2c. At least one higher order factor will be significantly associated with the Anxiety, Depression, Anger, Vulnerability, and Self-Consciousness facets of Neuroticism, and this higher order factor will be related to the PSS.

Hypothesis 3

We predict that at least one smoking motive higher order factor will be associated with nicotine dependence.

3a. At least one smoking motive higher order factor will be related to the FTND-R.

Hypothesis 4

We expected that the relationship between affect regulation (IPIP-J Neuroticism and PSS-10) and nicotine dependence to go through at least one of the smoking motive higher order factors. In addition, we expected Conscientiousness (BFI) to be a protective factor.

Chapter II

Method

Participants

Participants' ages ranged from 19 - 69 years of age (*M*=33.26, *SD*=10.41). Sixty-one percent of the sample was male, while 39% was females. With regards to racial background, 90% identified as non-Hispanic and 10% identified as Hispanic. Among those identifying as non-Hispanic, 81.5% identified as White, 7% identified as African American, 8.5% identified as Asian, and 2% identified as Other. The amount of time smoked ranged from 1 year to 50 years (M= 154.54 months, SD= 124.80); 91% of the sample reported smoking daily; 57/200 participants were considered Low-to-Mild Dependence based on FTND R cutoffs while 143/200 were considered Moderate-to-High Dependence.

Measures

Smoking History. Smoking history was assessed using 2 questions following the demographic questions in the survey: Are you a daily smoker? (yes or no) and How long have you been smoking (in months/years)? (fill in the blank answer).

The Wisconsin Inventory of Smoking Dependence Motives-37 (WISDM-37). Smoking motives were indexed using the brief version of the Wisconsin Inventory of

Smoking Dependence Motives-68 (WISDM-68; Piper et al., 2004). The original WISDM-68 is a self-report measure of smoking motives, containing 68 items across 13 subscales of smoking motives. Smith et al. reported 12 of the the 13 scales produced coefficient alphas of greater than .70 (they ranged from .73- .94). With the exception of the Cue Exposure/Associative Processes subscale, for which alpha ranged from .68-.72 (Piper et al., 2004). The WISDM-37 is the version used in this study. This measure is a brief version of the WISDM-68 that was developed by Smith et al. (2010). The WISDM-37 includes 37 items that measure 11 of the smoking motivation subscales All 11 scales were taken from the the original subscales of the WISDM-68 (Affiliative Attachment, Automaticity, Loss of Control, Cognitive Enhancement, Craving, Cue Exposure/Associative Processes, Social/Environmental Goads, Taste, Tolerance, and Weight Control). In addition to fewer items, the WISDM-37 differs from the WISDM-68 in that it does not include the Behavioral Choice/Melioration subscale and the positive and negative reinforcement item were condensed into a single item and included in the Affective Enhancement subscale. As noted above, prior studies have shown that the WISDM-37 subscales are strongly associated with corresponding subscales from the WISDM-68 and the WISDM-37 scales have shown strong internal consistency estimates. In the current study, alpha coefficients for the 11 WISDM-37 subscales ranged from .76 to .92. In addition to the 11 subscales, factor analytic research with both the WISDM-68 and the WISDM-37 indicate that Automaticity, Craving, Loss of Control, and Tolerance scales can be combined to produce a Primary Dependence Motives and the remainder of the scales can be combined to form the Secondary Dependence Motives scales (Piper et

al., 2008; Piasecki, Piper, Baker, & Carter, 2011). Participants were asked to respond with the following options: The WISDM-37 measure can be found in Appendix A.

Fagerström Test for Nicotine Dependence -Revised (FTND-R). Nicotine dependence was assessed using the 6-item Fagerström Test for Nicotine Dependence - Revised (FTND-R: Korte et al., 2013), based on scoring revisions made to the original Fagerström Test for Nicotine Dependence (FTND: Heatherton et al., 1991) in order to improve psychometric properties. Item 1 allows respondents to select a category for how many cigarettes they smoke per day (0= less than 10, 1= 11-20, 2 = 21-30, 3 = 31+). Items 2, 5, and 6 utilize a 4-point Likert response set 6 (0=never, 1=sometimes, 2=most of the time, 3 =always). Item 3 uses reverse coding to assess how soon after waking a person smokes their first cigarette (3= within 5 min, 2= 6-30 min, 1= 21-30 min, 0= after 60 min). Finally, item 4 asks which cigarette respondents would most hate to give up (1= first in the morning, 0= all others). The FTND-R is included in Appendix A.

The FTND-R has a number of benefits over the original FTND. The internal consistency of the FTND-R (alpha=.69: Korte et al., 2013) is stronger than estimates for the original FTND (which was reported to be as low as alpha = .56: Payne, Smith, McCracken, McSherry, & Antony, 1994). Consistent with prior studies, coefficient alpha in the present study was .72 for the FTND-R, indicating adequate internal consistency for use in group-based research. The FTND-R has also evidenced improved item distributions as a function of altering some of the questions (Korte et al., 2013). The FTND-R employs more of a dimensional, as opposed to a dichotomous, approach to measure nicotine dependence. It eliminates many of the forced-choice items on the

original FTND (Forte et al., 2013) and includes more dimensional items. Nonetheless, some validated cutoffs for categorizing participants have been proposed. Moolchan, Radzius, Epstein, Uhl, Gorelick, Cadet, and Henningfield (2002) suggested using a score of 4 or below to indicate low dependence while scores of 5 or above can be considered moderate or high dependence. Alterations to items and the inclusion of validated cutoff scores allow researchers to use the FTND-R in both dimensional and categorical manners.

Big Five Inventory of Personality (BFI). The five higher-order factors of personality (Openness to New Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, based on the Five Factor Model [FFM]: Digman, 1990; McCrae & John, 1992) were assessed using the Big Five Inventory (BFI: Johns & Srivastava, 1999). Though this measure provides scores for all five factors, the measure was included in this study to assess Conscientiousness, as the measure is currently the most widely used inventory for assessing Conscientiousness (Hypothesis 3). This 44-item inventory is a self-report measure. Items are worded as statements that respondents answer using a five-point Likert scale with the following response options: Disagree strongly (1), Disagree a little (2), Neither agree nor disagree (3), Agree a little (4), and Agree strongly (5). Summer, Lajunen, and Ozkan (2005) reported Cronbach's Alpha reliabilities between .64 and .77. This study produced alpha coefficients ranging from .85 to .94. This measure can be found in Appendix D.

The Neuroticism Factor and Facets of the International Personality Item Pool NEO-120. (IPIP-J) The Neuroticism factor and facets were assessed using the 24-

item scale taken from the brief version of the Neuroticism scale on the International Personality Item Pool-NEO-120 (IPIP-J: Johnson, 2014). The IPIP-J is a representation of the Revised NEO Personality Inventory - Revised (Costa & McCrae, 1991, 1995). The IPIP-J is a well-validated inventory for assessing the five personality factors. It was derived from the 300-item International Personality Item Pool-NEO (IPIP-NEO, Hendricks, 1997; Goldberg, 1999). Both the IPIP-NEO and the IPIP-J have shown to be highly consistent with the NEO-PI-R (Johnson, 2014). The International Personality Item Pool is a public domain, free inventory.

Items for the IPIP-J Neuroticism scale are worded as statements that respondents rate based on how accurately or inaccurately the item describes the respondent. Participants rate items using a five-point Likert scale ranging from 1 (Very Inaccurate) to 5 (Very Accurate). The 24-item Neuroticism scale produces an overall score for Neuroticism, as well as subscale scores for the six Neuroticism facets (Anger, Depression, Self-Consciousness, Immoderation, and Vulnerability). The Neuroticism factor score has been shown to achieve strong internal consistency, with coefficient alphas ranging from .88 to .90 in prior studies. The IPIP-J Neuroticism scale also produces scores for six facets. Each facet score is based on four items. Prior studies also suggest adequate to good internal consistency for the Anxiety facet (alpha symbol ranges from .71-.78), Anger facet (.77-.87), Depression facet (.80-.86), Self-consciousness facet (.63-.72), Immoderation facet (.69-.71), and Vulnerability facet (.70-.76). In the present study, the Neuroticism factor produced a coefficient alpha of .94 and all facet scales achieved alpha values above .70 (Anxiety: .87, Anger: .85, Depression: .88, Self

Consciousness: .76, Immoderation: .73, and Vulnerability: .73). Appendix E shows the items of this measure.

Perceived Stress Scale (PSS-10). Stress was measured using the 10-item Perceived Stress Scale (PSS-10: Cohen, Kamarck, & Memelstein, 1983). THe PSS-10 is a 10-item self-report scale assessing respondents' subjectively experienced stress *in the last month*. Participants are asked to report how often they have experienced stress-related feelings, thoughts, or responses in the last month using a 5-point Likert scale (0 = Never, 1 = Almost Never, 2= Sometimes, 3= Fairly Often, 4 = Very Often). The PSS-10 was developed from the original 14-item Perceived Stress Scale. The PSS-10 revision removed four items repeatedly shown to be problematic. The PSS-10 has consistently obtained adequate internal consistency for use in group-based research (e.g., coefficient alpha symbol = .78, Taylor, 2015). In the present study, coefficient alpha for the PSS-10 was quite strong at .91. See Appendix C for items.

Validity Questions. Validity questions were placed every 10 items on the survey in order to assess attentiveness and to screen for bots. These included items such as "In math, 2 plus 5 is equal to?" and "Which of the following is an animal?" with 4 multiple choice answer options per questions. Inclusion of these items is considered a best practice for getting the most valid data from Amazon's Mechanical Turk (Kittur, Chi & Suh, 2008; Mason & Suri, 2012).

Procedure

In February of 2016, following IRB approval of the study, a request for participation in a psychological survey investigating smoking motives, personality traits, and stress was distributed electronically using the Amazon Mechanical Turk (MTurk) internet crowdsourcing service to a United States population. MTurk is a useful too for crowdsourcing human intelligence tasks for a wage (Mason & Suri, 2012). MTurk is particularly useful for students because it is easy to use and removes the restrictions associated with using convenience samples such as student subject pools at universities (Bates & Lanza, 2013; Berinsky, Huber, & Lenz, 2012). It has been demonstrated that attentiveness of MTurk workers matched attentiveness of participants in other data-collection methods (e.g. Berinsky, Margolis, & Sances, 2015; Paolacci et al., 2010). When items directly assess for attentiveness, honesty, and manipulation, reliability can be reestablished (Bates & Lanza, 2013) though Paolacci and Chandler (2014) advise against strict screening methods that assess attentiveness, suggesting that they often present error and minimize sample diversity. It has been suggested that including questions with verifiable answers such as "Who is the president of the United States?" or "What is 2+2?" helps assess the quality of the gathered data by screening for bots and inattentiveness and allows requesters on MTurk to determine if someone deserves to be compensated for their work or not (Kittur, Chi & Suh, 2008; Mason & Suri, 2012).

Participants were able to find this study when sorting by recency and payment amount, as well as by searching for topic keywords: smoking, personality, and stress. While in Mturk, potential participants were able to read a brief description of the study

that included study requirements and other details about participation. In order to increase the likelihood of obtaining usable data via MTurk, participants were informed in advance that 1) there were validity questions in the study, 2) that participants who failed to accurately answer at least 90% of the validity questions would not have their data used in the study, and 3) that participants who failed to accurately answer at least 90% of the validity questions would not be compensated for participating in the study. Participants were also informed that they were required to meet the following criteria in order to participate and to be reimbursed: they must be at least 18 years of age or older, they needed to reside in the United States of America, and they need to currently be a smoker (occasional and daily smokers were both acceptable). Potential participants were informed of the anonymity of their participation in the survey, the amount of time the study would requires, and were offered $1.40 compensation for participating in the study.

Participants who decided to participate clicked on a link that took them to a separate Qualtrics survey form. They first completed an online consent form that explained the confidentiality and limits of confidentiality of the study, risks and benefits, and set expectations for what to expect from the study. The limits of confidentiality associated with online studies and with the MTurk database were explained. Participants were asked to pay careful attention to the instructions and response options of the survey items, since different parts of the survey have different response options and rating scales.

The survey measures were presented in the order detailed above. First, participants answered the 6-item FTND assessing smoking behaviors, then the 37-item

WISDM-37 to assess smoking motives, followed by 48 items assessing Neuroticism and Conscientiousness, pulled from the IPIP-J, and lastly, 10 items measuring perceived stress via the PSS. However, every 20 items, there will be a screener item that will be used to 1) assess attentiveness and 2) screen for bots. These items were fill-in-the-blank and participants were required to correctly and attentively respond to at least 80% of these for the results to be accepted. Finally, participants were asked to copy the code produced by completing the survey and input it on the M-Turk task page so they could be eligible for compensation.

Within the first day of the request distribution, a sample of 200 individuals had completed the survey. Of the 200, 2 individuals were rejected afte failing the validity portion of the survey; the study was reposted and 2 new people completed the survey within a day.

Chapter III

Results

Descriptive Statistics

Descriptive statistics for the WISDM-37 can be found in Table 1. Descriptive statistics for the IPIP-J Neuroticism items, FTND-R scale, and PSS-10 scale can be found in Table 2. Inter-correlations among the WISDM-37 subscales are reported in Table 3. Inter-correlations among the Neuroticism factor facets are reported in Table 4. These data are included for descriptive purposes to ease comparisons with prior studies.

Hypothesis 1 Results

In Hypothesis 1 we predicted that a factor analysis of the 11 WISDM-37 smoking motives subscales would condense them down into a smaller number of factors. To examine this hypothesis we first conducted a parallel analysis; a parallel analysis is a technique used to estimate the number of factors to extract from a factor analysis. We used the SPSS syntax created by O'Connor (2000) to conduct the parallel analysis. Specifications for this parallel analysis were as follows: we entered a sample size of 200, set the confidence interval at the 95th percentile, and entered a seed rate of 1000. In addition, this parallel was conducted using permutations of the actual data set.

The Exploratory Factor Analysis (EFA) used a Principal Axis Factoring (PAF) approach. This approach was selected because of its widespread application and utility in the social sciences; over 1700 studies in the span of two years on PsycInfo used the EFA approach and over half used varimax rotation (Costello & Osborne, 2005). This EFA yielded three factors with Eigenvalues above 1.0 (Table 5) which explained 68.92% of the variance. Only two of these Eignevalues, however, exceeded corresponding 95th percentile values established by the parallel analysis. Together, these two factors explained 59.28%. The scree plot for this analysis also supported extraction of two factors can be viewed in Figure 1. To further examine the merits of the two-factor model, we re-ran the PAF and explicitly extracted two factors. To describe scale loadings on factors, we used descriptors provided by Tabachnick and Fidell (2007); they recommended descriptors of uninterpretable (loadings $< .30$), poor (loadings of .30 to .44), good (loadings of .45 to .70), and excellent (loadings $> .70$)..We also sought a simple factor structure and attempted to place each scale on only a single Factor. A scale was said to have a primary loading when it a) loaded onto only one factor with a loading $> .55$ and on other factors with a loading $< .30$ *or* if the scale loaded on one factor $> .65$ and all other loadings (secondary loadings) were less than .20 of the primary factor loading (MacCallum et al., 2001; Costello & Osborne, 2005). A scale was said to have a non-trivial, secondary loading when it loaded onto multiple factors with loadings $\geq .40$.

Table 6 displays the factor loadings for the rotated solution. Automaticity (.56), Loss of Control (.86), Craving (.80), Cue Exposure (.61), and Tolerance (.74) loaded onto Factor 1 while Affiliative Attachment (.54), Cognitive Enhancement (.76), Cue Exposure (.51), Taste (.48) and Affective Enhancement (.83) loaded on Factor 2. Factor

1 was highly similar in nature to the Primary Dependence Motives factor that has been reported in prior research (Piper et al., 2008; Piasecki et al., 2011). Affective Enhancement (.83) and Cognitive Enhancement (.76) had excellent primary loadings on Factor 2, while Affiliative Attachment (.54) and Taste (.48) had good and fair primary loadings respectively. In addition, Cue and Associative Processes failed to meet our criteria for a primary loading because it loaded on both Factor 1 (.61) and Factor 2 (.51). The Social and Environmental Goals and Weight Control subscales failed to achieve a primary loading on either factor (factor loadings <.40), and thus were not included. Prior studies have tended to find these scales to load primarily onto a SDM factor (e.g. Adkison et al., 2015).

Using our findings we created composite scores. To create factor composite scores, we averaged all scales showing a primary loading on Factor 1 and all scales showing a primary loading on Factor 2. After examining item-level statistics and prior factor analytic studies, we also included the Cue and Associative Processes subscales on Factor 2 (as this resulted in an improved coefficient alpha and strong corrected-item-to-total item correlations). The decision to include this subscale on Factor 2 was consistent with prior work in this this area with this measure which has tended to find that this subscale loads with the other subscales on this Factor (see Adkison et al., 2015). Finally, we conducted analyses with this subscale included on Factor 2 and without this subscale included within Factor 2. The pattern of associations with other variables was virtually identical supporting the decision to place this subscale on Factor 2. Factor 2 in large part resembled the SDM factor, with a few exceptions (e.g., the Social and Environmental Goads and Weight control typically load onto the SDM factor, but did not do so in our

study). Coefficient alpha for the Factor 1 composite was .87. Coefficient alpha for Factor 2 composite (including Cue and Associative Processes) was .83. These two scales were highly correlated (r=.74, p<.001).

Overall, there is limited support for our first hypothesis. The scales condensed down to two factors. These factors mirrored the PDM and SDM factors typically obtained by prior researchers, with some exceptions. Further, as expected the second factor was composed of scales (e.g., Affective Enhancement; Cognitive Enhancement) that are clearly related to affective regulation capacities. While an argument can be made for two factors, it should also be noted that the second factor was highly correlated with the first factor. Thus, the motives appear to be highly related as opposed to distinct.

Hypothesis 2 Results

We predicted that there would be at least one higher order factor strongly related to affect regulation traits. In this case, we expected one of the factors to be related to Neuroticism, stress, and/or to several Neuroticism facets. To examine this hypothesis, we conducted Pearson correlations and examined the specific associations. These correlations can be found in Table 7. The only significant correlation was between the Immoderation facet of Neuroticism and Factor 1 (r = .22, p < .01). Given that Factor 2 was the factor containing the scales that would be expected to be more strongly associated with affect regulation, the finding involving an association between Factor 1 and affect-related traits does not offer support for the hypothesis.

We did not find support for Hypothesis 2. Neither of the two factors were associated with stress or the Neuroticism factor. In addition, five of the six facets were unrelated to either factor. Immoderation was the only facet to show any association with one of the factors (r = .22, p <. 01). Further, the factor associated with Immoderation was the PDM-like factor (i.e., Factor 1). We would have expected this relationship to emerge between Factor 2 (i.e., the SDM-like factor).

Hypothesis 3 Results

Hypothesis 3 concerned inter-relationships among nicotine dependence, Neuroticism, and smoking motivation. This hypothesis predicted that the higher-order factors would each be related to FTND-R. We found support for this hypothesis; both factors were associated with FTND-R Total Score. The association between the FTND-R Total Score and Factor 1 was .64 (p <.001) and the association between the FTND-R Total Score and Factor 2 was .43(p <.001). This hypothesis was largely confirmed. Table 7 shows the results.

Hypothesis 4 Results

This hypothesis called for an association between Neuroticism and the FTND-R Total Score. No such association was found. The correlation between the Neuroticism factor and the FTND-R Total Score was .06 (p = .37). We explored correlations between the various facets and the FTND-R Total Score; none of these were significant (r values ranged from -.04 to .10). Thus, we found no support for this part of the hypothesis.

We had predicted that an affective motive would mediate the relationship between Neuroticism and dependence; however, given a lack of a main effect (i.e., FTND-R was unrelated to Neuroticism), there was no point in examining this prediction.

This hypothesis also concerned Conscientiousness (as measured on the BFI) and dependence. We had expected Conscientiousness to be inversely related to FTND-R scores. Conscientiousness also failed to show a significant association with FTND-R Total Score (r=.01, p=.95).

Overall, we found virtually no support for this hypothesis. While the overarching factors underlying smoking motives were related to nicotine dependence, personality was largely unrelated to these factors *and* largely unrelated to nicotine dependence.

Exploratory Analyses Results

Given limited support for hypotheses, we explored a number of post-hoc hypotheses in our data. There are a number of factors about this study that may have resulted in our failure to find support for hypotheses derived from prior research. We first examined if age of respondents could be impacting associations. Older individuals tended to be higher on the Conscientiousness factor (r = .21) and were more likely to endorse the Loss of Control motive (r=.19) and the Cue Exposure motive (r = .15). Older individuals were less likely to endorse overall Neuroticism (r = -.14 and r = -.17) and the Vulnerability (r =-.23), Anger (r = -.18), and Anxiety (r =- .15) facets of Neuroticism. While significant associations were observed, all were quite small in

magnitude and thus highly unlikely to impact associations between personality and smoking motives overall. Thus, we turned our attention to other potential issues.

A review of our sample indicated that the vast majority of respondents had fairly high levels of dependence. We speculated that associations between personality and smoking motives could possibly vary as a function of level of dependence. Thus, we decided to first determine if smoking motives differed across participants as a function of level of dependence. Based on FTND-R suggested cut-offs (Moolchan et al., 2002; Huang, Lin, & Wang, 2008), we placed participants into one of two groups. Those with FTND-R scores of 4 and under were considered to have Low-to-Mild Dependence and were placed in one group, while those with FTND-R scores of 5 and over were considered to have Moderate-to-High Dependence and were placed in a second group. 71.5% of our sample was in the Moderate-to-High dependence group, and 28.5% of our sample was in the Low-to-Mild dependence group. Results of the independent samples *t*-tests comparing Low-to-Mild and Moderate-to-High Dependence groups found significant differences between the two groups on the WISDM-37 subscales (Table 8). We compared groups for all personality scales, the PSS-10, and the WISDM-37 subscales. No significant differences were found for the PSS-10 or IPIP-J Neuroticism scales. The Low-to-Mild Dependence group tended to score lower on all WISDM-37 motives than the Moderate-to-High Dependence group (*t*-values range from .41 to 8.40; p-values were all $<.01$ except Weight ($p = .68$); *d* ranges from .06 to 1.19). Only the effect size for Weight Control was considered trivial ($d < .20$). Small effect size ($.20 < d < .50$) was found for Affiliative Attachment, Craving, and Taste. The effect sizes for Automaticity, Cognitive Enhancement, Cue Exposure, Social and Environmental Goads,

and Affective Enhancement were medium (.50 < *d* < .80). Loss of Control, Craving, Tolerance, and Total WISDM Score had large effect sizes (*d* > .80). The difference was particularly prominent on the WISDM-37 Total Score and Primary Dependence Motives. Groups appeared to differ on motivation but not Neuroticism or perceived stress. This is, to a large extent, as would be expected. Those who have higher levels of nicotine dependence also report experiencing more intense motivation to smoke.

Given the size of these differences across smoking motives across nicotine dependence levels and the absence of differences in stress and personality scales, we speculated that associations between smoking motive factors and personality characteristics might vary as a function of level of dependence. To explore this hypothesis we conducted a series of regressions using interaction variables. Interaction variables were created for the PSS-10 total score the Neuroticism Facets by first converting these scales to *z*-scores. We then multiplied each scale with a dummy coded variable in which a score of zero indicated Low-to-Mild Dependence group status and a score of one indicated Moderate-to-High Dependence Status. We then conducted regressions, with Dependence Group Status entered on the first step, the z-score for each scale entered on the second step, and the interaction factor entered on the third step.

Consistent with the *t*-test results, the regressions predicting Factor 1 scores all showed a main effect for Group Status. Those in the Moderate-to-High group scored significantly higher on Factor 1 than those in the Low-to-Mild group ($R = .50$, $R^2 = .25$, $F(198, 1) = 65.18$, $p < .001$) and Dependence Group Status accounted for 25% o the variance in Factor 1 scores. We found no evidence that the Depression, Self-

Consciousness, or Vulnerability Facets interacted with Dependence Group Status to predict Factor 1 motives. Dependence Group Status also did not interact with stress level (i.e., PSS-10) to predict Factor 1 scores. In contrast, data suggested that the Anxiety Facet and Anger Facet interacted with Dependence Group Status. Further, Group Status impacted associations between the Immoderation facet and Factor 1 motives.

Inclusion of the Anxiety Facet nearly improved prediction of Factor 1 scores (ΔR^2 = .01; ΔF (197,1) = p = .07); however, inclusion of the Anxiety x Dependence Group Status term did significantly improve prediction of Factor 1 scores (ΔR^2 = .02; ΔF (196,1) = 3.65, p = .05) while lowering the contribution (i.e., standardized Beta weight) of the Anxiety Facet from .11 to -.06. As can be seen in Figure 2, Moderate-to-High participants were more likely to report higher levels of Factor 1 motives when they scored higher on the Anxiety Facet (r =.21, p =.01); in contrast, one's standing on the Anxiety Facet was unrelated to Factor 1 smoking motives for those in the Low-to-Mild dependence group (r =.07, p = *ns*). Similarly, though inclusion of the Anger facet did not significantly improve prediction of Factor 1 scores beyond that accounted for by Dependence Group Status (ΔR^2 = .001; ΔF (197,1) = 0.22, p = .64), inclusion of the Anger Facet x Dependence Group Status interaction term did significantly improve prediction (ΔR^2 = .02; ΔF (196,1) = 4.50, p = .04). As can be seen in Figure 2, participants who were Low-to-Mild in nicotine dependence trended towards being more likely to endorse Factor 1 motives if they experienced low levels of difficulty managing feelings of anger (r = -.20, p = .13), while those in the Moderate-to-High dependence group were *slightly* more likely to endorse Factor 1 motives if they reported more difficulties managing anger (r = .13, p = .12). While an interaction existed, the

association between the Anger facet and Factor 1 scores was not significant for either group. Consistent with the results reported above, the Immoderation facet also improved prediction beyond Group Status ($\Delta R^2 = .04$; ΔF (197,1) = 11.78, $p < .001$), but the Immoderation Facet x Dependence Group Status interaction did not significantly improve prediction ($\Delta R^2 < .01$; ΔF (196,1) = 0.01, $p = .91$). As can be seen in Figure 2, the association between the Immoderation facet and Factor 1 was roughly .24 for both groups.

The regressions predicting Factor 2 scores all showed a main effect for Group Status. Those in the Moderate-to-High group scored significantly higher on Factor 2 than those in the Low-to-Mild group ($R = .36$, $R^2 = .13$, F (198, 1) = 29.92, $p < .001$) and Dependence Group Status accounted for 13% of the variance in Factor 1 scores. We found no evidence that the Anxiety, Depression, Self-Consciousness, or Vulnerability Facets interacted with Dependence Group Status to predict Factor 1 motives. Dependence Group Status also did not interact with stress level (i.e., PSS-10). In contrast, data suggested that the Immoderation Facet and Anger Facet interacted with Dependence Group Status.

Inclusion of the Immoderation Facet trended towards improving prediction of Factor 2 scores beyond that accounted for by Dependence Group Status ($\Delta R^2 = .01$; ΔF (197,1) = 3.229 $p = .07$), but the contribution of the Immoderation Facet x Dependence Group Status failed to further improve the model ($\Delta R^2 = .008$; ΔF (196,1) = 1.84, $p = .18$). Nonetheless, as shown on the left side of Figure 3, the nature of the relationship between this facet and Factor 2 did appear to differ as a function of Dependence Group

Status. Higher levels of Immoderation in the Low-to-Mild Dependence group were associated with strong Factor 2 motives (r = .27, p = .05); however, Immoderation was not associated with Factor 2 scores in the Moderate-to-High Dependence group (r = .07, p = .36). As with Factor 1, the Anger facet did not significantly improve prediction of Factor 1 scores beyond that accounted for by Dependence Group Status (ΔR^2 = .001; ΔF (197,1) = 0.14, p = .71), but inclusion of the Anger Facet x Dependence Group Status interaction term trended towards improving prediction (ΔR^2 = .02; ΔF (196,1) = 3.06, p = .08). Surprisingly, as can be seen in Figure 3, the Anger Facet was inversely associated with Factor 2 scores in the Low-to-Mild Dependence group, though this association only trended towards significance (r = -.22, p = .10), while the Anger Facet was unrelated to Factor 2 scores in the Moderate-to-High Dependence group (r = .06, p = .50).

It is also possible to examine Dependency Group Status differences using a four category approach: Low Dependence (FTND-R <= 2), Mild-Moderate Dependence (FTND-R 3-4), Moderate Dependence (FTND-R 5-7), and High Dependence (FTND-R > 7). We explored this approach and found results that were essentially identical to the two-group approach. Table 9 depicts the results of a one-way ANOVA comparing the four groups on each of the WISDM-37 smoking motives and the total score. Significant differences among groups emerged for the Total Score (F (3,199) = 29.75, p< .001). As can be seen in Table 9, Bonferroni corrected post-hoc tests indicated that the Low Dependence group scored significantly lower on the WISDM-37 total score relative to the Mild Dependence group, which scored significantly lower than the Moderate Dependence group, which scored significantly lower than the High Dependence group. Groups also differed significantly in this way in terms of Primary Dependence Motives

($F(3, 199) = 43.91$ $p < .001$), and Secondary Dependence Motives ($F(3, 199) = 15.39$ $p < .001$).

Chapter IV

Discussion

Despite widespread and publicized agreement on the dangers of smoking, people continue to smoke cigarettes; millions attempt to quit, but only approximately 4% appear to be successful (Piper et al., 2004). Nicotine fosters dependence and promotes addiction and addictive behaviors, and is considered by many the prime motive for why individuals maintain smoking behaviors over time and with awareness of the risks (Schachter, 1977; Heatherton et al., 1991; Rios-Bedoya; 2008). Others view dependence as the result of a multifaceted set of motives which contribute to the addiction and/or further physiological dependence on nicotine (Piper et al., 2004; Smith et al., 2010; Rosa et al., 2014). The purpose of this study was to examine one of the most widely used multifaceted smoking motivation measures, the WISDM-37, to determine if motivation subscales would condense down to a smaller number of underlying factors. Based on prior research (e.g. Straub, 2012;Schachter, 1977; McEwen et al., 2008; Brown, Carpenter, & Sutfin, 2011; Darlow & Lobel, 2012; Levinson et al., 2007; Berlin et al., 2003; Stromberg et al., 2007), we expected to find evidence for a biologically-based motive factor and more situationally and an emotionally triggered motive factor. We also expected both factors to be associated with nicotine dependence. In contrast, we expected only the situationally-emotionally driven factor to be associated with features of affect regulation and self-control, given that these aspects of personality have been linked to smoking

behaviors and nicotine dependence (Terraciano & Costa, 2004; Munafo, Zetteler & Clark, 2007; Munafo & Black, 2007; Gonzales et al., 2008; Golestan, Hamsan, & Abdullah, 2015).

Overall, we found only limited support for our hypotheses. While we did find that the 11 factors of the WISDM-37 condensed down into two factors, personality variables related to affect regulation and experienced stress showed minimal associations with the derived smoking motivation factors. Our sample included mostly moderate-to-high dependence smokers, and it is possible that this may have impacted our findings. Even if there are many routes to smoking addiction, as one becomes more and more dependent individual differences in affect regulation may contribute less and less to smoking motives and behaviors. Instead, smoking-specific motives and cues may come to play the largest role in the maintenance of nicotine dependence. Similarly, the distinctiveness of smoking motives may become less and less clear as dependence increases. Said differently, as one becomes more and more dependent on nicotine, the number of motives one experiences to smoke may broaden. We base this statement on exploratory analyses showing that those who were more nicotine dependent scored higher across almost all WISDM-37 subscales relative to those lower in dependence. It is possible that though there may be many factors that cause smokers to begin smoking, as smokers become more dependent on nicotine they become more similar in terms of what motivates them to smoke. This is consistent with those who would argue that much of the variance in smoking behavior is accounted for by physical dependence (Schachter, 1977; Fagerstrom, 1978; Piper et al., 2004; Korte, et al., 2013), even if there are some differences in how

dependence is subjectively experienced. We discuss findings and implications regarding our individual hypotheses below.

This first hypothesis proposed that the 11 subscales of the WISDM-37 would condense down to a smaller number of factors. While others have examined this hypothesis at the item level, this is one of the first studies to examine the hypothesis at the subscale level. Further, this is one of the first studies to examine this hypothesis using the brief form of the WISDM, the WISDM-37. A review of the literature found some indications of smoking mechanisms being explained by more general categories of motivation (e.g., affect regulation; dependence). For example, Rosa and colleagues (2014) had used 17 unique smoking motive items in their study, but grouped them into scales of Social Reasons, Addicted Reasons, and Stress/Emotional Regulation Reasons. In fact, a wide range of self-report based research suggests that the regulation of affect is an overarching motive that relates to smoking behavior and nicotine dependence (Straube, 2010; Lujic et al., 2005; Rosa et al., 2014). Our factor analysis of the WISDM-37 scales, however, found mixed findings in this respect. On the one hand, we did find evidence for two factors. As expected, the first factor was composed of subscales clearly associated with physical dependence (Automaticity, Loss of Control, Craving, and Tolerance) and the second factor was more social and affective in nature. This factor was composed of subscales clearly more effectively-triggered in nature (Affiliative Attachment and Affective Enhancement). On the other hand, our factors were *highly* related to one another, which calls into question the distinctiveness of these motivational sets.

The two-factor model that emerged in this study has much in common with two-factor models reported in prior studies focusing on the WISDM model. A number of prior studies have shown that the scales (and items) can be organized around PDM for smoking and SDM for smoking. For example,Piper and colleagues identified distinctions in the WISDM measure between scales tapping PDMs (e.g., Automaticity, Craving, Loss of Control, and Tolerance) and scales tapping SDMs (all remaining scales). Other studies confirmed these factors (e.g. Piasecki et al., 2011). Our factors are similar in many ways; the four PDM scales loaded onto our first Factor and four of the SDMs showed strong loadings on Factor 2. Some differences between our factors and the PDM/SDM factors of Piper and colleagues (2008) and Piasecki and colleagues (2011) did occur. One difference is that Cue Exposure and Associative Processes loaded highly on both Factor 1 and Factor 2, whereas these have generally been categorized as being scales that should load on SDM factors. Also, Social and Environmental Goads and Weight Control failed to load on Factor 2 as they had on the Secondary Dependence Motives factor. Finally, while prior research suggests that PDMs and SDMs are related, the magnitude of the correlation was notably large in our study. Participants who scored higher on our first factor were more likely to score higher on the second factor. This somewhat calls into question the distinctiveness of these motives. In other words, while conceptually distinct they appear to covary considerably. Thus, one could argue that these two factors really condense down into a single dependence motive. This position has been adopted by some experts (Fagerstrom, 1978; Piper et al., 2004).

Our study differed from research in this area in several ways. This study analyzed the WISDM-37 on a scale level rather than item level. Previous research looked at

secondary factors, examining item loadings onto scale factors, and then scale factors onto higher-order factors. The developers of the WISDM predicted that items would load primarily onto one scale and all scales would load onto a secondary order factor of overall smoking motivation. What most have found is that items load onto the correct scales (Piper et al., 2004; Smith et al., 2010), but the scales do not tend to load onto just one factor; on the contrary, they load onto two factors of PDM and SDM (Piper et al., 2008; Piasecki et al., 2011). We refrained from this approach to our study due to sample size. In order to do such a study, it would be ideal to have a much higher participant-to-item ratio (Costello & Osborne, 2005). Thus, we looked at higher-order factors structure using an EFA approach where scale scores were observed and treated as items. We utilized the WISDM-37 which does not contain Behavior Choice Melioration and combines Positive and Negative Reinforcement subscales into one Affective Enhancement factor. While somewhat unlikely, this could have impacted our loadings and may account for some of the differences in findings. It is possible that some of the differences between our study findings and those obtained from prior investigators have to do with differences in the measures used or differences in approach to factor analysis.

In our second hypothesis, we argued that at least one of the emerging factors would be clearly related to affect regulation and have associations to stress and/or personality traits associated with strongly affect regulation. We found minimal support for this hypothesis. On the one hand, our second factor appeared to be composed of a number of scales related to smoking as a function of regulating affect or stimulation (e.g., Affective Enhancement; Cognitive Enhancement). One could argue that this grouping of clearly affect-related scales supports the first portion of our hypothesis. This factor,

however, failed to show strong associations with the Neuroticism Factor and the Neuroticism Facets. In fact, counter to expectations, the first factor was the only factor to show a significant relationship with a Neuroticism Facet, and this was with immoderation. This finding is not surprising in that scales such as Loss of Control and Automaticity clearly be expected to be associated with the chronic difficulties resisting temptation. Further, immoderation is associated with the tendency to engage in habitual behaviors and difficulty disrupting well-practiced behavioral routines, especially when they bring about immediate pleasure. Overall, the failure to obtain significant associations between our second factor and the Neuroticism Facets and Factor within our sample limits our ability to argue that our second factor involves trait-like affect dysregulation.

Failure to obtain support for this assumption is surprising given considerable research linking smoking to affect-dysregulation generally and Neuroticism specifically. Malouff and colleagues' (2006) meta-analysis indicated that higher Neuroticism levels are associated with smoking across many studies.Various other studies have also linked Neuroticism to higher levels of smoking (Terraciano & Costa, 2004; Folestan, Hamsan, & Abdullah, 2015).

While speculative in nature, exploratory post-hoc analyses do support the notion that associations between smoking motivation factors and affect regulation may vary as a function of level of dependence. First, the WISDM-37 smoking motives differed significantly across the Low-to-Mild Dependence groups and the Moderate-to-High Dependence group. The more dependence an individual endorsed, the more highly he or

she was likely to rate WISDM subscales. Results were nearly identical when smokers were broken into four groups (i.e., Low, Mild, Moderate, High). This is consistent with the original goal of the WISDM measures, which was to gauge dependence of smokers using a wider range of indices and broader conceptualization of dependence. Second, the role of affect regulation in relation to smoking dependence, motivation, and behaviors may vary as a function of dependence. Indeed, Zvolenksy and colleagues (2015) found Neuroticism to associate with increased likelihood of lifetime smoking and progression from casual to daily smoking. Thus, those with higher levels of neuroticism were more likely to become dependent over time. Nonetheless, it is possible that as one becomes more dependent one is less motivated to smoker as a function of neuroticism and more like to smoke due to physical dependence and addiction. Thus, associations between affect regulation variables and smoking motivation may vary across levels of nicotine dependence.

As we speculate above, it is possible that associations between affect regulation characteristics and smoking motives may be masked when level of dependence is not accounted for. Our post-hoc interaction analyses were intended to explore this possibility. We explored interactions between dependence levels (Low-to-Mild and Moderate-to-High Dependence groups) and Neuroticism facets and found that including some of these interactions aided in predicting Factor scores. This suggests that dependence level plays a role in whether personality traits, particularly affect-related traits, affect the reasons for which people smoke. It appears that controlling for dependence may be an important step in studying the relationship between personality and smoking motives.

In the third hypothesis, we expected to find that at least one smoking motivation factor would show a strong association with physiological dependence. Though based on a slightly different conceptualization of dependence, the WISDM-37 was also intended to assess physiological indicators of nicotine dependence, including withdrawal symptoms, tolerance, and cravings. As expected, both of the factors that emerged in our study were strongly associated with a widely used measure of nicotine dependence. This is consistent with prior findings linking WISDM subscales and PDMs/SDMs to nicotine dependence (Piper, McCarthy, Bolt, Smith, Lerman, Benowitz, Fiore, and Baker, 2008; Piper, Piasecki, Federman, Bolt, Smith, Fiore, and Baker, 2004; Smith et al., 2010). Thus, as its authors intended, the WISDM-37 appears to tap into a variety of physiological motivations (e.g., Factor 1 subscales) linked to nicotine dependence. Further, scales tapping social motives, affect-related motives, and environmental cues (i.e., Factor 2 subscales) also appear to be relevant to highly dependent smokers. The WISDM model holds that the more motives an individual has for smoking, the more dependent he or she is likely to be. Though the model proposes that motivation may occur from physical dependence, internal emotion-related sources, or external triggers, it also assumes that motives co-occur and that high scores across a wider range of motives would be expected to be associated with greater overall dependence. Of course, this study was not designed to explore if the WISDM model was somehow stronger or more valid for assessing dependence. Future studies that use both physical based measures of dependence, like the FTND-R, and broader measures like the WISDM-68 or WISDM-37 to predict key outcomes are needed to determine which approach is better (Fagerstrom, 1978; Kenford et al., 2002; Robinson & Berridge, 1993, Piper et al., 2004).

In our fourth hypothesis, we predicted that at least one smoking motivation factor would emerge that would explain the relationship between affect regulation traits and nicotine dependence. Though, as noted above, affect regulation variables have been frequently linked to nicotine dependence no prior study has sought to determine if these relationships are mediated by distinct smoking motives. Given that the PDMs and SDMs factors from the WISDM have been shown to be related to nicotine dependence, we speculated that at least one factor would emerge that could mediate associations between affect regulation variables and nicotine dependence. Such a finding would be consistent with the WISDM model which views dependence as being expressed in a number of ways. We failed, however, to find any evidence for this hypothesis. In fact, we could not even test our model as we failed to find any relationship between nicotine dependence and the Neuroticism Factor. In addition, Neuroticism was predicted to act as a protective factor for smoking behaviors; no such association was found.

There are a number of reasons why our study may have deviated from the typical pattern of findings. First, our sample consisted of a disproportionate amount of highly dependent smokers; 71.5% of the sample was considered to have a moderate or high dependence (above 5 on the FTND-R). Second, and related, many studies focused on samples of young/college participants who were in the early stages of initiation of smoking. Third, most studies had a much higher sample size than the 200 participants in this study. It is possible that the current study did not find links between Neuroticism Facets and the smoking motivation Factors because dependence, once established, involves repetitive behaviors characteristic of addiction. These repetitive behaviors may supersede individual differences in personality traits. In other words, once addicted

smokers may appear more similar in nature due to the addiction and personality traits may exert less influence on their behaviors (at least with regard to smoking behaviors). It is possible that studies using occasional smokers, social smokers, or recent smokers may have an easier time establishing links between personality traits and motives for smoking and dependence. Alternatively, it may be that personality plays a role in the initiation of smoking, but plays a less significant role in maintaining smoking behaviors over time. Also, as noted above, it is possible that in our sample associations between affect-regulation variables and nicotine dependence may have been masked given that the majority of our sample was moderate-to-high in dependence.

In our exploratory analyses we examined some additional relationships in our data that we decided to explore post-hoc. We found several notable things in regards to factors impacting smoking motivation. Several important correlations were identified that substantiated the quality of the data. As expected, smokers who reported smoking for a longer time showed higher dependence scores (FTND-R). Older individuals rated themselves higher on loss of control; this could be linked to lowered executive functioning with aging. Older individuals also indicated more difficulty with resisting cue exposure motivation to smoke. Finally, in regards to age, older individuals endorsed more cravings. It may be that they have more cravings as they become older and more dependent, and they are harder to deal with. Again, these speculative assertions should be treated with caution until they can be further assessed by future research efforts.

Overall, several aspects of our findings seem to fit the incentive sensitization theory (Robinson & Berridge, 1993), which posits that the reward system (dopamine and

related systems) become transformed towards higher sensitivity by continued drug use in some individuals. The theory suggests that the rewards system changes normal stimuli (e.g. cues) into incentive stimuli, intensifying and individuals wanting of a substance, even if the individual no longer likes the substance (Robinson, Robinson, & Berridge, 2013). This may explain cravings and substance-directed behaviors in some smokers, even those who no longer like smoking and do not smoke for any enjoyment or enhancement purposes. It may be that the limited findings regarding associations between smoking motives and affect regulation/dysregulation in this study can in part be explained by the presence of incentive sensitization in some participants considered to have higher dependence. We speculate that if this is the case, smoking in the more dependent portion of the sample may be attributed to wanting as the main motivation for smoking. The concept of wanting a substance appears highly related to Primary Dependence Motives (e.g. Craving), as well as the Cue Exposure motive, which this study found to group with the PDMs. However, as this study was not measuring neuropsychological aspects of smoking dependence, this is only speculation.

Strengths and Limitations of the Current Study

This study utilized a sample from Amazon's Mechanical Turk, a crowdsourcing website that grants requesters access to workers such as research participants. Precautions were taken to ensure the likelihood of receiving valid data (e.g. validity items, high approval ratings of participants) and analyses showed them to be seemingly successful.

The measures used in this study were shown to be valid and reliable by previous studies (Piper et al., 2004; Smith et al., 2010; Heatherton, Kozlowski, Frecker, &

Fagerström, 1991; Korte, Capron, Zvolensky, & Schmidt, 2013; Johns & Srivastava, 1999; Johnson, 2014; Kamarck, & Memelstein, 1983), and their nature suggested they were appropriate for the goals of this study.

Despite efforts made to ensure validity of measures and recruitment of a solid sample, this study found limited support for the proposed hypotheses. Several factors may have contributed to the limited nature of the findings.

Sample size is a crucial factor that affects the strength of findings in any given study. While the sample appeared solid, it was limited to 200 people due to funding. This may have contributed to the minuteness of the findings, particularly given the factor analytic nature of the study. This sample size was adequate for a scale-level EFA, fitting the goals of this study; however, a higher number of participants may have produced clearer results. Furthermore, an item-level factor analysis, which would likely provide better information, would require as many, or more, participants per item as this study had per scale.

A large limitation of this study is the high percentage of highly dependent smokers in the sample (71.5% of participants being classified as Moderate-to-High Dependence by FTND-R cutoffs). It appears that dependence trumped the impact personality may have on motives. It is likely that when a smoke reaches a state of smoking dependence, most motives and personality associations get washed out. Primary Dependence Motives (Piper et al., 2008; Piasecki et al., 2010) account for much of the smoking behavior, and dependence as a whole drives the smoking, making specific motivations hard to pick out, both for participants and researchers. It appears that

personality may affect routes that lead to smoking and take individuals from casual smoking to dependence, but lose relevance as dependence takes over.

An important factor affecting results of such a study is the distinction between initiation versus maintenance of smoking behaviors. Personality likely plays a different role in motivation in initiation of smoking behaviors rather than the maintenance of dependent smoking behaviors. This study did not explore the difference in stages of smoking, and the majority of the sample were dependent smokers; minimal significant associations between personality and smoking motives were found, indicating that level of smoking is likely a crucial factor.

Potential Methodological Improvements and Considerations for Future Research

Based on limitations noted above, several methodological improvements are recommended for future studies exploring similar concepts and hypotheses and using the WISDM measures. As mentioned above, factor analyses call for a large amount of participants per item. A sample size that has more participants per subscale (WISDM-37) would address this concern. Furthermore, an item-level rather than scale level analysis may be beneficial, needing even more participants (e.g.Costello & Osborne, 2005).. Future studies utilizing the WISDM-37 would benefit from much higher sample sizes.

Based on exploratory analyses, it appears that controlling for dependence may be important to examining the relationship between personality and smoking motives. Future studies may also benefit from including more casual/non-dependent smokers, both

by FTND-R cutoffs and other dependence measures. Dependence should carefully be defined in order group to properly identify those who are non-dependent smokers.

It may also be advisable for measures to be chosen to assess both initiation and maintenance stages for a smoker. It may be useful to focus future studies to a sample of smokers who recently initiated smoking in order to accurately assess the initiation stage. It may be useful to explore personality and smoking motive associations in younger individuals (e.g. high school students) who have recently initiated, clinical populations where personality factors may be more dramatically defined, or cessation seeking populations who may be more motivated towards careful introspection into their motivations, having battled them in attempts to quit.

A future longitudinal study assessing at-risk individuals may address these deficits by assessing personality prior to smoking initiation or early in initiation as well as down the road as dependence does or does not develop.

Conclusion

The main purpose of the present study was to explore whether over-reaching higher-order factors of smoking motives could be identified using the WISDM-37 subscales, particularly to test if one of them would be related to affect regulation. Based on theory, validated methods were selected to assess personality, smoking motives, nicotine dependence, and stress in order to explore whether motives may be grouped into higher-order factors such as affect-regulation. The present study supported prior work suggesting a two-factor structure for expalining variance in the WISDM model subscales.

This approach suggests that subscales can be grouped in terms of Primary and Secondary Dependence Motives. The present research extends prior research with the WISDM-68 to the WISDM-37, showing that the factor model appears largely stable.

Most of our hypotheses with regard to the role of affect regulation in smoking motivation were not substantiated. It seems possible that dependence level may have strongly affected our results in this area. It appeared that as dependence level increased, personality had less impact on smoking motivation. Since the sample in this study consisted of primarily dependent smokers, repeating the study with a higher sample size and higher number of smokers with lower levels of dependence. In fact, it may be important for researchers interested in links between individual difference variables and smoking motivation to plan to control for dependence in advance of their studies and to consider this when forming hypotheses.

In the larger context, the gap between our findings and other research in this area suggest a possibility that personality factors and facets may play different roles in initiation and early stages of smoking than in established dependence. This is, at this time, simply speculation. Future empirical exploration of these possibilities is needed to substantiate such claims. If such research clarified differences in smokers at various stages of dependence, then it may be possible for clinical studies to take the step of determining if these differences are useful for understanding clinically-relevant outcomes (e.g., likelihood of stopping; treatment outcome; response to intervention). Literature is lacking in studies of smoking motivation in general, especially in relationship to personality.Facet-level exploration of personality factors often linked to smoking

(Neuroticism and Conscientiousness) is also limited in literature. Future studies should continue to explore smoking motivation and personality, especially the changes in these factors as a person goes from non-dependent to dependent, as smoking behavior is far from being eradicated, despite health concerns. Following methodological improvements, it is foreseeable that literature may find larger groupings of smoking motivation and associations between personality factors and smoking motivation within a non-dependent or newly initiated sample of smokers. This may help aid understanding of smoking behaviors and progression from initiation to dependence.

Understanding the roles personality has in the motives driving individuals to smoke, as well as understanding the motives themselves, could add to the arsenal used for smoking prevention, cessation treatment, and future research. Understanding individual personalities and motivations, as well as interactions, may help clinicians and community programs achieve higher success rates in prevention and cessation outcomes and add to our arsenal of tools for understanding and addressing addiction.

TABLES

Table 1
WISDM-37 Descriptive Statistics

	Mean (SD)	Skew	Kurtosis	Cronbach's α
Affiliative Attachment	3.49(1.71)	0.16	-0.97	0.87
Automaticity	4.07(1.68)	-0.18	-0.84	0.92
Loss of Control	4.19(1.57)	-0.12	-0.63	0.88
Cognitive Enhancement	4.72(1.46)	-0.62	0.06	0.86
Crave	4.92(1.53)	-0.63	-0.22	0.89
Cue Exposure/Assoc. Proc.	4.89(1.34)	-0.72	0.48	0.76
Social and Environ. Goads	4.11(1.73)	-0.1	-0.95	0.92
Taste	4.99(1.51)	-0.76	0.13	0.9
Tolerance	3.96(1.60)	-0.13	-0.5	0.82
Weight Control	3.17(1.67)	0.27	-0.95	0.83
Affective Enhancement	4.99(1.34)	-0.65	0.05	0.8
Total WISDM	47.51(11.56)	-0.58	0.94	0.88

Notes. N=200

Table 2
FTND-R, BFI, PSS-10 and IPIP-J Neuroticism Descriptive Statistics

	Mean (SD)	Skew	Kurtosis	Cronbach's α
FTND-R Total	6.04(3.18)	0.23	0.26	0.72
BFI	-	-	-	-
Extraversion	2.94(.88)	-0.03	-0.77	0.85
Agreeableness	3.66(.82)	-0.26	-0.48	0.86
Conscientiousness	3.84(.76)	-0.15	-0.78	0.87
Neuroticism	2.75(1.00)	0.12	-0.79	0.90
Openness	3.7(.74)	-0.37	-0.14	0.87
PSS-10 Total	17.53(8.50)	0.00	-0.50	0.91
IPIP-J Neuroticism	65.97(19.58)	0.05	-0.60	0.94
Anxiety	11.24(4.56)	0.07	-0.93	0.87
Anger	10.62(4.23)	0.33	-0.66	0.85
Depression	10.25(4.72)	0.30	-1.07	0.88
Self-Consciousness	11.96(3.96)	0.07	-0.77	0.76
Immoderation	11.53(3.36)	-0.08	-0.50	0.73
Vulnerability	10.38(4.08)	0.23	-0.77	0.73

Notes. N = 200; descriptives for BFI not calculated.

Table 3
Inter-correlations between the WISDM-37 Subscales

		WISDM-37										
WISDM-37 Subscales		1	2	3	4	5	6	7	8	9	10	11
1	Affiliative Attachment	-										
2	Automaticity	.36**	-									
3	Loss of Control	.44**	.53**	-								
4	Cognitive Enhancement	.46**	.45**	.36**	-							
5	Craving	.47**	.61**	.78**	.52**	-						
6	Cue and Assoc. Proc.	.48**	.47**	.47**	.64**	.51**	-					
7	Social and Environ.	.27**	.36**	.32**	.32**	.36**	.31**	-				
8	Taste	.28**	.24**	.31**	.47**	.48**	.46**	.18*	-			
9	Tolerance	.45**	.50**	.73**	.36**	.66**	.56**	.38**	.35**	-		
10	Weight Control	.38**	.21**	.14*	.21**	.09	.14	.13	0.01	0.13	-	
11	Affiliative Attachment	.59**	.40**	.49**	.71**	.63**	.65**	.29**	.52**	.50**	.19**	-

Note: * = $p < .05$; ** $p < .01$

Table 4
Inter-correlations between the IPIP-J Neuroticism Scales

		IPIP-J Neuroticism Scales						
IPIP-J Neuroticism Scales		1	2	3	4	5	6	7
1	Anxiety	-						
2	Anger	.66**	-					
3	Depression	.75**	.61**	-				
4	Self Consciousness	.59**	.43**	.60**	-			
5	Immoderation	.26**	.17*	.33**	.24**	-		
6	Vulnerability	.86**	.63**	.71**	.58**	.30**	-	
7	IPIP-J N Total	.90**	.77**	.88**	.74**	.46**	.89**	-

Table 5
EFA Factor Loadings for Factors with Eigenvalues Above 1.0.

WISDM-37 Subscales	Factor 1	Factor 2	Factor 3	h^2
Affiliative Attachment	.20	**.52**	-.38	.64
Automaticity	**.73**	-	-	.57
Loss of Control	**.90**	-	-	.78
Cognitive Enhancement	-	.24	**-.75**	.69
Craving	**.75**	-	-.30	.84
Cue Exposure/Associative Processes	**.53**	-	**-.44**	.70
Social and Environmental Goads	**.59**	-	-	.34
Taste	-	-	-	.69
Tolerance	**.85**	-	**-.85**	.71
Weight Control	-	**.92**	-	.82
Affective Enhancement	-	-	**-.77**	.80

*Notes.*Principal Axis Factoring; factor loadings < .20 not shown; boldface type indicates loadings considered significant for interpretation.

Table 6
EFA Factor Loadings for WISDM-37 Subscales After Varimax Rotation

WISDM-37 Subscales	Factor 1	Factor 2	h^2
Affiliative Attachment	.35	**.54**	.41
Automaticity	**.56**	.33	.41
Loss of Control	**.86**	.21	.79
Cognitive Enhancement	.24	**.76**	.63
Craving	**.80**	.43	.82
Cue Exposure/Associative Processes	**.61**	**.51**	.63
Social and Environmental Goads	.35	.25	.18
Taste	.27	**.48**	.30
Tolerance	**.74**	.28	.62
Weight Control	-	.24	.06
Affective Enhancement	.35	**.83**	.81

*Notes.*Principal Axis Factoring; factor loadings < .20 not shown; boldface type indicates loadings considered significant for interpretation.

Table 7
Correlations between IPIP-J Neuroticism Facets, PSS-10, and FTND-R with Extracted Factors

	Extracted Factors	
	Factor 1	Factor 2
IPIP-J Neuroticism	.12	.09
Anxiety	.13	.13
Anger	.02	-.03
Depression	.03	.02
Self Consciousness	.11	.14
Immoderation	.22**	.13
Vulnerability	.08	.06
PSS-10 Total	.07	.04
FTND-R Total	.64**	.43**

Note: * = $p < .05$; ** $p < .01$

Table 8
Independent t-test Results Comparing WISDM-37 Subscales in Two Dependence Groups: Low-to-Mild Dependence and Moderate-to-High Dependence Smokers

	Low-to-Mild Dependence	Moderate-to-High Dependence			
WISDM-37 Subscales	Mean (SD)	Mean (SD)	*t*	*p*	*d*
Affiliative Attachment	2.94 (1.40)	3.71 (1.77)	2.93	<0.01	0.42
Automaticity	3.14 (1.34)	4.44 (1.66)	5.26	<0.01	0.75
Loss of Control	3.20 (1.42)	4.58 (1.45)	6.09	<0.01	0.86
Cognitive Enhancement	4.0 (1.49)	5.00 (1.34)	4.59	<0.01	0.65
Cravin	3.75 (1.34)	5.39 (1.33)	7.84	<0.01	1.11
Cue Exposure/Assoc. Proc.	4.20 (1.32)	5.16 (1.25)	4.80	<0.01	0.68
Social and Environ. Goads	3.32 (1.47)	4.43 (1.72)	4.27	<0.01	0.61
Taste	4.43 (1.53)	5.21 (1.45)	3.42	<0.01	0.49
Tolerance	2.67 (1.44)	4.48 (1.35)	8.40	<0.01	1.19
Weight Control	3.09 (1.57)	3.20 (1.72)	0.41	0.68	0.06
Affective Enhancement	4.23 (1.37)	5.29 (1.20)	5.40	<0.01	0.76
Total WISDM	38.99 (11.01)	50.91 (9.94)	7.42	<0.01	1.05

Notes. Equal variances assumed; 2-tailed

Table 9
One-way ANOVA Results Comparing Four Dependence Level Groups: Low Dependence, Mild Dependence, Moderate Dependence, and High Dependence

	Low Dependence	Mild Dependence	Moderate Dependence	High Dependence		
WISDM-37 Subscales	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	*F*	*p*
Affiliative Attachment	2.33 (1.17)	3.45 (1.39)	3.54 [a,] (1.65)	3.96 [a,] (1.92)	5.90	<0.01
Automaticity	2.49(1.18)	3.69 [a,] (1.24)	4.03 [a,] (1.64)	5.04 [a,b, c] (1.50)	18.69	<0.01
Loss of Control	2.51(1.29)	3.78 [a,] (1.29)	4.17 [a,] (1.28)	5.17 [a,b, c] (1.49)	24.91	<0.01
Cognitive Enhancement	3.58(1.60)	4.35(1.32)	4.97(1.28) [a,]	5.05 [a,] (1.46)	8.67	<0.01
Craving	3.11(1.41)	4.28 [a,] (1.02)	5.10 [a,b] (1.28)	5.80 [a,b, c] (1.32)	30.04	<0.01
Cue Exp./Assoc. Proc.	3.78(1/37)	4.56(1.18)	4.96 [a,] (1.22)	5.44 [a,] (1.26)	11.60	<0.01
Social Environ Goads	2.76(1.50)	3.80(1.30)	4.23 [a,] (1.63)	4.71 [a,] (1.82)	9.16	<0.01
Taste	4.22(1.54)	4.60(1.53)	5.18 [a,] (1.33)	5.26 [a,] (1.60)	4.23	0.01
Tolerance	1.98(1.26)	3.24 [a,](1.35)	4.07 [a,b,] (1.22)	5.07 [a,b c] (1.32)	39.21	<0.01
Weight Control	2.41(1.22)	3.67 [a,] (1.61)	3.38(1.75)	2.94(1.66)	3.66	0.01
Affective Enhancement	3.94(1.47)	4.48(1.26)	5.19 [a,b] (1.18)	5.43 [a,b c] (1.22)	11.13	<0.01
Total WISDM	33.12(10.64)	43.91 [a,] (8.77)	48.82 [a,b] (9.82)	53.88 [a,b c] (9.41)	29.76	<0.01

Note: [a] = Bonferroni Post Hoc test indicates that this value is statistically larger than the mean value for the Low Dependence group;
[b] = Bonferroni Post Hoc test indicates that this value is statistically larger than the mean value for the Mild Dependence group;
[c] = Bonferroni Post Hoc test indicates that this value is statistically larger than the mean value for the Moderate Dependence group.

FIGURES

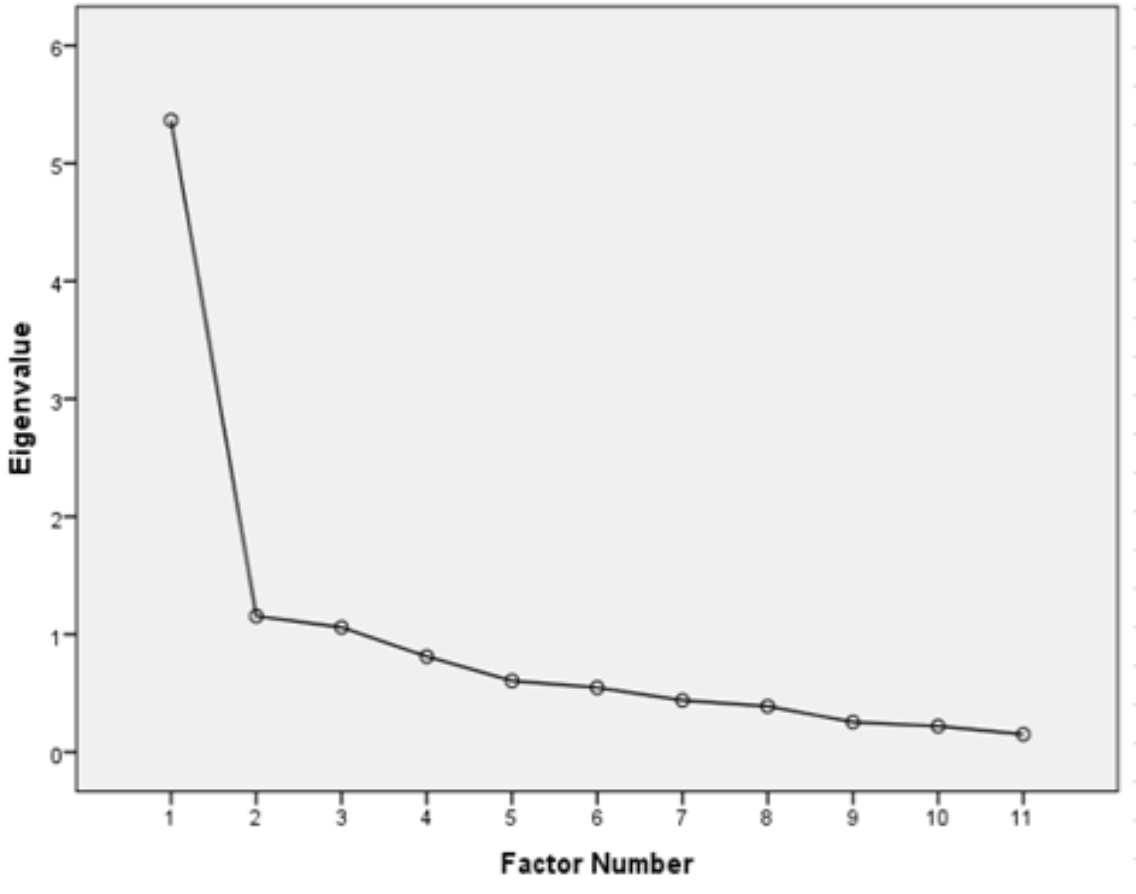

Figure 1. Scree Plot of Eigenvalues for EFA-extracted Factors.

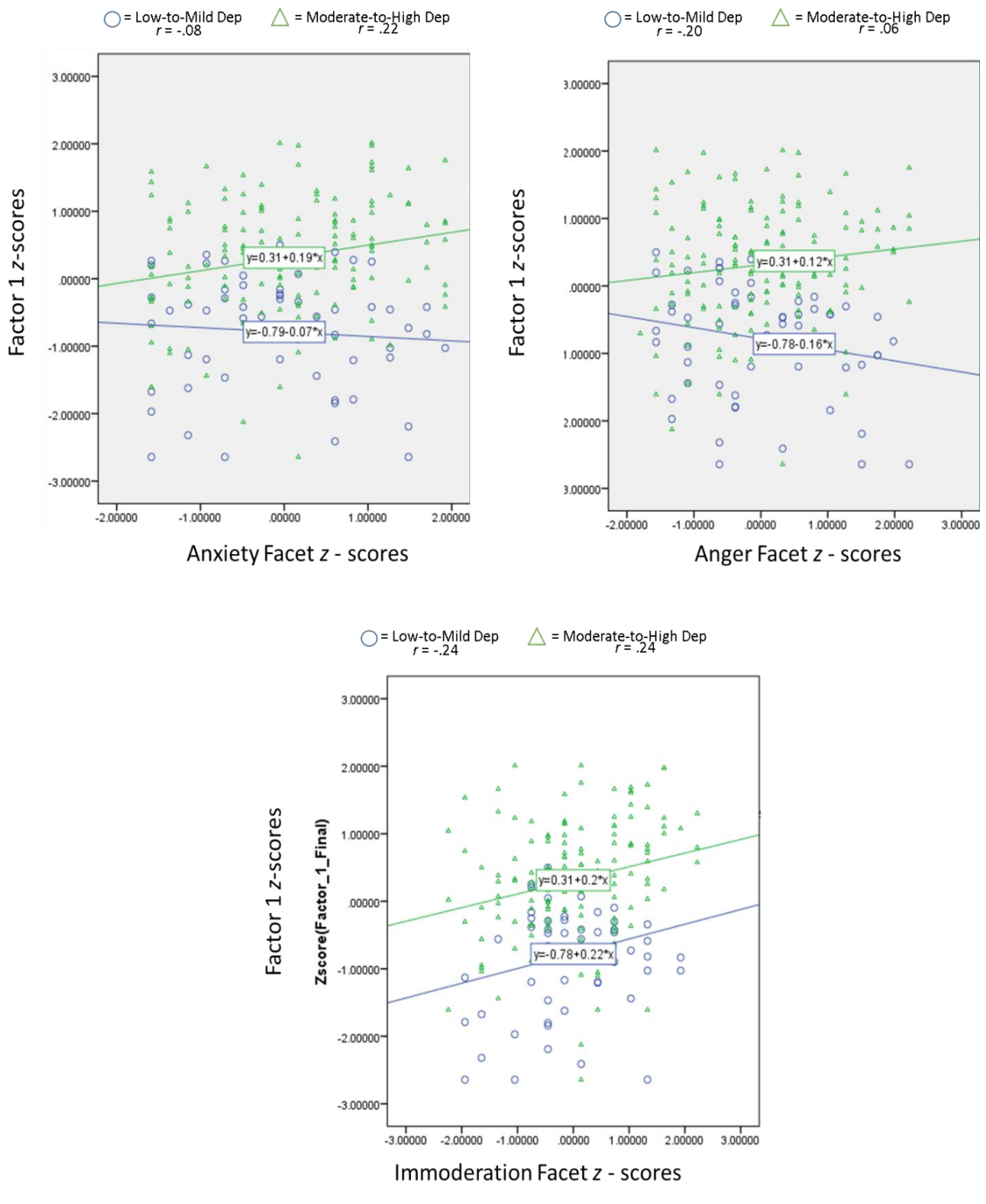

Figure 2. Charts Depicting Differential Associations of Factor 1 Scores with the Anxiety Facet, Anger Facet, and Immoderation Facet.

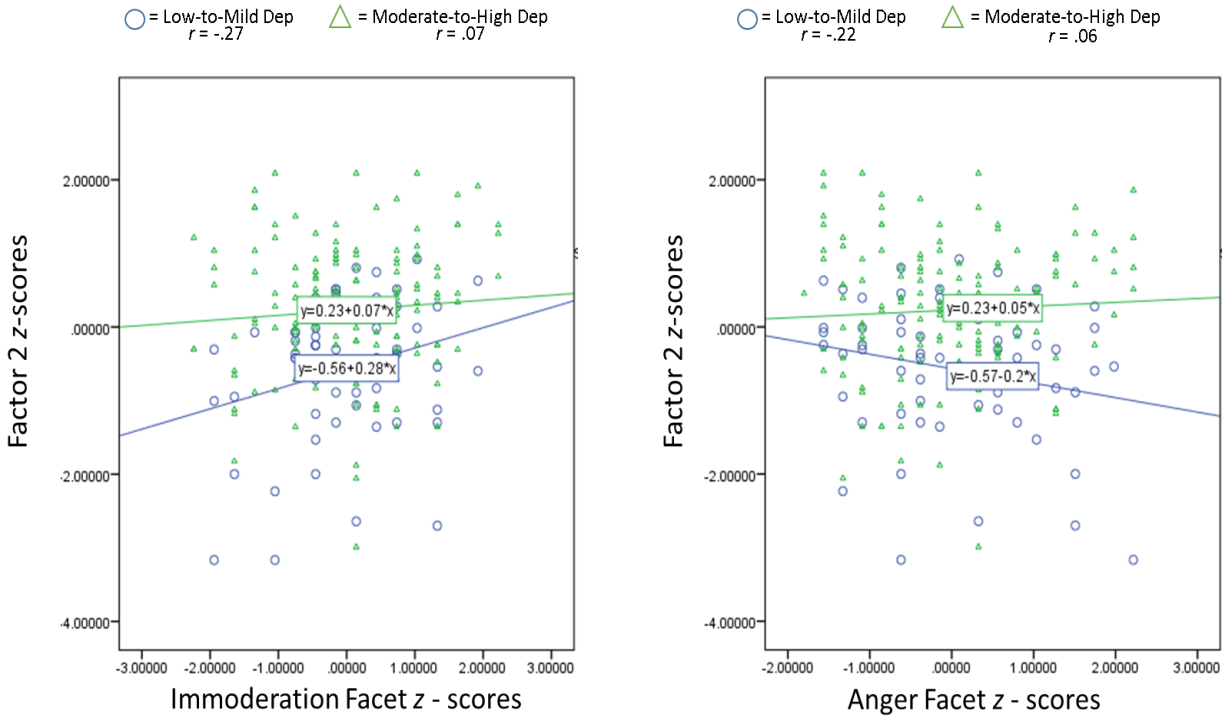

Figure 3. Charts Depicting Differential Associations of Factor 2 Scores with the Immoderation Facet and Anger Facet.

APPENDIX A: Brief Wisconsin Inventory of Smoking Dependence Motives

(WISDM-37)

WISDM-37

Below are a series of statements about cigarette smoking. Please rate your level of agreement for each using the following scale:

		1	**2**	**3**	**4**	**5**	**6**	**7**
		Not true of me at all						**Extremely true of me**
1.	I often smoke without thinking about it.	1	2	3	4	5	6	7
2.	Cigarettes control me.	1	2	3	4	5	6	7
3.	I usually want to smoke right after I wake up.	1	2	3	4	5	6	7
4.	It's hard to ignore an urge to smoke.	1	2	3	4	5	6	7
5.	The flavor of a cigarette is pleasing.	1	2	3	4	5	6	7
6.	I frequently smoke to keep my mind focused.	1	2	3	4	5	6	7
7.	I rely upon smoking to control my hunger and eating.	1	2	3	4	5	6	7
8.	My life is full of reminders to smoke.	1	2	3	4	5	6	7
9.	Smoking helps me feel better in seconds.	1	2	3	4	5	6	7
10.	I smoke without deciding to.	1	2	3	4	5	6	7
11.	Cigarettes keep me company, like a close friend.	1	2	3	4	5	6	7
12.	There are particular sights and smells that trigger strong urges to smoke.	1	2	3	4	5	6	7
13.	Smoking helps me stay focused.	1	2	3	4	5	6	7

14.	I frequently light cigarettes without thinking about it.	1	2	3	4	5	6	7
15.	Most of my daily cigarettes taste good.	1	2	3	4	5	6	7
16.	Sometimes I feel like cigarettes rule my life.	1	2	3	4	5	6	7
17.	I frequently crave cigarettes.	1	2	3	4	5	6	7
18.	Most of the people I spend time with are smokers.	1	2	3	4	5	6	7
19.	Weight control is a major reason that I smoke.	1	2	3	4	5	6	7
20.	Some of the cigarettes I smoke taste great.	1	2	3	4	5	6	7
21.	I'm really hooked on cigarettes.	1	2	3	4	5	6	7
22.	Sometimes I feel like cigarettes are my best friends	1	2	3	4	5	6	7
23.	My urges to smoke keep getting stronger if I don't smoke.	1	2	3	4	5	6	7
24.	Seeing someone smoke makes me really want a cigarette.	1	2	3	4	5	6	7
25.	I find myself reaching for cigarettes without thinking about it.	1	2	3	4	5	6	7
26.	I would feel alone without my cigarettes.	1	2	3	4	5	6	7
27.	A lot of my friends or family smoke.	1	2	3	4	5	6	7
28.	Other smokers would consider me a heavy smoker.	1	2	3	4	5	6	7
29.	When I haven't been able to smoke for a few hours, the craving gets intolerable.	1	2	3	4	5	6	7
30.	Most of my friends and acquaintances smoke.	1	2	3	4	5	6	7
31.	I smoke within the first 30 minutes of awakening in the morning.	1	2	3	4	5	6	7
32.	Smoking helps me think better.	1	2	3	4	5	6	7

33.	Smoking really helps me feel better if I've been feeling down.	1	2	3	4	5	6	7
34.	Smoking keeps me from overeating.	1	2	3	4	5	6	7
35.	My smoking is out of control.	1	2	3	4	5	6	7
36.	I consider myself a heavy smoker.	1	2	3	4	5	6	7
37.	Even when I feel good, smoking helps me feel better.	1	2	3	4	5	6	7

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APPENDIX B: Fagerström Test for Nicotine Dependence—Revised (FTND-R)

FTND-R

1. How many cigarettes a day do you smoke?
0 = less than 10
1 = 11–20
2 = 21–30
3 = 31+

2. Do you smoke more in the morning than the rest of the day?
0 = never
1 = sometimes
2 = most of the time
3 = always

3. How soon after you wake up do you have your
first cigarette?
3 = within 5 min
2 = 6–30 min
1 = 21–30 min
0 = after 60 min

4. Cigarette most hate to give up
1 = first in the morning
0 = all others

5. Do you find it difficult to refrain from smoking in places where it is forbidden, for example, in church, at the library, in the cinema, etc.?
1 = sometimes
2 = most of the time
3 = always

6. Do you smoke if you are so ill that you are in
bed most of the day?
0 = never
1 = sometimes
2 = most of the time
3 = always

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APPENDIX C: Perceived Stress Scale (PSS-10)

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?..... **0 1 2 3 4**

2. In the last month, how often have you felt that you were unable to control the important things in your life? **0 1 2 3 4**

3. In the last month, how often have you felt nervous and "stressed"? **0 1 2 3 4**

4. In the last month, how often have you felt confident about your ability to handle your personal problems? **0 1 2 3 4**

5. In the last month, how often have you felt that things were going your way?..... **0 1 2 3 4**

6. In the last month, how often have you found that you could not cope with all the things that you had to do? **0 1 2 3 4**

7. In the last month, how often have you been able to control irritations in your life?..... **0 1 2 3 4**

8. In the last month, how often have you felt that you were on top of things?.. **0 1 2 3 4**

9. In the last month, how often have you been angered because of things that were outside of your control?..... **0 1 2 3 4**

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? **0 1 2 3 4**

Please feel free to use the *Perceived Stress Scale* for your research.

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APPENDIX D – Big Five Inventory (BFI)

The Big Five Inventory (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please select a number for each statement to indicate the extent to which you agree or disagree with that statement.

1-Disagree strongly 2- Disagree a little 3- Neither agree nor disagree 4 –Agree a little 5- Agree strongly

I see Myself as Someone Who...
____1. Is talkative
____2. Tends to find fault with others
____3. Does a thorough job
____4. Is depressed, blue
____5. Is original, comes up with new ideas
____6. Is reserved
____7. Is helpful and unselfish with others
____8. Can be somewhat careless
____9. Is relaxed, handles stress well
____10. Is curious about many different things
____11. Is full of energy
____12. Starts quarrels with others
____13. Is a reliable worker
____14. Can be tense
____15. Is ingenious, a deep thinker
____16. Generates a lot of enthusiasm
____17. Has a forgiving nature
____18. Tends to be disorganized
____19. Worries a lot
____20. Has an active imagination
____21. Tends to be quiet
____22. Is generally trusting
____23. Tends to be lazy
____24 Is emotionally stable, not easily upset
____25 Is inventive
____26 Has an assertive personality
____27 Can be cold and aloof

____28 Perseveres until the task is finished
____29 Can be moody
____30 Values artistic, aesthetic experiences
____31 Is sometimes shy, inhibited
____32 Is considerate and kind to almost everyone
____33 Does things efficiently
____34 Remains calm in tense situations
____35 Prefers work that is routine
____36 Is outgoing, sociable
____37 Is sometimes rude to others
____38 Makes plans and follows through with them
____39 Gets nervous easily
____40 Likes to reflect, plays with ideas
____41 Has few artistic interests
____42 Likes to cooperate with others
____ 43 Is easily distracted
____44 Is sophisticated in art, music, literature

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APPENDIX E - International Personality Item Pool-NEO-120 (IPIP-J) –

Neuroticism Facets

Please decide how accurate these statements are about you, using the following scale: 1- Very inaccurate 2- Moderately inaccurate 3- Neither inaccurate nor accurate 4 – Moderately accurate 5- Very accurate

N1 Anxiety
- Worry about things
- Fear for the worst
- Am afraid of many things
- Get stressed out easily

N2 Anger
- Get angry easily
- Get irritated easily
- Lose my temper
- Am not easily annoyed

N3 Depression
- Often feel blue
- Dislike myself
- Am often down in the dumps
- Feel comfortable with myself

N4 Self-Consciousness
- Find it difficult to approach others
- Am afraid to draw attention to myself
- Only feel comfortable with friends
- Am not bothered by difficult social situations

N5 Immoderation
- Go on binges
- Rarely overindulge
- Easily resist temptations
- Am able to control my cravings

N6 Vulnerability
- Panic easily
- Become overwhelmed by events
- Feel that I’m unable to deal with things
- Remain calm under pressure

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