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THE INFLUENCE OF INDIVIDUAL TRAITS ON ABSTINENCE SELF-EFFICACY IN DEPENDENT SMOKERS

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ABSTRACT

The majority of cigarette smokers express a desire to quit; however, many smokers struggle to achieve and maintain abstinence. Relapse frequently occurs soon after smoking cessation, and most smokers have multiple unsuccessful quit attempts. Abstinence self-efficacy (ASE) has been shown to be a critical component in successful smoking cessation outcomes. Developed from Social Cognitive Theory, self-efficacy is an individual's judgment of his or her own ability to execute a behavior in a prospective situation. Higher ASE is linked with decreased negative withdrawal symptoms and increased likelihood of abstinence. Although nicotine dependence and craving have been shown to be associated with ASE, few studies have investigated theoretical determinants of ASE and the contribution of personality traits. Impulsivity and self-control are two such personality characteristics that can influence how a smoker may respond in highly tempting situations. The inclusion of personality traits in the development of ASE has the potential to inform specific interventions in smoking cessation.

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CHAPTER 1: INTRODUCTION

It is widely known that cigarette smoking is associated with numerous adverse health outcomes, including lung disease, several types of cancer, and increased risk for cardiovascular diseases. Despite this, smoking remains one of the leading causes of preventable death in the United States (Center for Disease Control and Prevention, 1997). One factor that contributes to the ultimately lethal consequences of smoking is the difficulty many smokers experience trying to quit. A recent study indicated that over half of current cigarette smokers expressed a strong desire to quit and reported at least one cessation attempt in the preceding year (McClave et al., 2010). However, approximately 75% of treatment seeking smokers relapse, and the average smoker has multiple unsuccessful quit attempts (Zhou et al., 2009). Therefore, even with the widespread use of therapeutic interventions, the vast majority of dependent, treatment-seeking smokers will likely relapse after a cessation attempt. Relapse Prevention, the predominant cognitive-behavioral model for substance treatment, focuses on two specific strategies: 1) preventing relapse and maintenance of abstinence, and 2) reducing continuation of substance use if an initial lapse occurs (Witkiewitz & Marlatt, 2004).

A defining technique of Relapse Prevention is identification of high-risk situations in which an individual would be susceptible to return to regular substance use. This technique facilitates the assessment of interpersonal, intrapersonal, environmental, and physiological relapse precipitants (Marlatt, 1996). In this therapeutic model, specific environmental and personal characteristics are indentified as "triggers" for substance use. After the identification of relapse triggers, treatment is focused on specific interventions and global self-management strategies. Goals of treatment include teaching effective coping strategies and encouraging mastery over successful outcomes (Witkiewitz & Marlatt, 2004). This combination of treatment

elements results in “relapse road maps”, wherein the therapist and client evaluate possible outcomes that pertain to choices when confronting temptations to smoke. By employing coping strategies in high-risk situations, a client is better able to manage his or her own smoking behavior. Coping strategies are designed to build an individual’s confidence that they can refrain from smoking and prolong abstinence.

Numerous studies have suggested that self-efficacy is a critical component in successful smoking cessation treatment (Bricker et al., 2010; Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992; Gwaltney, Shiffman, Balabanis, & Paty, 2005; Hendricks, Delucchi, & Hall, 2010; Hyde, Hankins, Deale, & Marteau, 2008). Specifically, abstinence self-efficacy (ASE) is defined as the confidence to refrain from smoking in a specific situation and has been shown to be predictive of continued abstinence (Etter, Bergman, Humair, & Perneger, 2000; Gwaltney, Metrik, Kahler, & Shiffman, 2009; Gwaltney et al., 2001; Laudet & Stanick, 2010; Miller, Westerberg, Harris, & Tonigan, 1996; Zheng et al., 2007). High ASE has been linked to reduced cue-induced craving (Nordgren, van der Pligt, & van Harreveld, 2008; Shadel & Cervone, 2006) and positive feelings about abstinence (Berman, Forsberg, Durbeej, Kallmen, & Hermansson, 2010); while smokers with low ASE report a higher frequency of urges to smoke (Gwaltney, Shiffman, Balabanis, et al., 2005; Herd, Borland, & Hyland, 2009) and a reduced likelihood of recovering from lapses once they occur (Marlatt & Donovan, 2005). Despite the clinical significance of ASE and the frequency with which it is measured in smoking treatment studies, very few studies have investigated major determinants of self-efficacy in smokers.

The objective of the present thesis is to address this important knowledge gap by evaluating the relationship between personality characteristics and abstinence self-efficacy in a large sample of adult smokers. Toward this end, the current study will emphasize the role of self-

efficacy in smoking cessation, evaluate the importance of personal mastery and quit attempts in building self-efficacy, and highlight personality factors that may influence self-efficacy (i.e.: impulsivity and self-control) in high risk situations.

Self-Efficacy

Born from Social Cognitive Theory, self-efficacy is an individual's confidence to execute a behavior in a prospective situation (Bandura, 1977). The concept of self-efficacy delves further than social conceptualizations of self-esteem, self-confidence, or self-worth (Maddux & Gosselin, 2005). Bandura describes self-efficacy as the "foundation of human agency" (Bandura, 2001). Personal self-efficacy functions as a reciprocal learning process in which personal beliefs can impact behavior and vice versa (Bandura, 2001). According to Bandura (1977), self-efficacy is derived from four sources: performance accomplishments (personal experiences of success or failure), vicarious experience (exposure to others' success or failure), verbal persuasion (encouragement from others), and physiological states (biofeedback and internal states). Via these four sources of information, self-efficacy directly influences the likelihood an individual will engage in a specific behavior. An individual draws on personal and social experiences to determine how much energy to expend when facing a particular challenge. Thus, the likelihood of success in a prospective situation directly depends on whether an individual believes they are capable of producing the desired results via personal/vicarious experience and/or social encouragement.

The most important, and the most influential, determinant of self-efficacy is personal experience (Bandura, 1977; Bandura, Adams, & Beyer, 1977; Maddux & Gosselin, 2005; Pajares, 1997). Bandura stated that the influence of personal accomplishments is based on the

notion of personal mastery of a behavior. That is, individual successes raise mastery expectations while repeated failures lower them. The impact of failures is amplified if mishaps occur early in the course of events (Bandura, 1977). Personal mastery builds self-efficacy via progressive experiences of success that encourage personal belief in the ability to exercise control and maintain confidence when confronted with difficulties or setbacks.

As mentioned above, self-efficacy is also determined by vicarious experience, verbal persuasion, and emotional arousal (Bandura, 1977). Vicarious experience builds self-efficacy via exposure to others' experience. Bandura cautions that relying on others' experience is considered a far less dependable source of information compared to personal mastery (Bandura, 1977). As a result, efficacy improvements that result from vicarious experience are less likely to persist. Verbal persuasion is perhaps the simplest method to influence behavior; however, it is also the weakest source of self-efficacy (Bandura, 1977). Emotional arousal, the fourth and final source of self-efficacy, exerts influence on behavior via negative physiological states. Emotional arousal impacts self-efficacy primarily while coping with threatening situations and the experience of fear (Bandura, 1977). Compared to other determinants of self-efficacy, treatments that focused on improving personal mastery resulted in stronger, higher, and more generalized expectations of personal efficacy (Bandura, et al., 1977).

Structured mastery programs are one the most effective methods of encouraging personal change (Bandura, 2004). Building self-efficacy by focusing on mastery of behavior has been utilized in numerous public health domains to encourage personal change (Bruvold, 1993; Byma, Given, Given, & You, 2009; Cohen, 2009; Hinton & Olson, 2001; Ozer & Bandura, 1990). For example, patients at risk for cardiovascular disease demonstrated greater adherence, defined as actively participating in the practice and maintenance of health behaviors, with increased self-

efficacy to achieve behavioral change and an individual sense of personal mastery (Cohen, 2009). Similarly, in postpartum women, increased exercise self-efficacy was associated with a greater frequency of exercise (Hinton & Olson, 2001). The authors suggested exercise self-efficacy could be increased by developing inventions using mastery experiences and setting behavioral goals. Finally, the simple act of running for 5, 10, or 20-minute intervals was shown to significantly increase exercise self-efficacy in a population of moderately active female college students (Rudolph & Butki, 1998). The subsequent increase in exercise self-efficacy was also associated with an increase in positive well-being. The above studies demonstrate the inclusion of mastery programs have been successful in increasing individual self-efficacy. Furthermore, research also has found that behavioral interventions that include multiple mastery experiences, relative to those that include a single mastery event, increase the potential for a positive health outcome (Bruvold, 1993).

In addition to Social Cognitive Theory, other theories of behavioral change have incorporated constructs similar to Bandura's model of self-efficacy. Most notably, the Theory of Planned Behavior (TPB) suggests behavior can be directly influenced by behavioral intentions, derived from attitudes and norms, and perceived behavioral control. Perceived behavioral control reflects an individual's self-confidence regarding his or her capacity to carry out a specific behavior (Ajzen, 1991). Ajzen recognized the "role of perceived behavioral control comes from the systematic research program of Bandura and associates" (p.184) (Ajzen, 1991). Previous research has supported a conceptual overlap between perceived behavioral control and self-efficacy (Rodgers, Conner, & Murray, 2008). TPB has been employed in public health and smoking cessation treatment literature. For example, Norman and colleagues (1999) evaluated the impact of perceived behavioral control on intention to quit smoking. They found that the TPB

model predicted 49% of the variance within intention to quit smoking, with perceived behavioral control emerging as the single best predictor of intention to quit smoking (Norman, Conner, & Bell, 1999).

As noted above, available data indicate that personal mastery is the most important determinant of self-efficacy. Expanding on this theory, it is likely that smokers who have experienced multiple failed quit attempts would be more inclined to have low expectations of personal mastery in maintaining abstinence. Many studies have demonstrated the importance of previous quit attempts in predicting successful smoking cessation outcome (Hyland et al., 2006; Hymowitz et al., 1997; Velicer, Redding, Sun, & Prochaska, 2007). Results from a large international tobacco study demonstrated that previous quit attempts are strongly related to future cessation successes (Hyland, et al., 2006). Specifically, previous quit attempts of short duration (less than 1 week) were more likely to have a negative effect on subsequent attempts while quit attempts of longer duration (6 months or more) were more advantageous. In addition to length of quit attempts, perceived difficulty in previous quit attempts would be a major contributor to the degree of confidence in the ability to successfully abstain from smoking. Grove (1993) assessed the association between perceived success of prior quit attempts, social influence of smoking, and attributional processes with ASE in a population of smokers. Consistent with Bandura's model of self-efficacy, perceived success of prior quit attempts ($r = 0.26$) was the strongest predictor of ASE (Grove, 1993). Given the reported importance of ASE in smoking cessation, the above studies demonstrate the importance of measuring the perceived difficulty of prior quit attempts as a major determinant of ASE. Additionally, as described below, the various methods used to measure ASE in smokers can inform different predictions about cessation outcome.

Abstinence Self-Efficacy in Smokers

Historically, ASE has been measured using a single item asking smokers to rate their own confidence to remain abstinent (Hendricks, et al., 2010; van den Putte, Yzer, Willemsen, & de Bruijn, 2009; Zheng, et al., 2007); however, dynamic measures of ASE have recently been used to capture the daily struggles of individuals attempting to quit cigarettes (Gwaltney, Shiffman, & Sayette, 2005). Gwaltney and colleagues have demonstrated that dynamic or global measures of ASE yield unique information regarding relapse behavior (Gwaltney, Shiffman, & Sayette, 2005). Using a dynamic approach, researchers can evaluate changes in ASE to investigate situational factors contributing to a drop in ASE and predict when a relapse is likely to occur (Gwaltney, Shiffman, Balabanis, et al., 2005). Ecological momentary assessment (EMA) is a research technique that has been employed to capture the daily changes in ASE of smokers after a quit attempt (Gwaltney, Shiffman, Balabanis, et al., 2005; Gwaltney, Shiffman, & Sayette, 2005). In these studies, participants were repeatedly asked over the course of a quit attempt to rate their confidence to abstain from smoking in a variety of environmental, emotional, and physiological situations via a handheld computerized device. Results from these studies suggest that self-efficacy fluctuates over the duration of a cessation attempt. Specifically, a decrease in ASE was predictive of an increased likelihood of lapse the next day and ASE systematically decreased four days prior to a relapse (Gwaltney, Shiffman, Balabanis, et al., 2005). These results support previous research showing that a decrease in ASE immediately precedes and contributes to smoking lapses and relapse (Shiffman et al., 2000). A dynamic measure of ASE exemplifies the complicated and transient nature of self-efficacy and provides an effective method to assess *intra*-individual changes in relapse risk.

Similar to a dynamic approach, measurement of ASE at a single time point is used as a predictor of treatment outcome. Global measurement of ASE typically occurs immediately prior to a cessation attempt, often building up to a quit day (Amodei & Lamb, 2010; Hendricks, et al., 2010; Kowalski, 1997). In a study examining a population of treatment seeking dependent smokers, pre-quit total ASE was highly predictive of the incidence of a lapse (Gwaltney, Shiffman, Balabanis, et al., 2005). Specifically, for every one-point increase in pre-quit total ASE confidence, an individual was 34% less likely to lapse. Even within studies using a dynamic assessment, a low quit day ASE was associated with increased likelihood of a subsequent lapse (Gwaltney, Shiffman, Balabanis, et al., 2005).

These findings are clinically meaningful, as the incidence of a lapse is a critical milestone in smoking cessation and has been shown to be the best predictor of a full relapse (Juliano, Donny, Houtsmuller, & Stitzer, 2006; McKee, 2009). Between 68% and 95% percent of smokers resume regular smoking behavior after an initial lapse (Baer, Kamarck, Lichtenstein, & Ransom, 1989; Brandon, Tiffany, Obremski, & Baker, 1990; Garvey, et al., 1992; Shiffman et al., 1996); therefore a global assessment of abstinence self-efficacy may be particularly informative about *inter*-individual variability in relapse risk. That is, measuring ASE at a single time point (as opposed to a change in ASE) can serve as an indicator of *which* subjects are prone to lapse, as opposed to *when* a lapse will occur. Using this principle, the assessment of ASE prior to a quit attempt can inform immediate treatment interventions.

In addition to temporal considerations, some researchers have suggested the importance of an "Achilles' heel", or the lowest-rated ASE domain (Gwaltney, et al., 2001; Haaga, 1990). The presence of an Achilles' heel is conceptually similar to high-risk situations described in Relapse Prevention treatment model (Marlatt, 1996; Witkiewitz & Marlatt, 2004). After

evaluating pre-quit ASE in a variety of domains, the lowest rated domain remained a robust predictor of lapse. Specifically, for every one-point increase (conveying greater confidence) in the lowest ASE domain, lapse risk was reduced by approximately 50% (Gwaltney, et al., 2001). Assessing contextual situations where an individual feels most vulnerable to initiate smoking behavior can be considered an extension of behavioral change theories. Both Social Cognitive Theory and the TPB rely on individual confidence to determine the likelihood of engaging in a behavior. Thus, the domain in which one had the lowest confidence would be expected to be the most clinically relevant predictor of a specific behavior (i.e. quitting smoking) and may require the most attention to improve ASE.

As described above, the determinants of self-efficacy rely heavily on reciprocal learning via experiential sources of information. Developing personal efficacy can be considered a process whereby an individual develops confidence, based on individual and social factors, to perform a specific behavior and exert a corresponding amount of effort. Recent research has suggested that the inclusion of personality trait variables may improve the predictive utility of self-efficacy (Churchill, Jessop, & Sparks, 2008; Churchill & Jessop, 2010). In particular, some studies have suggested that personality characteristics representative of an individual's capacity to control hedonistic, automatic response patterns, such as the related constructs of self-control and impulsivity, may contribute to personal efficacy (Churchill & Jessop, 2010). Thus, the inclusion of self-control and impulsivity may account for variance in self-efficacy above and beyond captured by domain-specific personal experience.

Self-Control

Self-control is often broadly defined as capacity for individual change and ability to disrupt undesirable behavioral tendencies (Tangney, Baumeister, & Boone, 2004). According to

the influential model developed by Baumeister and colleagues, self-control reflects an individual's ability to exert control over responses, rather than allowing them to proceed in a normal or automatic fashion (Muraven & Baumeister, 2000). Baumeister et al. proposed that while self-control can be exerted in a variety of ways across a number of different situations, all behaviors requiring self-control draw from a common resource. Baumeister conceptualized this limited individual capacity to control behavior as analogous to a muscle's ability to work (Baumeister, Gailliot, DeWall, & Oaten, 2006; Muraven & Shmueli, 2006). Total capacity for self-control is generally static and frequent strengthening followed by an opportunity for rest and replenishment (akin to a building muscle) can increase individual self-control resources (Baumeister, 2003; Muraven & Shmueli, 2006). A person has a finite capacity for self-control and depletion of self-control resources can have a direct impact on the success or failure within a prescribed behavior.

In a well-known self-control study, Baumeister and colleagues (1998) demonstrated the depletion of self-control resources via resisting temptation. In this study, participants were recruited for a study on taste perception. Participants were asked to skip one meal prior to coming into the lab and were simultaneously presented two food items during experimental sessions: a plate of fresh chocolate chip cookies and a bowl of radishes. When participants entered the experiment room, they were assigned to taste either the radishes or the cookies. Experimenters instructed participants either to eat one or two radishes or at least two or three chocolate chip cookies. After the food exposure, both groups performed an impossible puzzle task. The results indicated that participants in the radish condition, compared to those allowed to eat the fresh chocolate chip cookies, had significantly fewer puzzle attempts (8.35 versus 19.40) and gave up on the task approximately 10 minutes sooner (8.35 minutes versus 18.90 minutes)

(Baumeister, Bratslavsky, Muraven, & Tice, 1998). The authors hypothesized that resisting the temptation to eat cookies produced a rapid depletion in self-control resources exemplified in less patience and greater frustration with the impossible task (Baumeister, et al., 1998). As such, greater self-control capacity is an important aspect of personality that could promote positive, desirable outcomes (Baumeister, et al., 2006).

Recently two competing hypotheses regarding when individual differences in self-control capacity are likely to lead to divergent patterns of behavior (i.e., when individuals with high and low self-control capacity are likely to behave differently) have been proposed (DeWall, Baumeister, Schurtz, & Gailliot, 2010). One hypothesis states that individual differences in self-control capacity exert the strongest behavioral influence under unpredictable, tempting situations. Support for this idea is derived from literature investigating the effect of temptation on task performance. Social drinkers performed significantly worse on two measures of self-control (handgrip and response inhibition task) after sniffing alcohol (a procedure designed to deplete self-control resources) compared to sniffing water (Muraven & Shmueli, 2006). Using a similar protocol, Gauggel and colleagues (2010) studied the depletion effects of recently detoxified alcoholics sniffing water or alcohol prior to a response inhibition task. The results demonstrated that alcohol-dependent individuals performed significantly worse on a stop-signal task after sniffing an alcoholic beverage (Gauggel et al., 2010). Likewise, performing behavioral tasks that deplete self-control impact the ability to refrain from resisting temptation. For instance, Muraven and colleagues (2002) demonstrated increased alcohol consumption prior to a simulated driving task after completing a self-control depleting task.

A competing view suggests that personality traits are more influential under normal circumstances. This theory states that under non-demanding conditions, individuals with high trait self control regulate their behavior to a greater extent than those with low trait self-control. Conversely, under demanding conditions (when self-control resources are depleted), both individuals with low- and high- trait self-control are unlikely to regulate behavior. Stated differently, those with comparatively high self-control resources regulate behavior when they have sufficient reserves but not when self-control stores are depleted, while those with relatively low self-control resources do not regulate their behavior regardless of self-control demands. Consequently, individuals with high and low self-control behave differently under conditions of low, but not high, demand. Research investigating the ability to resist temptation in restrained and unrestrained eaters provides some support for this pattern (Kahan, Polivy, & Herman, 2003). Specifically, restrained eaters deplete self-regulatory capacity by resisting daily temptations were more susceptible to consume tempting, diet-breaking cookies. Individuals who did not regulate daily eating behavior, or unrestrained eaters, ate the same amount of cookies irrespective of experimental condition. Similarly, Vohs and Heatherton (2000) reported that chronic dieters, characterized by increased overall behavioral inhibition, demonstrated a greater reduction in self-control as evidenced by increased snack consumption in highly tempting situations. Additionally, inhibition in one domain exerted a generalized depletion of behavioral regulation in another domain. For example, self-control depletion via suppression of emotional reactions resulted in a reduced ability to resist highly tempting snacks (Vohs & Heatherton, 2000).

These competing hypotheses lead to different predictions regarding how an individual will react to a highly tempting situation as a function of trait self-control. In the first hypothesis, exposure to a vulnerable situation would be likely to increase the influence of personality traits

on behavioral outcomes. According to this logic, self-control capacity would have the greatest impact in a situation which an individual has the lowest confidence to resist temptation (e.g., a smoker's "Achilles' heel" situation). The alternative hypothesis emphasizes the importance of personality traits during general behavior as opposed to a state of self-regulatory depletion. From this perspective, self-control capacity should be less influential in a vulnerable situation and more relevant in daily regulatory behavior. To date, very few studies have investigated both hypotheses in the domain of cigarette smoking behavior. Further, other personality factors may contribute to individual ability to resist temptation. In order obtain a clearer picture of how self-control influences the ability to resist temptation, inclusion of other behavioral constructs related to non-reflective behavior may provide additional information.

Impulsivity

A construct highly related to the notion of self-control is impulsivity. Impulsivity is a complex, multi-dimensional behavioral construct prominent in many psychological disorders (Arce & Santisteban, 2006; Evenden, 1999). Although a variety of definitions exist, impulsivity is almost always considered to be a component in the initiation of a behavior. Specifically, high impulsivity is characterized by a generalized pattern of maladaptive behavior marked by a tendency to act without forethought of possible negative consequences. Using this definition, impulsivity has been associated with both the occurrence and the severity of substance use and risky behavior (De Wit, 2009; Reuter & Netter, 2001; Romer et al., 2009; Sher, Bartholow, & Wood, 2000). In reviewing the influence of impulsivity on the initiation and continuation of drug use, Perry and Carroll (2008) suggested a model where impulsivity is involved in multiple phases of addiction, including drug abuse vulnerability and treatment variables such as abstinence and relapse. Additional research has echoed these findings in demonstrating the

relationship between elevated impulsivity and likelihood of relapse (Charney, Zikos, & Gill, 2010; McKellar, Ilgen, Moos, & Moos, 2008). For example, alcohol-dependent individuals who lapsed or relapsed during treatment, compared to successful abstainers, were more likely to be impulsive, use other substances, and endorse questions regarding psychological distress (Charney, et al., 2010). These results underscore the importance of measuring impulsivity and suggest that increased impulsivity would result in a decreased ability to resist temptations to achieve continued abstinence.

Compared to non-smokers, regular smokers have demonstrated higher impulsivity in a variety of self-report and behavioral measures (Baker, Johnson, & Bickel, 2003; Bergen & Caporaso, 1999; Mitchell, 2004; Sweitzer, Donny, Dierker, Flory, & Manuck, 2008). Recent research has indicated that abstinent smokers with increased trait impulsivity demonstrate greater craving when presented with smoking cues (Myers, Doran, Trinidad, Wall, & Klonoff, 2009; Reuter & Netter, 2001; VanderVeen, Cohen, Cukrowicz, & Trotter, 2008) and have greater difficulty quitting (Doran, Spring, McChargue, Pergadia, & Richmond, 2004). One potential rationale for the role of impulsivity in relapse behavior is impulsive individuals may experience greater cognitive detriments during abstinence that result in an increased likelihood to relapse. However, Harrison and colleagues demonstrated that an increase in cognitive impairment resulting from nicotine deprivation did not increase relapse risk among impulsive smokers (Harrison, Coppola, & McKee, 2009). Thus, it is unlikely that the cognitive consequences of withdrawal are the primary motivator for relapse in more impulsive smokers. Impulsivity may relate to lapse and ASE by conveying a willingness to engage in a behavior without forethought and tendency to act on impulses in the presence of temptation.

Self-Control and Impulsivity as Antagonistic Constructs

In the context of decision-making and substance abuse, impulsivity and self-control are often characterized as two antagonistic behavioral constructs (Kalenscher, Ohmann, & Güntürkün, 2006; Potenza, 2007; Simons, Maisto, & Wray, 2010). Measures of impulsivity and self-control are often viewed as providing similar information; however previous research has argued that both warrant individual attention. Friese and Hoffman (2009) describe high self-control as an ability to override and manage impulses. Impulses vary between individuals, and are specific to the object or behavior that is desired. Individuals experience impulses irrespective of capacity for self-control; however, an individual with low (but not high) self-control is more likely to translate a specific impulse into a behavior (Friese & Hofmann, 2009). Impulsivity is a general trait that describes a pattern of behavior across a variety of contexts. According to this logic, impulsivity represents sensitivity to action when presented with the opportunity to engage in a behavior (Friese & Hofmann, 2009). Within the decision making process, increased capacity for self-control functions as a protective trait to suppress impulsive desires to initiate behavior.

The separation of impulsivity and self-control is further supported by developmental and neurobiological research (Kalenscher, et al., 2006; Perry, et al., 2010; Somerville & Casey, 2010; Van Leijenhorst et al., 2010). Developmental research has highlighted windows of development when individuals are particularly susceptible to temptations and impulses (Mischel et al., 2010; Somerville & Casey, 2010). One well-developed neurobiological model of adolescent risk taking primarily focuses on the development of neuronal connections between two brain regions: the prefrontal cortex and striatum (Casey & Jones, 2010). The striatum is a region of the brain rich in dopamine receptors and is considered central to sensitivity to rewards. The prefrontal cortex (PFC) is considered a critical area in cognitive control and regulation of behavior. Development

of the neuronal circuitry between childhood and adolescence is characterized by a strengthening of connections between the striatum and the PFC. The transition from adolescent to adulthood is marked by strengthening of reciprocal neuronal signaling between the PFC and the striatum (Somerville & Casey, 2010). Studies investigating the development of these regions over adolescence demonstrate that limbic regions, such as the striatum, follow a curvilinear relationship while prefrontal regions develop in a linear pattern (Bava & Tapert, 2010; Casey, Jones, & Hare, 2008). This pattern of brain maturation suggests that sensitivity to rewards actually peaks during adolescence (Casey, et al., 2008; Galvan, Hare, Voss, Glover, & Casey, 2007). While this sensitivity to rewards is peaking, cognitive control over and regulation of behaviors has yet to fully develop. Thus, adolescent brain development exemplifies a period of tension between "bottom-up" impulsivity systems (limbic) and a lag in the maturation of "top-down" self-control systems. The separate developmental trajectories suggest that, while strongly related, trait expressions of impulsivity and self-control can provide different information on individual behavior.

Current Study and Specific Aims

At present, very few studies have directly investigated what factors shape self-efficacy, despite the frequent measurement and clinical utility of self-efficacy in smoking cessation literature. Personality traits, such as self-control and impulsivity, may differentially help build ASE via an increased sense of overall behavioral mastery and a decreased tendency to act on impulses. Timely, effective treatment interventions are necessary to prolong abstinence and/or prevent resumption of smoking behavior. Current treatment models describe a relapse "road map" that is focused on identification of individual triggers and learning coping mechanisms to control urges to smoke. These strategies are aimed at enhancing self-efficacy and actualizing

abstinence in high-risk situations. A better understanding of the relationship between abstinence self-efficacy and individual personality characteristics within high risk situations can help shape the relapse road map path to a potentially more successful treatment outcome.

The aims of this thesis are to a) investigate the importance of Bandura's concept of personal mastery in both overall ASE and lowest ASE domain and b) elucidate the differential influence of two similar constructs (self-control and impulsivity). Accordingly, I hypothesize that greater perceived difficulty in abstinence will be negatively associated with total (or overall) ASE. Since personal mastery is the most important determinant of self-efficacy, I also hypothesize that perceived difficulty in abstinence will account for significant variance in total ASE and the lowest domain ASE (the "Achilles' heel"). The inclusion of self-control and impulsivity is hypothesized to individually predict total ASE above and beyond perceived difficulty in abstinence. Support for this hypothesis would provide evidence that general behavioral mastery and control of impulses is related to domain-specific personal mastery within ASE.

Additionally, I hypothesize that self-control and impulsivity will moderate the relationship between perceived difficulty in abstinence and total ASE. Specifically, high levels of self-control (thus an increased strength resources to control behavior) and low levels of impulsivity (a reduced sensitivity to rewards and impulses) will be associated with high total ASE score, irrespective of difficulty in abstinence. To investigate the influence of personality traits in the presence of high temptation, I will perform the same analysis using the lowest ASE domain as the predicted outcome. This particular analysis will be aimed at testing two competing hypotheses about the influence of personality traits in highly tempting situations. In support of the hypothesis suggesting personality traits exert the strongest behavioral influence on self-

control depletion under unpredictable, tempting situations, I would expect high self-control and low impulsivity would correspond to an increased resistance to temptation and more confidence in the lowest ASE domain. Conversely, if personality traits exert a greater influence during general behavior as opposed to a state of self-regulatory depletion, I expect no relationship between the lowest ASE domain and self-control or impulsivity.

CHAPTER 2: METHODS

Participants

The present study uses questionnaire data collected from 176 adult smokers (ages 18-45) who participated in an fMRI imaging study at the University of Pittsburgh. Participants were initially recruited using flyers in the community advertising for treatment seeking, daily smokers. Qualified individuals were invited to the lab for a screening visit, which entailed obtaining informed consent, performing working memory tasks, and filling out a battery of questionnaires. During a second visit, participants returned to the laboratory and underwent an fMRI scanning protocol. All questionnaires included herein were administered prior to any imaging study manipulations. Data from fMRI and/or study manipulation are reported elsewhere (Wilson et al., under review). All subjects were compensated for their participation in the research. For this analysis, only participants who reported at least one prior quit attempt (n= 135) were included. Of these smokers, 23 failed to complete the relevant questionnaires and 1 was excluded for invariance in responses, leaving a final sample of 111 daily, adult smokers.

Measures

Smoking History Questionnaire: Demographic information regarding smoking behavior, including smoking chronicity, cigarette brand preferences, situational factors related to smoking, and previous quit behavior, was assessed using the Smoking History Questionnaire. Difficulty abstaining was measured in individuals who reported at least one quit attempt. Only participants responded affirmatively to "serious and deliberate attempt to STOP SMOKING cigarettes completely" were included in the current analyses. Participants also rated the following question on a 4-point Likert scale (1=easy, 2=slightly difficult, 3=difficult, 4=very difficult): "How hard

was it for you to quit smoking on your most recent attempt?". This item has been used in previous research as a marker for difficulty abstaining from smokers (Griffin & Sayette, 2008). Specifically, ambivalent smokers with at least one previous quit attempt expressed significantly greater difficulty abstaining compared to non-ambivalent smokers (Griffin & Sayette, 2008).

Abstinence self-efficacy: Abstinence self-efficacy was assessed using the Relapse Self Efficacy Questionnaire (RSEQ) (Gwaltney, et al., 2001). The RSEQ is a 43-item measure designed to assess confidence in the ability to remain abstinent when faced with an opportunity to smoke. Factor analysis of RSEQ scores indentified seven unique ASE domains: negative affect, positive affect, restrictive situations, idle time, social-food situations, low arousal, and craving. A single, overall ASE factor was also supported by pre and post-quit RSEQ scores. In validation studies, each context-specific factor displayed adequate internal consistency (Chronbach's alpha = 0.77 to 0.91). Total ASE was also internally consistent with a Chronbach's alpha of 0.96. Individual RSEQ scores were also predictive of smoking cessation outcome (Gwaltney, et al., 2001; Gwaltney et al., 2002). For the RSEQ measure, participants are asked to rate their confidence to remain abstinent from smoking cigarettes in the presence of a variety emotions and situations. Response to questions is on a 4-point Likert scale ranging from "Not at all confident" to "Extremely confident".

In addition to evaluating the total ASE score, the least confident ASE domain score was utilized to represent an individual's Achilles' heel. As discussed above, previous research has utilized the RSEQ to demonstrate the significant predictive utility of using the Achilles' heel as a marker for the situation of highest relapse risk (Gwaltney, et al., 2001). The ASE domain with the lowest score was shown to predict relapse after controlling for total ASE score and all other

domains. Thus, the lowest ASE domain can provide unique information about individual vulnerability in smoking self-efficacy.

Impulsivity: The Barratt Impulsiveness Scale (BIS) was used to assess level of impulsivity (Patton, Stanford, & Barratt, 1995). The BIS is one of the oldest and most widely used measures of impulsivity (Stanford et al., 2009). The most recent version, the BIS-11, is a 30-item questionnaire that asks participants to rate the degree to which a statement applies to them on a 5 point Likert scale from "Rarely/Never" to "Always". The BIS-11 has been validated on psychiatric inpatients and male inmates at a maximum-security prison by comparing BIS-10 scores from a nonclinical undergraduate population. Three second-order factors emerged: attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness. Within the psychiatric inpatient population, substance abuse patients were separated from general psychiatric inpatients. Undergraduates, substance abuse patients, general psychiatric patients, and inmates all demonstrated good internal consistency coefficients with Chronbach's alpha of 0.82, 0.79, 0.83, and 0.80, respectively. Only the overall level of impulsivity was utilized in the current statistical analysis.

Self-Control: The Self-Control Scale (TSCS) is a 36-item questionnaire designed to be a broad measure of general self-control (Tangney, et al., 2004). TCSC was validated on two large samples of undergraduate populations. Higher scores on self-control were associated with positive outcomes in a number of social and interpersonal arenas such as higher grade point average, less pathology, fewer impulse control problems, better psychological adjustment, better interpersonal relationships, secure attachment, and more optimal emotional responses. Both populations were internally consistent with a Chronbach's alpha of 0.89. Additionally, the test-retest reliability was strong with an alpha of 0.89. Scores on TSCS were correlated with

additional clinical, social, and interpersonal measures. Participants were asked to rate how true a statement is about them on a 5-point Likert scale from “Not at all like me” to “Very much like me”.

CHAPTER 3: RESULTS

Descriptive statistics for the demographic variables for 111 participants are presented in Table 1. Participants were mostly male (81%) with an average age 32.55 and smoked an average of 19.05 (5.51) cigarettes per day. Smokers had an average FTND score of 4.97 (1.69); a score greater than 4 is generally accepted as an indicator for nicotine dependence, with greater than 6 indicating severe nicotine dependence.

Bivariate correlations between total ASE score, lowest ASE score, perceived abstinence difficulty, self-control, and impulsivity are presented in Table 2. As predicted, greater self-control was strongly associated with decreased impulsivity ($r= -.78$, $p< .001$). Higher total ASE was associated with both decreased perceived abstinence difficulty ($r= -.29$, $p= .003$) and lowest ASE score ($r= .74$, $p< .001$). Greater self-control was also significantly associated with increased total ASE ($r= .21$, $p= .026$). Lowest ASE domain was significantly associated with perceived difficulty in abstinence ($r= -.28$, $p= .003$). All participants demonstrated variability within individual ASE domain responses, thus vulnerability could be indentified within specific domains. Negative affect was the most common lowest ASE score (64%), followed by crave (22.5%), social-food situations (20.7%), idle time (7.2%), and low arousal (3.6%). Percentages do not add up to 100 because more than one factor could be rated the lowest ASE domain. The complete absence of positive affect suggests that confidence to remain abstinent is less affected by positive emotions. Current smokers have also likely adapted smoking behavior to comply with recent public smoking legislation (i.e. airplanes, restaurants, etc.). No participants reporting restrict as an Achilles' heel may reflect general confidence in refraining from smoking in places where it is explicitly forbidden.

Hierarchical regression analyses were performed to investigate the predictive utility of specific factors on total ASE and lowest ASE domain. Regression analyses followed Aiken and West's (1991) procedure for analyzing interactions in multiple regression. First, all continuous individual predictor variables were centered by subtracting the mean score from original scores for each variable. Interaction terms were created by multiplying the centered variables together (Aiken & West, 1991). Total ASE was entered as the outcome variable and the following variables as predictors: perceived abstinence difficulty, self-control, impulsivity, self-control X perceived abstinence difficulty, and impulsivity X perceived abstinence difficulty.

The results of the hierarchical multiple regression analysis is presented in Table 3. Steps 1, 2 and 3 represent the direct effects of three predictor variables: perceived abstinence difficulty, self-control, and impulsivity. Regression analyses resulted in statistically significant increments in R^2 for perceived abstinence difficulty (R^2_{change}= 7.9%, p= .003), self-control (R^2_{change}= 4.1%, p= .026). Impulsivity did not contribute significant increment of R^2 in predicting total ASE controlling for other predictors (R^2_{change}= .8%, p= .330). Interaction effects between self-control X perceived difficulty in abstinence (Step 4) and impulsivity X perceived abstinence difficulty (Step 5) did not result in statistically significant increment in R^2 above and beyond the direct effects of predictor variables (R^2_{change}= .4%, p= .490 and R^2_{change}= .5%, p= .418, respectively).

To demonstrate the separate contributions of impulsivity and self-control, hierarchical multiple regression was run separately with only impulsivity as a predictor (Table 4). Steps 1 and 2 represent the direct effects of two predictor variables: perceived abstinence difficulty and impulsivity. Regression analyses resulted in statistically significant increments in R^2 for perceived abstinence difficulty (R^2_{change}= 7.9%, p= .003) but not for impulsivity (R^2_{change}= 1.1%, p= .255). Interaction effects between impulsivity X perceived abstinence difficulty (Step 3) did

not result in statistically significant increment in R^2 above and beyond the direct effects of predictor variables (R^2_{change}= .6%, p= .396). These results demonstrate that although self-control and impulsivity are highly correlated, only self-control accounts for significant variance in total ASE above and beyond perceived difficulty in abstinence.

Hierarchical multiple regression analysis was repeated exactly as described above except the lowest ASE domain score, or the Achilles' heel, was used as the predictor variable (Table 5). As above, steps 1-3 represent the direct effect of perceived abstinence difficulty, self-control, and impulsivity on lowest ASE domain score. Hierarchical entry resulted in statistically significant increments in R^2 for perceived abstinence difficulty (R^2_{change}= 7.9%, p= .003), but not for self-control (R^2_{change}= 1.2%, p= .234) and impulsivity (R^2_{change}= .4%, p= .482). Interaction effects between self-control X perceived abstinence difficulty (Step 4) resulted in a significant increment of R^2 above and beyond the direct effects of predictor variables (R^2_{change}= 3.3%, p= .048); the addition impulsivity X perceived abstinence difficulty (Step 5) was not significant (R^2_{change}= 1.1%, p= .239). Figure 1 illustrates the interaction effect of self-control X perceived difficulty in abstinence when predicting lowest ASE domain.

When the interaction between impulsivity and perceived abstinence difficulty was included in the above model, the interaction between self-control and perceived abstinence difficulty was no longer significant. To address the change in significance, hierarchical multiple regression analysis was repeated exactly as described above except impulsivity factors were entered into the model before self-control factors (Table 6). Steps 1-3 represent the direct effect of perceived abstinence difficulty, impulsivity, and self-control on lowest ASE domain score. Hierarchical entry resulted in statistically significant increments in R^2 for perceived abstinence difficulty (R^2_{change}= 7.9%, p= .003), but not for self-control (R^2_{change}= .2%, p= .618) and

impulsivity (R^2_{change}= 1.4%, p= .198). Interaction effects between impulsivity X perceived abstinence difficulty (Step 4) resulted in a significant increment of R^2 above and beyond the direct effects of predictor variables (R^2_{change}= 4.4%, p= .022); the addition self-control X perceived abstinence difficulty (Step 5) was not significant (R^2_{change}= .1%, p= .799).

CHAPTER 4: DISCUSSION

Bandura stated that personal experience is the most reliable source of information regarding self-efficacy; specifically, perceived success or failure raises and decreases personal efficacy, respectively (Bandura, et al., 1977). Despite commonly being used as a cessation treatment outcome variable, very few studies have evaluated specific determinants of abstinence self-efficacy. Self-reported difficulty to perform a task in a specific domain (e.g. difficulty in abstinence) could be used as an effective marker for individual confidence of mastery within that domain. As such, in the current study, personal mastery was strongly related to total ASE and lowest domain ASE. Individuals who experience greater perceived difficulty in a quit attempt were significantly more likely to have a both a lower overall ASE and lower ASE domain-specific score. This relationship highlights the importance of personal mastery during previous abstinence attempts in determining ASE, in accord with pervious findings (Grove, 1993; Hyland, et al., 2006).

The current results extend prior research by suggesting that personality characteristics also play an important role in shaping ASE. Specifically, overall trait self-control contributes significant variance to total ASE above and beyond personal mastery during previous abstinence attempts. Self-control accounted for an additional 4.1% of the variance in total ASE, controlling for personal mastery in abstinence. As previously stated, high trait self-control is associated with optimal performance in multiple behavioral domains including grade point average, emotional responses, adjustment, and regulated behavior (Tangney, et al., 2004). Therefore, high self-control could be considered analogous to high personal mastery in a variety of behavioral domains. Bandura argued that personal mastery in one behavioral domain could generalize to increased self-efficacy in other areas (Bandura, 1977). Based on the current results, personal

mastery in general behavioral domains may influence domain specific self-efficacy to remain abstinent.

These findings have potentially important clinical implications. Previous research has suggested that mastery training in non-smoking domains may help improve smoking specific self-efficacy. For example, mastery training in areas related to physical exercise has previously been shown to be beneficial mood symptoms and a smoker's self-efficacy to remain abstinent. In a study conducted by Prochaska et al., participants were enrolled in a relapse prevention program that included recording the number of steps per day using a pedometer combined with brief, individualized treatment sessions (Prochaska et al., 2008). Four weeks of physical activity sessions were performed after relapse prevention cessions were complete (weeks 16 and 20). Participants were encouraged to gradually increase personal mastery to reach a goal of 10,000 of steps per day. Individual increases in the number of steps per day were accompanied by an increase in engaging in moderate to vigorous physical activity (MVPA). A change in MVPA significantly predicted sustained abstinence at from smoking at week 24 (Prochaska, et al., 2008). Among participants achieving sustained abstinence, increased MVPA was associated with decreased perceived difficulty staying smoke free. The authors hypothesized that a decreased difficulty staying smoke free could be representative of increased confidence to remain abstinent (Prochaska, et al., 2008). Therefore, increased MVPA in smoker's achieving sustained abstinence may benefit from mastery experiences accompanying increased exercise, which in turn could influence individual self-efficacy to remain abstinent.

While trait self-control appears to be related to global ASE independent of the perceived difficulty of prior quit attempts, results suggest that the relationship between lowest domain ASE (or Achilles' heel), perceived difficulty of past quit attempts, and trait self-control is more

complex. Contrary to total ASE, trait self-control did not account for significant variance in the lowest ASE domain above and beyond perceived difficulty in abstinence. Preliminary evidence questioning the beneficial impact of increased self-control in resisting temptation is demonstrated in the moderation analyses with lowest ASE domain as an outcome. Specifically, individuals with high self-control are more likely to have greater confidence in their lowest ASE domain score only when perceived difficulty in abstinence is easy. When abstinence is perceived as difficult, smokers report a decreased confidence in lowest ASE domain irrespective of self-control capacity. Thus, smokers with high self-control capacity, compared to low self-control, may exhibit a significant decline in lowest ASE confidence as difficulty in abstinence increases.

In other words, self-control capacity may not boost confidence to resist smoking in difficult, highly tempting situations. These results raise important questions regarding the clinical utility of increasing behavioral mastery in areas not associated with abstinence in the hopes or raising increasing personal mastery in vulnerable abstinence domains. Assuming increased confidence is associated with an increased sense of mastery, the significant relationship between self-control and total ASE is likely a result of an association between self-control and ASE domains typically characterized by heightened confidence (e.g. restrict, positive affect). High self-control does not appear to be protective for confidence in resisting highly tempting situations that have been shown to predict the occurrence of a lapse.

Similar to other recent findings, the present results raise questions regarding the application of Baumeister et al.'s model of self-control to resisting temptation in vulnerable situations (Kahan, et al., 2003; O'Connell, Schwartz, & Shiffman, 2008; Vohs & Heatherton, 2000). For example, O'Connell and colleagues (2008) evaluated the effect of the resource depletion self-control model in two large samples of heavy smokers using EMA measurement.

Results indicated that occurrence of one resist incidence in the prior 4 hours was significantly predictive of successful resisting and a greater amount of time spent resisting was not independently predictive of a lapse. The resource model of self-control would predict that the act of resisting should deplete resources, and a smoker would be more likely to lapse as resources are depleted; however, the results suggest that participants who reported more resist episodes demonstrated stronger, not weaker, self-control (O'Connell, et al., 2008). The study concludes that the act of resisting temptation does not appear to deplete self-control resources sufficiently to increase the risk for a subsequent lapse. The present study supports the hypothesis suggesting smokers with comparatively high trait self-control may regulate behavior in a non-depleted state but not when self-control stores are depleted, while those with relatively low self-control resources do not regulate their behavior irrespective of self-control demands. These results are preliminary and warrant further investigation to determine the role of self-control capacity in resisting temptation in the context of quit attempts.

The potentially depleting effects of temptation may not be the most effective at elucidating the relationship between self-control and confidence in remaining abstinent. The utility of self-control capacity in highly tempting situations may be related to the perception of self-control resources rather than actual depletion. Clarkson et al. (2010) demonstrated decreased performance in tasks after individuals performed tasks that were perceived as highly depleting. Increased perceived self-control depletion, but not actual depletion, impaired task performance on problem-solving tasks, attention-regulation task, and ability to process a persuasive message (Clarkson, Hirt, Jia, & Alexander, 2010). Therefore, behavioral depletion may not necessarily exhaust individual mental resources, particularly if the task is not perceived to be depleting. In the current study, individuals reporting high difficulty in abstinence are more likely to report a

decreased confidence in the lowest ASE domain regardless of self-control capacity. In other words, the perception of how difficult or depleting the experience of abstinence supersedes actual individual self-control capacity. For smokers who reported less difficulty in abstinence, high, compared to low, trait self-control was associated with increased confidence in the lowest ASE domain. This result suggests that perception of difficulty or depletion may be an important determinant of subsequent impairment in behavior, perhaps beyond the actual depleting effects of temptation.

Strengthening self-control is a frequent coping technique used by many smokers attempting to quit. Though behavioral self-control programs have exhibited success in reducing the number of cigarettes smoked, few participants actually quit smoking (Schneider, 1984). The results of the current study support an association between self-control depletion and regulated behavior. The positive relationship between self-control and total ASE is likely due to increased confidence to resist in a variety of situations (as opposed to very high confidence in one situation). O'Connell et al. (2008) acknowledged that frequent resisting may be a function of increased motivation or awareness in the cessation process. As such, higher total ASE may reflect an increase in confidence to remain abstinent via frequent resisting and an awareness of difficult situations. Accordingly, lowest ASE domain is not associated with increased self-control. While occurrences and duration of resists may not predict a lapse, the situational vulnerability under which smokers report resisting may impact individual confidence to remain abstinent.

In addition to examining the relationship between personality traits and ASE, the current study allowed for exploration of the differential relationship self-control and impulsivity to ASE. Self-control and impulsivity are often simply considered two antagonistic choice patterns (Arce

& Santisteban, 2006; Monterosso & Ainslie, 1999). The present study indicates that, although impulsivity and self-control are strongly related, they contribute different information about beliefs in personal change. Bandura describes the human mind as "generative, creative, proactive, and reflective, not just reactive" (p.4) (Bandura, 2001). Evaluating what people believe they will do in a prospective situation may involve more "top down" cognitive factors, such as self-control. Previous research has demonstrated that measures of behavioral impulsivity predict the initiation and maintenance of smoking behavior (De Wit, 2009; Krishnan-Sarin et al., 2007; VanderVeen, et al., 2008). The present study suggests that impulsivity and self-control may provide similar information with only in situations characterized by high temptation and perceived difficulty in abstinence. Therefore, while impulsivity may impact the decision to smoke in a vulnerable domain and/or sensitivity to smoking urges, refraining from smoking appears to be associated with conscious control in regulating smoking behavior.

Limitations

The results of the current study provide insight into important determinants of ASE; however, there are several interpretive limitations. First, the current study only assessed ASE at a single time point, which did not include any information regarding actual lapse or relapse behavior. A dynamic measure over the course of a quit attempt may provide a more information on events leading up to a lapse and the stability of personality factors influencing ASE over time. Second, the current study uses measures of self-report to evaluate the importance of specific predictor variables within ASE. Although all of the measures employed have been well validated in various populations, behavioral measurement of self-control and impulsivity may help to clarify the relationship between self-control and ASE. For example, employing a self-control task that involved actively resisting the temptation to smoke would provide more definitive

information regarding the role of temptation in self-control capacity. Also, some research has pointed to a "restraint bias" wherein people tend to overestimate their capacity for impulse-control (Nordgren, van Harreveld, & van der Pligt, 2009). Specifically, inflated impulse control beliefs could lead smokers to overestimate their ability to control their behavior in highly tempting situations. Utilizing self-report measures could increase the susceptibility to a restraint bias; however, the current study measured self-control in a number of domains and the present analysis controlled for perceived difficulty in abstinence (presumably a good indicator of actual difficulty in abstinence). Nevertheless, the inclusion of actual temptation and/or behavioral measures of self-control may provide more insight beyond self-report measures.

Finally, with regard to the lowest ASE domain, the scale of responses on the RSEQ questionnaire may have limited interpretations. The lowest possible value for any given ASE domain was 1.00 (with a maximum of 4.00), potentially creating a "floor effect" in the Achilles' heel score. Low self-control was associated with a low ASE domain score of approximately 1.00 irrespective of perceived difficulty in abstinence. With a larger range of possible responses, individuals with low self-control may have demonstrated a lower ASE score as perceived difficulty in abstinence increased. Despite these limitations, the finding that individuals with high self-control demonstrate a drop in lowest ASE domain score as perceived difficulty in abstinence increases is of significant clinical utility.

Conclusions

Abstinence self-efficacy is a critical component of smoking cessation. Bandura postulated that self-efficacy is the most important component in initiating behavioral change (Bandura, 1977). The determinants of self-efficacy vary by individual, but generally rely on

personal experience and mastery. As such, perceived difficulty in abstinence should, and does, influence the strength of ASE. Self-control is frequently a focus of smoking cessation programs, however the relationship to factors that predict a lapse, such as ASE, remains unclear.

The resource depletion self-control model would predict high self-control to be associated with an increased ability to resist temptation; however, self-control capacity is unrelated the lowest, and most vulnerable, ASE domain. Furthermore, as perceived difficulty in abstinence increases, confidence in lowest ASE domain decreases sharply in smokers with a high capacity for self-control. This relationship underscores the importance of perceived difficulty in abstinence in building ASE (both total and lowest domain), but questions the utility of general self-control building exercises as a strategy to increase a smoker's efficacy to resist temptation. Increased self-control capacity may only benefit smokers who perceive abstinence as easy. These smokers may require fewer interventions to remain abstinent and therefore may not provide much clinical utility. Alternatively, low self-control could be indicative of reduced confidence to remain abstinent, perhaps via reduced motivation or greater perceived depletion of self-control (as opposed to actual depletion). Therefore, smokers with low self-control may be more apt to give up or report lower confidence due to reduced control of overall behavior.

High self-control is related to numerous positive outcomes and increased behavioral self-regulation (Tangney, et al., 2004). The relationship between higher self-control and higher total ASE may reflect an increased regulation of smoking behavior and/or increased mastery in specific ASE domains. If personal mastery and self-control capacity can generalize across behavioral domains, then one might assume that high confidence in one domain would be related to behavioral mastery in other behavioral domains. Thus, focusing on building self-control resources in areas not related to smoking cessation may only reinforce confidence in domains

already characterized by high personal mastery. Low self-control most likely conveys reduced personal mastery of overall behavior. To increase confidence in remaining abstinent, treatment interventions aimed at building self-control during tempting situations should focusing on perceived difficulty in previous quit attempts as opposed to mastery of other non-smoking domains. Smoker's who report comparatively high difficulty in abstinence are more likely to have decreased confidence to remain abstinent when faced with an extremely tempting situation. Although the present study raises questions about the potential benefits of high trait self-control in potentially depleting situations, the results are preliminary and further investigation would help clarify this relationship. Additionally, the inclusion of individual motivations and perceptions about smoking abstinence and self-control capacity can still provide more insight into raising confidence to achieve continued abstinence.

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APPENDIX A

Table 1. Descriptives of Study Variables (N=111)		
	Mean	SD
Gender	0.27	--
Age	32.55	8.38
FTND	4.97	1.69
CPD	19.05	5.51
ASE total	2.14	0.44
Lowest ASE	1.33	0.37
Self-Control	115.22	18.35
Impulsivity	70.23	12.62

Note: FTND = Fagerstrom Test for Nicotine Dependence; CPD = Cigarettes per day; ASE = Abstinence Self-Efficacy

Table 2. Bivariate Correlations of Predictor Variables

	Total ASE	Lowest ASE domain	Abstinence Difficulty	Self-Control	Impulsivity
Total ASE	1				
Lowest ASE domain	**.74*****	1			
Abstinence Difficulty	**-.29****	**-.28****	1		
Self-Control	**.21***	.12	-.03	1	
Impulsivity	-.14	-.08	.13	**-.78*****	1

Note: ASE= Abstinence self-efficacy; *p< .05; **p< .01; ***p< .001

Table 3. Hierarchical Regression Analysis Predicting Total ASE

		Total ASE				
			Standardized Coefficients		95.0% Confidence Interval for B	
Step		Change in R^2	Beta	p	Lower Bound	Upper Bound
1	(Constant)			.000	2.054	2.215
	Difficulty in Abstinence (DA)	7.9%	-.281	**.003**	-.222	-.047
2	(Constant)			.000	2.055	2.213
	Difficulty in Abstinence (DA)		-.275	**.003**	-.218	-.046
	Self-Control (SC)	4.1%	.204	**.026**	.001	.009
3	(Constant)			.000	2.053	2.211
	Difficulty in Abstinence (DA)		-.291	**.002**	-.227	-.052
	Self-Control (SC)		.316	**.033**	.001	.015
	Impulsivity (IM)	.8%	.144	.330	-.005	.015
4	(Constant)			.000	2.052	2.211
	Difficulty in Abstinence (DA)		-.287	**.002**	-.226	-.050
	Self-Control (SC)		.321	**.030**	.001	.015
	Impulsivity (IM)		.140	.343	-.005	.015
	SC X DA	.4%	-.063	.490	-.006	.003
5	(Constant)			.000	2.046	2.207
	Difficulty in Abstinence (DA)		-.273	**.004**	-.220	-.042
	Self-Control (SC)		.328	**.027**	.001	.015
	Impulsivity (IM)		.148	.319	-.005	.016
	SC X DA		.036	.815	-.007	.009
	IM X DA	.5%	.125	.418	-.006	.015
Total Change in R^2		13.7%				

Note: ASE= Abstinence self-efficacy

Table 4. Hierarchical Regression Predicting Total ASE Excluding Self-Control

		Total ASE				
			Standardized Coefficients		95.0% Confidence Interval for B	
Step		Change in R^2	Beta	p	Lower Bound	Upper Bound
1	(Constant)			.000	2.054	2.215
	Difficulty in Abstinence (DA)	7.9%	-.281	**.003**	-.222	-.047
2	(Constant)			.000	2.055	2.216
	Difficulty in Abstinence (DA)		-.267	**.005**	-.216	-.040
	Impulsivity (IM)	1.1%	-.106	.255	-.010	.003
3	(Constant)			.000	2.050	2.212
	Difficulty in Abstinence (DA)		-.254	**.008**	-.211	-.032
	Impulsivity (IM)		-.112	.229	-.010	.003
	IM X DA	.6%	.080	.396	-.004	.009
	Total Change in R^2	9.6%				

Note: ASE= Abstinence self-efficacy

Table 5. Hierarchical Regression Analysis Predicting Lowest ASE Domain (Self-control)

		Lowest ASE Domain				
			Standardized Coefficients		95.0% Confidence Interval for B	
Step		Change in R^2	Beta	p	Lower Bound	Upper Bound
1	(Constant)			.000	1.258	1.395
	Difficulty in Abstinence (DA)	7.9%	-.281	**.003**	-.190	-.041
2	(Constant)			.000	1.258	1.395
	Difficulty in Abstinence (DA)		-.279	**.003**	-.188	-.040
	Self-Control (SC)	1.2%	.110	.234	-.001	.006
3	(Constant)			.000	1.257	1.394
	Difficulty in Abstinence (DA)		-.290	**.002**	-.194	-.043
	Self-Control (SC)		.192	.198	-.002	.010
	Impulsivity (IM)	.4%	.106	.482	-.006	.012
4	(Constant)			.000	1.256	1.391
	Difficulty in Abstinence (DA)		-.280	**.003**	-.189	-.040
	Self-Control (SC)		.209	.158	-.002	.010
	Impulsivity (IM)		.095	.520	-.006	.012
	SC X DA	3.3%	-.183	**.048**	-.008	.000
5	(Constant)			.000	1.249	1.386
	Difficulty in Abstinence (DA)		-.259	**.007**	-.182	-.030
	Self-Control (SC)		.219	.138	-.001	.011
	Impulsivity (IM)		.107	.471	-.006	.012
	SC X DA		-.039	.799	-.008	.006
	IM X DA	1.1%	.182	.239	-.004	.014
	Total Change in R^2	14.0%				

Note: ASE= Abstinence self-efficacy

Table 6. Hierarchical Regression Analysis Predicting Lowest ASE Domain (Impulsivity)

		Lowest ASE Domain				
			Standardized Coefficients		95.0% Confidence Interval for B	
Step		Change in R^2	Beta	p	Lower Bound	Upper Bound
1	(Constant)			.000	1.258	1.395
	Difficulty in Abstinence (DA)	7.9%	-.281	**.003**	-.190	-.041
2	(Constant)			.000	1.258	1.396
	Difficulty in Abstinence (DA)		-.276	**.004**	-.188	-.037
	Impulsivity (IM)	.2%	-.046	.618	-.007	.004
3	(Constant)			.000	1.257	1.394
	Difficulty in Abstinence (DA)		-.290	**.002**	-.194	-.043
	Impulsivity (IM)		.106	.482	-.006	.012
	Self-Control (SC)	1.4%	.192	.198	-.002	.010
4	(Constant)			.000	1.248	1.384
	Difficulty in Abstinence (DA)		-.256	**.007**	-.180	-.030
	Impulsivity (IM)		.110	.456	-.005	.012
	Self-Control (SC)		.220	.136	-.001	.010
	IM X DA	4.4%	.213	**.022**	.001	.012
5	(Constant)			.000	1.249	1.386
	Difficulty in Abstinence (DA)		-.259	**.007**	-.182	-.030
	Impulsivity (IM)		.107	.471	-.006	.012
	Self-Control (SC)		.219	.138	-.001	.011
	IM X DA		.182	.239	-.004	.014
	SC X DA	.1%	-.039	.799	-.008	.006
	Total Change in R^2	14.0%				

Note: ASE= Abstinence self-efficacy

APPENDIX B

Figure Caption 1: Moderation Effect of Self-Control on Perceived Difficulty in Abstinence and Lowest ASE Domain

Note: ASE=Abstinence self-efficacy

Figure 1. Moderation Effect of Self-Control on Perceived Difficulty in Abstinence and Lowest ASE Domain