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Self-Control, Context, and Health-Impairing Behaviors: Understanding Addiction Risk

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Melissa Vera Auerbach

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Abstract of the Dissertation

Self-Control, Context, and Health-Impairing Behaviors: Understanding Addiction Risk

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Self-control failure is a potent predictor of unhealthful behaviors such as drinking and smoking and a risk factor for addiction. Although research examining self-control failure among addicted individuals is growing, less is known about non-addicted people who fail at controlling health behavior. Social-cognitive models are often used to examine health behaviors among non-addicted individuals. However, health behavior theories tend to be trait-based and underemphasize the role of context. It is important to take into account the influence of situational factors (e.g., stress, fatigue, and negative mood) when understanding the association of dispositional self-control and health-impairing behaviors. This study seeks to advance current theories of self-control and their association with health-impairing behaviors. Health-impairing behaviors in this study include two behavioral categories: substance use (i.e. drinking alcohol, smoking cigarettes, and smoking marijuana), and uncontrollable eating, which is defined as the inability to successfully reduce food consumption despite the psychological distress and physical discomfort it may produce. The present study used structural equation modeling to test

hypotheses about self-control with four main goals: 1) to develop and establish a theoretically driven, empirically-valid latent factor model of dispositional self-control; 2) to examine the predictive validity of this model by examining its association with health-impairing behaviors (i.e. substance use and uncontrollable eating); 3) to explore how contextual variables, namely stress, fatigue, and negative mood, moderate the relationship between latent dispositional self-control and health-impairing behaviors; and 4) to explore whether dispositional self-control is associated with health-promoting behaviors (e.g., exercise and eating well), and whether gender moderates the association between latent self-control and health behavior. Questionnaire data collected from 615 student participants who completed well-validated measures of trait self-control, impulsivity, mindfulness, stress, and uncontrollable eating, and measures created for this study to assess fatigue, health-promoting behavior, and substance use were analyzed.

A multi-dimensional latent factor model of dispositional self-control consisting of trait self-control, impulsivity, and mindfulness was confirmed, which demonstrates synthesis of these constructs. The multi-dimensional dispositional self-control factor predicted substance use and uncontrollable eating as hypothesized, suggesting that those with higher self-control are less likely to engage in substance use or uncontrollable eating compared to those with lower control. Moderation analyses indicated that there may be greater health-behavior benefits of self-control in less demanding contexts. Although this evidence was not sufficiently strong, this pattern was observed with fairly high consistency across three moderators and with three different types of health behaviors. One counter-intuitive finding was that self-control was more beneficial for those with higher than lower stress with respect to how frequently they eat uncontrollably. This study is one of the first to examine the interactive effects of variables reflecting the state of individuals with dispositional control. The study also suggests that the resources required to

carry out healthful behaviors may be distinct from the resources used to restrain from unhealthful behaviors. Furthermore, by identifying the impact of modifiable contextual factors including stress, mood, and fatigue, the study offers groundwork to advance health behavior theory and interventions.

Table of Contents

List of Tables

List of Figures

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Introduction

Health behaviors provide a potent context for examining self-control failure, as many health-relevant behaviors, including food consumption, sleep, substance use, and sexual behaviors affect critical outcomes including physical health, longevity, and even survival. Cigarette smoking is a particularly common topic when studying self-control failure. Millions of Americans try to quit each year, yet a large majority of these attempts fail within the first month (Dube, Asman, Malarcher, & Carabollo, 2009). These high rates of failed smoking cessation are due not only to the physiological addiction to nicotine, but also to the emotionally and behaviorally addictive properties of cigarette smoking (Brewer et al., 2011). Overconsumption of food and alcohol are also considerable domains of self-control failure, as over time and with repeated failures of self-control, such behaviors may become chronic and evolve into addictions (Bland, Melton, Welle, & Bigham, 2012; Sayette & Griffin, 2011), especially when a person's motives for these behaviors change or intensify (Hustad, Carey, Carey, & Maisto, 2009; Perkins, Haines, & Rice, 2005). For example, it has been shown that moderate drinkers who consume alcohol for social reasons are at risk for addiction if they start drinking in order to cope with stress (Ansker, Helgason, & Ahacic, 2014). However, there has been little attention toward understanding why people who are not addicted fail at controlling their health behaviors. College students are a particularly important group to examine, as behaviors such as drinking and overeating are considered socially normative in college (Bland et al., 2012; Perkins et al., 2005), but can become unremitting and impair health and well-being. This study examines behavioral control among non-addicted college students to further our understanding of the origins of addiction risk.

Social-Cognitive Theories of Health Behaviors

Health behavior theories such as the Health Belief Model (Rosenstock, 1974) and Theory of Planned Behavior (TPB; Ajzen, 1991) are often used to investigate health behaviors among non-addicted individuals. These approaches are especially valuable in describing the uptake of health-promoting behaviors such as exercise and eating healthfully. The Theory of Planned Behavior (TPB) is one of the few health behavior theories that focuses both on health-promoting and health-impairing behavior (Ajzen & Fishbein, 2005). TPB suggests that intention to engage in a behavior (e.g. quitting smoking) is the essential predictor for behavior, and that this intention is determined by the attitude toward, perceived norms about, and perceived control of that behavior. Although health behavior theories like TPB may explain why or how people intend to quit smoking or drinking, these theories generally do not explain the *adoption* of such health-impairing behaviors. Furthermore, by focusing on future outcomes of health behaviors, prevailing theories tend to underestimate the role of the present moment as a factor that influences behavior (Darlow & Lobel, 2012; de Ridder & de Wit, 2006). Healthy intentions can be overruled by acute reactions to challenging situations (Gibbons, Gerrard, Blanton, & Russell, 1998). For example, even for individuals who regularly exercise and eat healthfully, vulnerability during periods of stress may lead them to succumb to vices such as unhealthy snacking. Furthermore, because most people are involved in multiple goal pursuits and engaged in many roles concurrently, they often need to divide their resources. Focusing on health behavior in isolation is a limited approach, as other life responsibilities compete for time, energy, effort, and resources. Therefore, it is important to take into account the influence of contextual or situational factors such as stress and fatigue when examining control of health behaviors.

Many health behavior theories emphasize goal setting as an instrumental first step in implementing self-control processes (Legault, Gutsell, & Inzlicht, 2011). Cybernetics has been

used to model self-control processes in humans, reducing control to three components: goal setting, behavioral monitoring, and behavior implementation (Inzlicht, Legault, & Teper, 2014). For example, according to cybernetic principles of self-control, dieters first set a specific goal for the kinds of food they want to eat. Next, they monitor their eating behavior for instances when it is discrepant from their goals. Then if any discrepancies are detected, they change their behavior (e.g., "Put down the chips and grab the broccoli!") (Legault et al., 2011). Goal setting creates a discrepancy between what one wants to do and what one is currently doing, and this discrepancy is what sets self-control in motion (Inzlicht et al., 2014).

A widely accepted perspective on self-control is that it can be characterized by two systems of behavior (Dvorak & Simons, 2009; Wills, Windle, & Cleary, 1998). One system involves control over goal-oriented behaviors, such as eating nutritiously or abstaining from smoking to promote good health. This control of goal-oriented behaviors tends to focus on long-term outcomes such as improvements in health. The second system involves appetitive or hedonistic behaviors that serve more immediate and contextually related goals, often to alleviate stress, improve mood, or derive pleasure (Vohs & Heatherton, 2000). This immediate system includes responses to temptations and cravings, such as consuming highly palatable and easily available foods (de Ridder & de Wit, 2006). Dual-process theories tend to separate cognitive and emotional processes: the immediate system is more emotionally reactive to context (e.g., smoking a cigarette in response to distress), and the goal-oriented one is more cognitively effortful (e.g., exercising to promote longevity). Therefore, according to this perspective, when people experience self-control failure, they are unable to override dominant, hedonistic response tendencies despite their desire to regulate behavior or maintain health goals (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012).

The "hot/cool system" theory (Metcalfe & Mischel, 1999) is one relevant example of a dual-process theory of self-control. This theory suggests that the "hot system" pertains to resisting temptation or impulses. The "cool system" pertains to acting on planned and premeditated actions. The cool system relies on long-term executive function resources, such as reasoning and strategizing, and is therefore considered a cognitively-based system, whereas the hot system is emotionally based as it deals with immediate reactions to the context. This theory suggests that the cool system functions less when individuals are confronted with impulses requiring immediate control, and that the hot system is used to pursue short-term, immediate goals (de Ridder & de Wit, 2006). Strack and Deutsch (2004) suggested a similar dual-process theory of self-control. One mode, termed "effortful," tends to rely heavily on information processing and regulatory control. The other mode, termed "impulsive," is reactive as it responds to emotional situations (Lieberman, 2007; Strack & Deutsch, 2004). Dual-process approaches thus suggest that when individuals struggle with self-control, they experience conflict between competing behavioral tendencies: one being more emotionally reactive (e.g., smoking a cigarette during a time of stress), and the other being more cognitively effortful and goal-oriented (e.g., smoking cessation).

The distinction between emotional and cognitive processes involved in self-control is also reflected in research elucidating the neural substrates of self-control. Compared to the reflective system, the brain structures that are activated under conditions that promote emotionally reactive information are phylogenetically older and are more conserved across species (Lieberman, 2007). It has been proposed that the emotionally reactive system is composed of the amygdala, basal ganglia, and the dorsal cingulated cortex (dACC; Eisenberger & Lieberman, 2004). The reflective system has been posited to consist of the anterior cingulate

cortex (ACC), lateral prefrontal cortex (LPFC), and the hippocampus and surrounding medial temporal lobe region (MTL; Lieberman, 2007). The LPFC is considered the heart of the reflective system as it is involved with intentional and effortful cognitive processes such as the implementation of top-down goals, inhibition, and self-control (Cabeza & Nyberg, 2000). The frontal lobe has also been linked to processes involved with overriding the emotional or impulsive system (Miller & Cohen, 2001), and the ACC has been shown to be helpful in evaluating aversive events that threaten current goals (Shenhav, Botvinick, & Cohen, 2013). Although much neural research has examined the emotional and cognitive systems separately, these systems are considered to be working together and working simultaneously (Lieberman, 2007).

The Power of Unhealthy Habits

Quick and automatic decisions may compel someone to abandon their long-term goals and to respond to the moment. It is unlikely that all the choices people make necessitate the active involvement of the self. Many choices that are made, especially those that are quick and effortless, may not be deliberate (Bauer & Baumeister, 2011). For example, skipping breakfast in the morning is considered to be an unhealthful behavior as it increases one's appetite throughout the day, deregulates glucose levels, and often leads to subsequent overeating and weight gain (Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006). However, the behavioral effects of skipping breakfast are often overlooked by individuals, especially young adults. Although automatic behaviors such as skipping breakfast are typically easy and effortless, the impact of such behaviors can jeopardize long-term health goals. Habits are a pertinent aspect of automatized behaviors. Routinized, repetitive, and mindless behaviors are common (Langer, 1992) and may lead to the development of poor health habits. Unconscious habits, or mindless

behaviors repeated over and over, may lead an individual to rely heavily on established patterns (Langer & Moldoveanu, 2000). Moreover, once a habit like smoking is formed, it becomes so engrained into one's routine, that brain structures such as the basal ganglia and other neurological circuits also adapt by processing these as automatic behaviors (Hilário, Clouse, Yin, & Costa, 2007), whereas awareness and decision making processes that were once involved at the initiation of this behavior are no longer active. When such behaviors are fully automatized, and the cues that stimulate them are constant, then these habits can be effortless, mindless, and occur without thought. It has been reported that many smokers who relapse are not experiencing negative affect but are smoking outside of their awareness (Sayette & Griffin, 2011; Tiffany, 1990). Poor health habits are also likely to persist if one is unaware of the long-term costs associated with these behaviors (Gottfredson & Hirschi, 1990). For example, research has shown that heavy drinkers do not pay attention to the "warning signs" of previous alcohol consequences, such as alcohol-related accidents, and do not adjust their drinking patterns to avoid them further (Hustad et al., 2009). Such poor health habits can thus be outside of awareness and well-learned, and may also be antithetical to health goals.

For those who routinely engage in poor health habits, controlling these automatic and non-conscious processes can be highly difficult. Controlling unhealthful routines would require one to be mindful of their reactions to environmental cues and then override these routines with healthier habits (Graybiel, 2005). For example, if one is trying to reduce snacking behavior but has a habit of reaching for the potato chips immediately after coming home from a long stressful day at work, then one must a) learn to be aware of this mindless routine and b) develop a healthy habit to override this routine, such as by grabbing fruit instead of chips. People can continue to routinely engage in poor health habits even when they are fully aware of their risks and would

prefer to avoid these damaging behaviors. This has been shown to be true in animals, as well. For example, in one study (Hilario et al., 2007), mice were trained to press a lever in response to certain cues, by rewarding them with food. Then the researchers poisoned the food so that it made the mice violently ill. The mice eventually learned that the food in the cage was dangerous, as the mice stayed away from the poisoned pellets. However, once the previously learned cues were re-introduced after an extinction period, the mice pressed the lever and ate the poisoned food, indicating that the cue-lever-eating habit had become so automatic that it overpowered the mice's awareness of the food's adverse effects. Similarly, alcoholics who are "on the wagon" most likely learned at one point that alcohol is dangerous and is associated with negative social and psychological consequences. However, this learning can be undone and one can "fall off the wagon" after some time (extinction period) and/or if environmental cues trigger previously hard-wired cravings.

Dispositional and Situational Perspectives on Control

Self-control failure arises when there is a conflict between two competing behavioral tendencies: one based on a specific goal or norm, and the other based on a hedonistic drive. Impaired control could be due to an individual's disposition such that a person could have an impaired ability to control their behavior. On the other hand, impaired control could also occur among those who possess dispositional control but who may be susceptible to contextual influences, making them more likely to succumb to unhealthy behaviors. Therefore, in order to understand the uptake of health-impairing behaviors, it is important to clearly differentiate dispositional from contextual factors that result in failed control.

Whereas situational perspectives indicate that failed self-control is due to the contexts that make it challenging for individuals, trait perspectives question if people fail at self-control

due to a dispositional trait. The trait model suggests that self-control represents individual differences in self-control of a broad spectrum of behaviors (Tangney, Baumeister, & Boone, 2004). For example, a commonly used self-control trait measure, the Brief Self-Control Scale (BSCS; Tangney et al., 2004), assesses people's ability to override inner responses ("I get carried away by my feelings," reverse scored), and refrain from acting on undesired behavioral tendencies ("I am good at resisting temptation"). Studies of this measure suggest that low self-control is a considerable risk factor for a broad range of problematic behaviors (de Ridder et al, 2012). For those struggling with self-control, goal-oriented behaviors compete regularly with momentary desires or impulses (Schroder, Ollis, & Davies, 2013). Research also shows that people with high dispositional self-control are better able to control their thoughts, regulate their emotions, and inhibit impulses compared to people with low self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998; de Ridder et al., 2012; Salmon, Fennis, de Ridder, Adriaanse, & de Vet, 2014).

However, a limitation of existing theoretical models of self-control is that they often overlook the role of contextual cues. For example, coping with stress often leads to relapses of smoking and drinking as well as diet breaking, even among those with high dispositional self-control (Baumeister et al., 1994). Demanding cognitive or emotional contexts may require more resources than what are available, which can lead to fatigue or a lack of strength to control behavior. Self-control can also vary across situations and time and is susceptible to situational influences including previous attempts at self-control (Baumeister et al., 1998; Muraven & Baumeister, 2000), mood (Fishbach & Labroo, 2007), and working memory capacity (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008). Elaborated below are some well-known contextual demands that may make an individual vulnerable to failed control.

Contextual Contributors to Failed Self-Control

Environmental cues are a powerful contextual contributor to failed control. Temptations toward unhealthful behaviors are ubiquitous in modern society and include frequent exposure to environmental cues such as fast food advertising. Such temptations, particularly if they are continuous, can undermine attempts to refrain from unhealthful behaviors such as overeating. Research suggests that when people are in a "hot" visceral or emotional state, the presence of temptation will direct their cognition toward an impulsive action (Nordgren & Chou, 2011). Yet people are often unaware that the stimuli in their environment may be spontaneously activating these cognitive processes that determine their behavior (Heatherton & Wagner, 2011). Temptations in the environment often trigger cravings, or intense desires for a particular substance, and can lead to weakened self-control. Stress and negative affect can also precipitate these cravings (Kassel, Stroud, & Paronis, 2003). Additionally, the restraint involved in day-to-day temptations and cravings can deplete self-control (Baumeister et al., 1998). Individuals with a goal to lose weight may at first be cognitively effortful as they inhibit their cravings for fatty snacks. However, after multiple occurrences of controlled and healthful eating, this inhibitory system may eventually break down either due to an overpowering stressor or due to cognitive overload. Another explanation for why people may respond to the moment as opposed to their distal yet healthier goals is the theory of discounting. The theory of discounting (Rachlin, Raineri, & Cross, 1991) suggests people may perceive the moment as more important than the future, which is distant and uncertain. The more an individual discounts the future, the more likely they will be to choose a short-term option over a long-term one (Rachlin et al., 1991). Therefore, this theory helps to explain why the moment may be prioritized over long-term health goals. Stritzke and colleagues (2004) found that smokers tend to hold conflicting beliefs: They

believe it is foolish to risk their health by continuing to smoke, yet they also believe life is uncertain so they might as well enjoy the moment. This study indicated that some people believe that it is highly uncertain that they will collect a long-term reward, so they might as well choose the more immediate reward. Thus, people may temporarily suspend their long-term goals when faced with certain contextual demands.

Fatigue. Fatigue is another contextual factor that often leads to failed control. This feeling is very common in everyday modern life and generally involves tiredness or even exhaustion, an aversion to continue with the present activity, and a decrease in the level of commitment to the task at hand (Holding, 1983; van der Linden, Frese, & Meijman, 2003). In the context of health behaviors, fatigue is often discrepant with an overarching health goal and may be regulated by engaging with sources of immediate gratification (Schmeichel, Harmon-Jones, & Harmon-Jones, 2010). Fatigue can occur when a person must override a set of impulses or learned behavior such as when a smoker is resisting a cigarette craving. Fatigue can also occur when a person is exhausted by difficult tasks, like solving challenging math problems, in which individuals have to resist simply quitting these tasks (Wright et al., 2007). It has been proposed that fatigue is an analogue for self-control failure as it reflects a depletion or an exhaustion of self-control resources (Hagger, Wood, Stiff, & Chatzisarantis, 2009). One of the more influential theories to come from research on fatigue is the limited strength model, which suggests that all of the resources available for self-control are in a single domain (Vohs & Heatherton, 2000). This model posits that self-regulatory strength is a finite, renewable resource that is consumed when people attempt to regulate their emotions, thoughts, or behaviors (Ginis & Bray, 2010). In other words, the resources required for behaviors like attentional control are the same as those that are used to resist unhealthful behaviors like overeating. Therefore, fatigue can ensue from an

over-exertion of thoughts or emotions, or when resisting a strong craving, despite the fact that these are distinctly separate behaviors. For example, one study (Muraven, Collins, & Neinhaus, 2002) tested this domain-general resource model of fatigue in a study involving alcohol restraint. In this study, male social drinkers were randomly assigned to either a high self-control depletion task (suppressing thoughts of a white bear), or a low control depletion task (solving simple arithmetic problems) and were given the opportunity to consume beer ad lib. As hypothesized, those in the high depletion group drank more beer and had higher blood alcohol content than participants who performed the low self-control task. This study indicated that, after people self-regulate on one task, they are more likely to succumb to fatigue or self-control failure shortly thereafter, regardless of the domain of the original task (Muraven et al., 2002).

Prior research also distinguishes physical and cognitive fatigue. For example, the Fatigue Impact Scale (FIS; Fisk, et al., 1994) is a three-factor scale of self-reported fatigue that differentiates cognitive, emotional, and physical fatigue items. Cognitive functioning concerns concentration, memory, and thinking; physical functioning reflects motivation, effort, stamina and coordination; and psychosocial functioning reflects emotions and coping. Recently, decision fatigue has attracted more research attention, as it has been found to be highly influential over a broad range of behaviors, from purchasing items while shopping to healthy/unhealthy eating choices. Decision fatigue is considered related to yet distinct from physical fatigue, as it refers to the limited reserve of stamina for decision making that is depleted gradually throughout the day. These decisions range in importance from what to eat for breakfast to more complicated decisions that may influence our health and well-being. If not adequately replenished, decision fatigue can lead to difficulty in making trade-offs, to impulsivity, and ultimately, to poor decisions. Thus, making choices may consume some of the self's limited supply of energy,

rendering the resource less available for future demands (Vohs et al., 2008). Vohs and colleagues examined the fatiguing influence of decision-making on procrastination levels. In this study, college students were asked to make a series of choices about courses required for their major, and were then given an opportunity to prepare for an upcoming exam. Those who endured higher levels of decision making procrastinated more in preparing for the exam compared to those with less decision-making. Making a series of choices can therefore be taxing, leading to fatigue, procrastination, and to unhealthy choices.

Stress. Similar to fatigue, stress can also exhaust an individual's personal resources essential for maintaining healthy goals (Hagger et al., 2009). Situational factors like stress may make individuals less responsive to goal-oriented processes. In particular, acute stress due to an emotionally demanding event may diminish the importance of long term goals while increasing the salience of the immediate context. This may explain why acute stress often leads to relapses of smoking and drinking as well as to diet breaking (Baumeister, Heatherton, & Tice, 1994). Baumeister and colleagues (1994) suggested that affectively charged moments focus attention on immediate stimuli, decreasing the resources needed to attend to higher level goals. In other words, it may be difficult for people to be aware of their goal-oriented behaviors when emotionally charged situations demand a focus on immediate stimuli. Threatening emotional states can also produce "a bias towards short-term thinking" (Gray, 2004). This bias may even be considered adaptive, as responding to the present context is sometimes more important for immediate survival than its long-term, accumulated consequences. Research on emotion-focused coping offers insight as to why people may prioritize substances that help ameliorate the immediate context. Alcohol is thought to serve as a form of immediate self-medication, reducing negative emotional states for some individuals (Colder, 2001). Similarly, a primary reason given

for smoking is to reduce anxiety (Parrott, 1995), and escape from negative affect has been found to be an essential motive for drug use (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). When an individual is experiencing *both* stress and fatigue, it can be particulaly difficult to override temptations or resist cravings. Prior research has found that fatigue and stress affect one's coping skills and ability to effectively deal with barriers (Hagger et al., 2009; Tice & Bratslavsky, 2000). Stressors are consistently reported in relation with fatigue, as both cross-sectional and longitudinal data indicate that stressful life events or work stressors are associated with fatigue in healthy working adults (Thorsteinsson & Brown, 2009; Van der Ploeg & Kleber, 2003).

Mood. Like fatigue and stress, the drive to improve a negative mood may also lead to failed control by making contextual demands particularly salient. Negative mood signals a need for action, often leading one to search for strategies that will improve the mood or one's environment. Although unhealthful, mood-improving behavior tends to be motivated by an emotionally impulsive system, it also may occur due to a conscientious choice to suspend one's long-term health goals. Unlike bouts of quick intense emotion, negative moods can last for several hours or days. A continuous, persisting negative mood can also lead to negative social and work-related consequences, as it impairs emotional inhibition and concentration. Therefore, improving mood via unhealthful behaviors may be a deliberate solution to relieve a persistent negative state. As evidenced by research on "negative state relief" (Cialdini, Darby, & Vincent, 1973) and tension reduction (Greeley & Oei, 1999), people are more willing to participate in risky unhealthy behaviors when attempting to ameliorate or avoid experiencing negative mood. The perceived duration of one's mood can also determine whether or not to engage in unhealthful behavior. Tice et al. (2001) found that after inducing a negative mood, those who believed their mood was modifiable engaged in impulsive behaviors such as eating fattening

snacks. However, when participants believed that their affective state was more permanent or long-lasting, the desire for impulsive behaviors diminished. Thus, people's perceptions of the controllability of their negative moods can determine whether or not they should indulge in immediate forms of gratification to make themselves feel better.

Integrating State and Trait Perspectives

Emerging theories suggest the value of integrating state and trait perspectives in conceptualization of self-control. Self-control may arise from interactions between temperament and the contextual influences of the individual's social world (Dvorak & Simons, 2009; Wills & Dishion, 2004). In other words, individual differences in one's predisposition to engage in risky health behaviors are the product of an individual's unique genes and environment (Caspi & Moffitt, 2006). Wills and Dishion (2004) proposed a model outlining the integrative influence of both temperament characteristics and environmental contexts (i.e. parenting and peer relations) on the development of self-control ability specific to substance use. According to this model of self-control, children with higher levels of negative emotionality (either borne out of disposition or negative parenting influences) may have restricted attentional resources available for self-regulation. Furthermore, these researchers suggested that self-control can be modified via certain contextual factors, recommending an approach to future interventions. Further research is needed to test such theories, exploring how situational factors and dispositional control jointly affect state self-control.

Limitations of Previous Research

There are several limitations of previous perspectives on self-control. Dual-process approaches suggest that the cognitive, effortful system is invoked less when individuals are confronted with impulses requiring immediate control, and that the emotionally reactive system

is used to deal with short-term, immediate goals (de Ridder & de Wit, 2006). Thus, these theories separate cognitive and emotional processes. However, there is considerable evidence that cognitive and emotional processes work in concert to influence behavior (Dvorak & Simons, 2009; Wills et al., 1998). According to contemporary theorists, emotion and cognition are fully integrated and without clear demarcation in the human brain (Inzlicht, Bartholow, & Hirsh, 2015; Lindquist & Barrett, 2012). Individuals confronted with an emotional impulse may experience two simultaneously occurring cognitive processes: a reduction in functioning of the goal-oriented cognitive system, and a cognitive appraisal of the situation at hand that helps determine emotional responses. Thus, the full experience of emotion typically includes thought and action impulses (Lazarus, 1982). Self-control of health behavior is therefore likely to involve simultaneous occurrence of emotional and cognitive processes.

Another shortcoming of previous models of self-control is that they tend to separate situational and dispositional perspectives. Similar to studying one's susceptibility to certain diseases by examining gene-environment interactions, it is also important to assess the interaction of dispositional and environmental demands involved with the uptake of health-impairing behavior. As well, previous examinations of the behavioral outcomes associated with self-control have been overly general, as they often suggest that aspects of self-control in one behavioral domain (e.g. academic performance) are similar to aspects of self-control in other domains (e.g. health behaviors) (Oaten & Cheng, 2006; Tangney, Baumeister, & Boone, 2004). However, this generalization can be too broad, as what motivates one to maintain good physical health may be entirely different from what motivates one to be academically successful. Therefore, the current project examines self-control in the context of a specific set of behavioral outcomes.

Comprehensive Operationalization of Dispositional Self-Control

There is considerable variability in the methods and measures used to assess dispositional self-control. Empirical findings suggest that different measures of self-control assess similar yet independent aspects of self-control. For instance, trait self-control and impulsivity are both considered to be stable characteristics of individuals (Patton & Stanford, 1995; Tangney et al., 2004) and impulse control problems are often linked to deficits in trait self-control (Tangney et al., 2004; Wills et al., 2007). Some researchers equate low dispositional self-control with impulsiveness (de Ridder et al., 2012; Duckworth & Kern, 2011), while other research has suggested that, although trait self-control and impulsivity are highly related, they are not redundant concepts (Friese & Hofmann, 2009). The current study aims to incorporate trait self-control and impulsivity into a common latent factor. By incorporating measures of both trait self-control and impulsivity, a multiply-indicated latent factor representing dispositional self-control is conceptually and statistically more powerful and more reliable than a unidimensional measure of self-control. There have been no studies to date that have examined dispositional self-control in this manner.

Although measures of impulsivity and trait self-control are often considered when operationalizing self-control, dispositional mindfulness is rarely considered. Mindfulness is defined as a dispositional trait of receptive awareness of present-moment experiences (Black, Sussman, Johnson, & Milam, 2012) and is considered to be orthogonal to habitual responses as it involves orienting attentional awareness to the present, and not past behaviors. Mindful people, compared to those who are less mindful, have a heightened awareness of their behavioral routines as well as to the motives that drive their behaviors (Brown & Ryan, 2003) and they have a greater ability to prevent certain behaviors or impulses (Black et al., 2007; Chatzisarantis &

Hagger, 2007). For example, one study found that compared to those who are more mindful, less mindful participants were less able to control counter-intentional binge drinking habits (Chatzisarantis & Hagger, 2007). Thus it is seems that individuals who have low self-control and/or high impulsivity tend to be less mindful of themselves and of their own behaviors. Furthermore, in one study that examined the effect of mindfulness on both healthy and unhealthy behaviors, results suggested that mindfulness plays a stronger role in protecting against harmful behaviors like smoking and a lesser a role in health-promoting behavior (Black et al., 2007). Because mindfulness (or the lack thereof) is a dispositional trait that encapsulates the perceptual limitations involved with poor self-control and impulsivity, this construct would be helpful to include in the theoretical and operational definition of dispositional control. One study to date has incorporated the concept of mindfulness into a definition of self-control. This study successfully combined uncontrollability and lack of awareness into a single-factor scale of habitual strength (Verplanken & Orbell, 2003). Such studies suggest the value of including trait mindfulness in definitions of self-control.

The Association of Self-Control and Health-Impairing Behaviors

People may engage in occasional risky behaviors simply because they enjoy them and are not motivated to control them. However, as previously discussed, the more one employs these types of behaviors, the more likely one is experiencing self-control failure. Compared to those with greater self-control, people with poor control are more likely to engage in risky behaviors to pursue immediate pleasure (Honken & Ralston, 2013). Dispositional self-control is also a potent predictor of a broad range of problematic health behaviors (de Ridder et al., 2012). Smoking, overeating, and problem drinking are all considerable domains of self-control failure. Additionally, college may be a particularly precarious time, as poor health habits may be socially

normative in school (Bland et al., 2012; Perkins et al., 2005), but can become unremitting over time if they are not controlled. Therefore, examining the association of health behaviors and control in this at-risk group can help advance theory of self-control failure and suggest ways to improve self-control of health behaviors in young adults.

Contextual Moderators of Self-Control and Health-Impairing Behaviors

While the direct association between dispositional self-control and health-impairing behaviors has been well-demonstrated (de Ridder et al., 2012; Gearhardt, Corbin, & Brownell, 2009; Gold, Frost-Pineda, & Jacobs, 2003), little is known about variables that may moderate this relationship. According to Hagger (2015), personal resources may moderate the extent to which self-control resources affect self-control related performance. Dispositional self-control may not protect as well against poor health behaviors during periods of stress. There has been little research investigating the interaction of trait self-control and contextual demands. The current study examined the effects of self-reported stress, which reflects the natural complexity of stressors in the real-world, rather than the effects of an experimentally-induced stressor.

There is emerging evidence explaining *why* contextual factors like stress may interact with self-control and health-impairing behavior. Goal-oriented behaviors compete regularly with momentary desires or impulses (Schroder, Ollis, & Davies, 2013). Thus, when a stressor occurs, especially for individuals already experiencing psychological depletion due to the exertion of moment-by-moment impulse control, smoking relapse or diet-breaking may become an attractive way to seek immediate relief (Baumeister et al., 1994). It is particularly important to study contextual moderators such as stress, fatigue, or negative mood, as these are present in most people's lives at one point or another.

Examining contextual moderators can also help integrate situational and dispositional perspectives of control, an aspect of prior research that has received little attention. One of the few integrated models of self-control, developed by Wills and Dishion (2004), suggests that children with higher levels of negative emotionality (by disposition or resulting from parenting influences) may have restricted attentional resources available for self-regulation. Thus self-control may arise from interactions between temperament and the contextual influences of the individual's social world (Dvorak & Simons, 2009; Wills & Dishion, 2004).

Conceptualizing Health-Impairing Behaviors

Although substance use and problem eating seem to be distinct from one another, neurological evidence suggests physical parallels to these problematic health behaviors. Animal models show that rats develop behavioral and neurochemical changes that are comparable to drug use when they have intermittent access to excessive amounts of food or a cafeteria-like diet (Johnson & Kenny, 2010). Considerable evidence has shown that food and drugs of abuse exploit similar pathways in the brain, namely the dopamine and opiate systems (Nieto, Wilson, Cupo, Roques, & Noble, 2002), as dopamine has been associated with the perceived value of reward of both food and psychoactive substances. Therefore, these behaviors appear to share similar mechanisms in the brain related to control despite the fact that they are distinct behaviors (Wagner & Heatherton, 2010).

One specific type of health-impairing behavior, uncontrollable eating, is particularly relevant when examining self-control failure. Unlike smoking or drinking alcohol, food consumption is a behavior that every human being must enact for survival, which makes overeating a risk familiar to many people. Poor eating behavior is also a commonly adopted coping response to stress, as consuming highly palatable foods tends to be strongly associated

with dopamine release and positive affect (Hagger, 2015). Characterized by an inability to successfully reduce food consumption despite the psychological distress and physical discomfort it may produce (Gearhardt, Corbin, & Brownell, 2009), measures of uncontrollable eating capture both the physical and psychological aspects of overeating. Uncontrollable eating also typically includes the over-consumption of highly palatable and caloric foods that commonly lead to weight gain. Additionally, uncontrollable eating is associated with poor health outcomes like obesity and binge eating, which have become increasingly prevalent in the U.S. (Meule, 2011). Therefore, although most people have a strong impulse to eat tempting food, there are individual differences in the strength of impulses related to eating behavior. Similar to other health-impairing behaviors, uncontrollable eating is also commonly associated with contextual triggers like stress (Parylak, Cottone, Sabino, Rice, & Zorrilla, 2012).

Study Overview

Study Population

The current project utilized a large data set incorporating a variety of measures of self-control, health behaviors, and related variables among college students. College students are an important target group because health-impairing behaviors like drinking and smoking are normative in college, but unremitting behavioral patterns are often determined by adoption of such behaviors in young adulthood (Bland et al., 2012; Perkins et al., 2005). Furthermore, young adults are more susceptible to risky behaviors than older adults due to differences in brain maturation relevant to behavioral control (Chambers & Potenza, 2003). Compared to older adults, young adults ages 18-25 are still undergoing development in regions of the brain associated with judgment and decision making (i.e., the prefrontal cortex). When young adults engage in risky behaviors like alcohol or drug consumption, their decision making abilities may

become even further impaired. Furthermore, the brain's reward system is highly active in young adulthood, which may also explain the tendency to seek excitement and risk taking during this age.

Among college students in the United States, alcohol and tobacco use are common (Wong & Rowland, 2013). In 2008, approximately 80% of college students in the United States reported using alcohol and 18% reported smoking cigarettes within the previous year (Merikangas & McClair, 2012). College students also tend to consume more alcohol in a drinking session than non-college attending peers. For example, 40% of students engage in a heavy episode of drinking in any two week period, making college students a high-risk population (Hustad et al., 2009). College is also a particularly important time to study psychosocial influences on health-impairing behaviors, as students focus during this transitional period of adult life on their purpose and identity, while experiencing what is for many a more challenging workload than they have encountered previously, and a new, fast-paced environment with more behavioral and decision-making freedom than they have encountered previously (Bland et al., 2012). Some students may respond to these challenges by turning to problematic health behaviors such as smoking, drinking, and overeating.

Study Goals

One goal of the current study was to examine trait self-control, impulsivity, and mindfulness as measurable elements of a comprehensive, multidimensional latent factor of dispositional self-control. Structural equation modeling was used to test this latent factor. Once a latent model of dispositional self-control was established, a second goal of this study was to examine the predictive validity of the latent factor by examining its association with health-impairing behaviors. Health-impairing behaviors in this study were conceptualized as two unique

behavioral types: substance use (i.e., drinking alcohol, smoking cigarettes, and smoking marijuana), and uncontrollable eating, which was defined as the inability to successfully reduce food consumption despite the psychological distress and physical discomfort it may produce. A third goal was to explore how contextual variables, namely stress, fatigue, and mood, moderate the relationship between latent dispositional self-control and health-impairing behaviors. This goal extends prior research (Wills & Dishion, 2004) by modeling the integrative influence of dispositional characteristics (i.e., trait self-control, impulsivity, and mindfulness) and environmental contexts (stress, fatigue, and mood) to further our understanding of self-control. This approach offers an advance to behavioral theory by identifying the influence of modifiable factors such as contextual stress. Contextual factors are pertinent for the design of addiction risk interventions because, unlike dispositional traits that are difficult or impossible to modify, contextual factors are constructs that can sometimes be changed.

Specific Aims and Hypotheses

Specific Aim 1: To develop a multidimensional operationalization of dispositional self-control. The first aim was to examine whether measures of trait self-control, impulsivity, and mindfulness can serve as indicator variables for a latent factor representing dispositional self-control (See Figure 1). The widely-used Brief Self-Control Scale (BSCS; Tangney et al., 2004) and Baratt Impulsiveness Scale-Brief (BIS-Brief; Steinberg, Sharp, Stanford, Matthew, & Tharp, 2013) were used as the measured indicators of trait self-control and impulsivity, respectively. While these scales evaluate broader personality characteristics regarding the self or one's abilities (e.g., ability to resist temptation or to concentrate), the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) was also incorporated as an indicator of dispositional self-control, as mindfulness is a dispositional trait that captures specific

occurrences of attentional awareness (e.g., "It seems I am running on automatic without much awareness of what I'm doing"). Thus, a more comprehensive operational definition of dispositional control was tested, comprised of general personality characteristics related to control as well as stable responses to specific situations that require mental control. A multiply-indicated latent factor representing dispositional self-control is conceptually and statistically more powerful and more reliable than separate measures of self-control. Structural equation modeling was used to develop and test this model of latent self-control.

Hypothesis 1. Trait self-control, impulsivity, and mindfulness will share common error variance, and be reliable indicators of a latent factor representing dispositional self-control (See Figure 1).

Exploratory Analyses. Differences may exist in the extent to which the three indicator variables contribute to the latent factor in the conceptual model. Therefore, the model will be tested to determine whether $DSC_1 = DSC_2 = DSC_3$ (where DSC_n is the path to an indicator variable from the latent factor representing dispositional self-control).

Specific Aim 2: To test whether dispositional self-control predicts substance use behavior and uncontrollable eating. Following the development of a well-fitting model of dispositional self-control, the relationship between this latent factor and frequency of substance use as well as uncontrollable eating was tested. Substance use was examined by selecting appropriate items from a measure used in prior studies of health behavior (DeLuca & Lobel, 1995). Four items were selected to measure substance use, which included drinking alcoholic beverages; smoking tobacco and electronic cigarettes; and marijuana use. Participants were asked, "How often in the past two weeks did you" engage in these behaviors. Responses were provided on a 5 point scale ranging from 0 (*Never*) to 4 (*Very Often*).

A strong inverse relationship between self-control and substance use frequency was predicted (See Figure 2). This aim was to replicate previous findings (de Ridder et al., 2012) indicating that those with compromised control are more likely to use substances. Similarly, a strong inverse relationship between dispositional self-control and frequency of uncontrollable eating was predicted (See Figure 3). The Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009) assesses how frequently one experiences the physical and psychological outcomes of uncontrollable eating (e.g. "I feel sluggish or fatigued from overeating"). Scale items were added to compute a total score for each participant.

Hypothesis 2a. The latent factor, dispositional self-control, will be strongly and inversely associated with substance use frequency. Those with lower dispositional self-control will engage in more frequent substance use.

Hypothesis 2b. The latent factor, dispositional self-control, will be strongly and inversely associated with uncontrollable eating frequency. Those with lower dispositional control will report more frequent uncontrollable eating.

Specific Aim 3: To examine contextual variables that moderate the association of dispositional self-control with frequency of substance use and uncontrollable eating.

Although low self-control has been shown to be a potent predictor of health-impairing behaviors, little research has been conducted on variables that moderate this association. This aim expanded upon previous theories of self-control by examining its interaction with a variety of relevant contextual variables.

For those experiencing low contextual demands low like stress or low fatigue, or those with positive mood, latent dispositional self-control was predicted to have a strong beneficial influence on health-impairing behaviors. As long as one is not experiencing high demands from

their environment, dispositional self-control can help reduce the likelihood that one would engage in harmful behaviors like substance use or uncontrollable eating. However, for those experiencing high contextual demands, latent dispositional self-control is predicted to have a weaker influence on health-impairing behaviors. Dispositional self-control is a resource that can be overpowered by the presence of high contextual demands. In addition, a negative mood can also overwhelm one's self-control. Thus, when an individual is depleted by high stress or fatigue, or is experiencing negative mood, then dispositional self-control is less likely to influence unhealthful behaviors.

All three moderators were examined separately, as opposed to being combined, in order to examine dispositional self-control's unique interactions with these contextual variables. Multi-group modeling was used in AMOS to test hypotheses 3a through 3f, elaborated below. Specifically, moderation analyses were used to determine whether the relationship between latent dispositional self-control and health-impairing behaviors depends on varying levels of perceived stress, negative mood, and fatigue.

Hypothesis 3a. Perceived stress will moderate the relationship between latent self-control and substance use frequency (See Figure 4). For those with low perceived stress, self-control will have a strong inverse relationship with substance use frequency. For those with high perceived stress, self-control will have a weaker association with substance use frequency.

Hypothesis 3b. Perceived stress will moderate the relationship between latent self-control and uncontrollable eating frequency (See Figure 5). For those with low perceived stress, self-control will have a strong inverse relationship with the frequency of uncontrollable eating. For those with high perceived stress, self-control will have a weaker association with the frequency of uncontrollable eating.

Hypothesis 3c. Mood will moderate the relationship between latent self-control and substance use frequency (See Figure 6). For those with positive mood, self-control will have a strong inverse relationship with the frequency of substance use. For those with negative mood, self-control will have a weaker association with the frequency of substance use.

Hypothesis 3d. Mood will moderate the relationship between latent self-control and the frequency of uncontrollable eating (See Figure 7). For those with positive mood, self-control will have a strong inverse relationship with the frequency of uncontrollable eating. For those with negative mood, self-control will have a weaker association with the frequency of uncontrollable eating.

Hypothesis 3e. Fatigue will moderate the relationship between latent self-control and substance use frequency (See Figure 8). For those with low fatigue, self-control will have a strong inverse relationship with the frequency of substance use. For those with high fatigue, self-control will have a weaker association with the frequency of substance use.

Hypothesis 3f. Fatigue will moderate the relationship between latent self-control and the frequency of uncontrollable eating (See Figure 9). For those with low fatigue, self-control will have a strong inverse relationship with the frequency of uncontrollable eating. For those with high fatigue, self-control will have a weaker association with the frequency of uncontrollable eating.

Aim 4: Exploratory Analyses

One of the remaining questions regards the potential association of latent dispositional self-control with health-promoting behavior. Health-promoting behavior in this study was measured by the frequency of the following five items: exercising, stretching, getting enough sleep, drinking enough water, and eating a balanced meal including fruits and vegetables. It is

possible that engaging regularly in healthful behavior like exercising depends on possessing reliable, stable resources such as dispositional self-control. Prior research has indicated that health-promoting and health-impairing behavior are only moderately correlated (e.g., Auerbach, Cannella, & Lobel, 2014), indicating that these constructs can be operationalized separately. Therefore, exploratory analyses were conducted to examine the extent to which dispositional self-control is associated with health-promoting behavior.

Additional questions regard whether or not gender moderates the relationship of self-control with substance use and uncontrollable eating. It was unknown whether the model would fit equally well among men and women. Women are less likely than men to use substances (Griffin, et al., 2000) and there is some evidence that they are more likely to engage in uncontrollable eating (Burton, Smit, & Lightowler, 2007), but whether differences in the impact of self-control might explain these gender differences in health behaviors is unknown. Research examining such possibilities is lacking, and thus these analyses were exploratory.

Method

Participants and Procedure

Participants were recruited from a Department of Psychology undergraduate subject pool at a public university located in a suburban area of the Northeastern United States. Students 18 years and older were eligible. Students viewed brief descriptions of experiments and enrolled in those they selected. Students were told they would complete a questionnaire to learn about their feelings, outlook, health, and behavior in college. Participants were also recruited directly from an undergraduate psychology course as one of several means to earn extra credit in the course. Participant characteristics are reported below.

The procedure involved completion of a questionnaire lasting approximately 20 to 30 minutes. The participants recruited directly from the psychology course completed a paper version of the survey in a private room. Participants recruited via the subject pool completed the questionnaire online. A total of 615 participants (218 from the course; 397 from the subject pool) were recruited between January 2014 and May 2014. This sample size offers sufficient statistical power for testing study hypotheses with potentially small effect sizes (Cohen, 1992). Structural Equation Modeling (SEM) using AMOS 22.0 computer software (Arbuckle, 2007) was used to conduct study analyses. SEM requires a minimum of 100 participants per model for reliable results (Grimm &Yarnold, 2000).

Measures

All participants completed questionnaires including well-validated measures, with some developed specifically for the study (all measures are included in Appendix A). The questionnaire included measures of three traits (self-control, impulsivity, mindfulness), two outcomes (substance use and uncontrollable eating), three moderators (stress, mood, and fatigue), sociodemographic variables (e.g., age and gender), and measures of additional variables not pertinent to the present study.

Trait Self-Control. Trait self-control was assessed with the widely used and well-validated 10-item Brief Self-Control Scale (BSCS; Tangney et al., 2004). This scale measures individual differences in control over thoughts, emotional control, impulse control, performance regulation, and habit breaking. Each participant indicated how much each item reflected their typical behavior. Sample items include "I am good at resisting temptation" and "I have a hard time breaking bad habits." Responses range from 1 (*Never*) to 5 (*All the Time*) and were summed. Prior work (Tangney et al., 2004) has demonstrated that the scale has high internal

consistency (α = .85), good test–retest reliability over a three week period of (*r* = .87), and is highly correlated with other measures of self-control. It has been successfully used with college students. In the current study, the scale had good internal consistency (α = .80).

Mindfulness. The 15-item Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) was used to measure the frequency of mindful states in day-to-day life. The scale measures dispositional mindfulness using both general and situation-specific statements. Response scores range from 1 (*Almost Always*) to 6 (*Almost Never*) and were summed. Sample items include "I find it difficult to stay focused on what's happening in the present." Higher scores indicate greater mindfulness. The scale has been validated among college students (Mackillop & Anderson, 2007) and is not unduly subject to social desirability biases (Brown & Ryan, 2003). The scale has shown adequate convergent validity with measures of well-being, has shown high reliability (α = 0.89) and good test-retest reliability (α = 0.85 and α = 0.88) in prior research (Brown et al., 2011) and was internally consistent in this study (α = 0.85).

Impulsivity. The 8-item Baratt Impulsiveness Scale-Brief was used to measure trait impulsivity (BIS-Brief; Steinberg, et al., 2013). Items include "I plan tasks carefully" and "I do things without thinking." For each item, respondents report how much they agree or disagree with the statements on a 4-point response scale, 1 = *Strongly Agree* to 4 = *Strongly Disagree.* The scale has good internal consistency in prior research (Steinberg, et al., 2013) (α = .83) as well as the current study (α = .74). The BIS-Brief has been shown to have good test–retest reliability (α = .83), and has been tested in college students in prior research (Stanford et al., 2009). Convergent validity with similar self-report measures has also been demonstrated with the scale (Lane, Cherek, Rhoades, Pietras, & Tcheremissine, 2003).

Perceived Stress. The reliable 10-item Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) asks respondents to report how often they have experienced stressful situations during the last month. The PSS evaluates the degree to which individuals believe their life has been unpredictable, uncontrollable, and overloaded during the previous month. Responses range from 1 (*Never*) to 5 (*Often*). In prior work, the PSS has demonstrated good internal reliability (α = .91) and adequate test-retest reliability, with coefficients ranging from 0.55 to 0.85 (Cohen et al., 1983). The scale also exhibited strong internal consistency in the current study (α = .86). Roberti, Harrington, and Storch (2006) validated the measure among college students.

Fatigue. The measure of fatigue in this study was adapted from the 3-item Empirical Fatigue Scale (EFS; Bailes et al., 2006). Participants estimate how frequently in the last month they experienced fatigue. Sample items include "I lack energy" or "I start things without difficulty but get weak as I go on." The scale has good internal reliability in prior work (α =.86) (Bailes et al., 2006) as well as convergent validity with other measures of fatigue (Shapiro et al., 2002). For the current study, the EFS was modified by adding three items involving fatigue-related decision making, or cognitive fatigue, such as, "I find it difficult to make good decisions regarding school because I am too fatigued." These items were included so that participants can explicitly report how often they've experienced specific fatigue events. Respondents report their fatigue on a 5 point scale (0 = *Never*; 4 = *Very Often*). The modified instrument was internally consistent here (α = .86).

Mood. Mood was a 1-item scale designed for the current study that asked "How positive do you feel at this very moment?" Participants report their mood on a 5 point scale (0 = *Not at all*; 5 = *Extremely*).

Substance Use and Health-Promoting Behavior. Health-promoting behavior and substance use were assessed with a multiple-item measure. Both scales were developed by selecting appropriate items from a measure used in prior studies of health behavior (Cannella, Auerbach, Lobel, 2013; DeLuca & Lobel, 1995; Lobel et al., 2008). Items from the original measure that were deemed inappropriate for college students were removed (e.g., lift heavy object and stand on feet too long) and substance use items relevant to college students (e.g., marijuana use and electronic cigarettes) were added, based on informal health-related interviews with undergraduate students at the campus where the study was conducted. The 4-item substance use subscale was comprised of the following items: drinking alcohol, smoking cigarettes, smoking electronic cigarettes, and marijuana use. The 5-item health-promoting subscale consisted of: exercising, stretching, drinking enough water, and getting enough sleep, and eating a balanced meal including fruits and vegetables. Respondents were asked, "How often in the past two weeks did you" engage in these behaviors. Responses were provided on a 5 point scale ranging from 0 (*Never*) to 4 (*Very Often*). Subscale items were totaled so that each participant had two scores, one representing substance use and the other representing health-promoting behavior. For the current study, the internal consistency was adequate for both substance use (4 items; $\alpha = .71$) and health-promoting behavior (5 items; $\alpha = .70$).

Uncontrollable Eating. The 7-item Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009) assesses uncontrollable eating behavior within the past month. Items include "my behavior with respect to food and eating causes me significant distress." The YFAS uses a 5-point response scale: 1 = *Never*; 2 = *Once per Month*; 3 = *2-4 times per month*; 3 = *2-3 times per week*; 4 = *4+ times per week*. Originally designed to be a clinical tool, the YFAS is used to diagnose food addiction if at least three symptoms and a clinically significant impairment or distress are

present. For this study, item scores were summed and the continuous summary score was used. In prior research (Gearhardt et al., 2009), the YFAS has been shown to have convergent validity with measures of eating pathology (binge and emotional eating, food cravings), adequate internal consistency ($\alpha = .76$) and has also been validated among college students. The instrument had excellent internal consistency in the current study ($\alpha = .85$).

Sociodemographic Characteristics. Participants reported their gender and their race or ethnicity (African-American or Black; White; Latino or Hispanic; Asian or Pacific Islander, Native American, or other) as well as other sociodemographic characteristics that were used for sample description.

Results

Preliminary Analyses

Data Preparation. Descriptive statistics including means, standard deviations, and frequencies were calculated to ensure that all values obtained were within range and exhibited sufficient variation between participants. Each variable was examined for missing values. For variables with minimal missing data that appeared to be random, missing values were replaced using mean imputation. Data were screened for violations of normality. In the sample of 615 participants, there were a total of 4 outliers that were removed. Thus, the final sample size was 611 participants.

Overview of Structural Equation Modeling. A benefit of SEM that is integral to the current study is its ability to accommodate latent variables, which are variables that cannot be measured directly. Hypothesized path models including both observed (measured) and unobserved (latent) variables are examined to determine whether the proposed model is a good fit to sample data (Byrne, 2001). Initially, the structure and goodness of fit of latent variables

must be confirmed with the construction of a measurement model. In this manner, SEM was used to develop and evaluate the fit of the latent dispositional self-control variable.

Once the latent dispositional self-control variable in the hypothesized model was developed, observed variables and hypothesized paths were added to the model. Goodness-of-fit indices were used to evaluate the fit of each model, including the Chi-square test, the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). A non-significant Chi-square value indicates that the data did not significantly depart from the model. However, with large sample sizes like the one in the current study, Chi-square tests tend to be less accurate. Therefore, the CFI and RMSEA were also used as fit indices. The CFI takes sample size into account and computes scores ranging from 0 to 1; scores closer to 1 indicate a good fit to the data. The RMSEA test also ranges from 0 to 1; with values less than 0.10 indicating a good model fit. Modification indices provided by the AMOS program were used to indicate if refinements could be made to the model to improve fit; only those that were conceptually coherent were considered.

Data Analytic Strategy. In the current study, the first aim was to develop a comprehensive operationalization of dispositional self-control. The latent variable dispositional self-control was operationalized as a combination of theoretically relevant dispositional characteristics: trait self-control, impulsivity, and mindfulness. Structural models were then used to test the hypotheses that the comprehensive model of dispositional control predicts substance use and uncontrollable eating, as elaborated above. All models were tested for the degree to which they fit the data using goodness of fit indices. Moderation hypotheses were then evaluated to test the interaction of self-control with contextual demands (stress, fatigue, and mood) on substance use and uncontrollable eating. Median splits were used to transform the continuous

moderators into dichotomous variables so that multi-group models could be examined. One limitation to this method, however, is that dichotomization limits the range of the moderator variables and may distort the interaction. For example, values just below and above the median are considered unequal (Aiken & West 1991). Moderation was evaluated under two conditions: a) when there were no model constraints on the path from the latent factor to the dependent variable across both models and b) when the path from the latent factor to the dependent variable was constrained to be equal in both models. A Chi-square test was used to compare models; a significant Chi-square value indicated that the paths were unequal across models, denoting a significant interaction.

Descriptive Statistics

Sample Description. The final sample included 611 college students, with ages ranging from 17-39 (M = 20, SD = 2.07). Almost all (98%) of the sample were between 18 and 24 years old; the remaining 2% were 25-39. Three-quarters of the sample were female. Approximately 42% were White, 34% Asian, 9% Black, 9% Latino, and 6% were Multi-ethnic. Approximately three-quarters (76%) of the sample were born in the United States, 14% born in Asia, 3% from Europe; 2% from Central or South America, 2% from the Caribbean, and 2% from the Middle East. Their average GPA was 3.16 (SD =.43) and ranged from 1.8 to 4.0. A total of 56 participants declined to report their GPA. Participants recruited from the Psychology undergraduate subject pool did not differ from those recruited directly from the undergraduate psychology course (all p's > .05).

Levels of perceived stress, trait self-control, impulsivity, and mindfulness were comparable to those in other studies of college students (Cohen, 1983; de Ridder et al., 2012; Li & Lindsay, 2013; Mackillop & Anderson, 2007; Steinberg et al., 2013). Compared to a prior

study with college students (Gearhardt et al., 2009), which was comprised of a relatively smaller proportion of participants who were female than was included here, participants in the present study had slightly higher rates of uncontrollable eating and more participants in this study met the diagnostic criteria for food dependence (31%). Other study measures (i.e., mood, substance use, and fatigue) were unique to the current study and could not be compared with prior research. Below is a description of endorsement of items among the three categories of health behaviors examined in the study: substance use, health-promoting behavior, and uncontrollable eating.

Substance use. There was considerable variability in endorsement of the alcohol consumption item. Responses ranged from never or almost never (45%), sometimes (25%), to fairly often or often (30%). However, for the remaining substance use items, there was less variability. Responses to "smoke cigarettes" ranged from never (80%), almost never (7%), sometimes (6%), to fairly often or often (7%). Responses to "smoke electronic cigarettes" ranged from never (90%), almost never (5%), sometimes (3%), to fairly often or often (2%). Responses to "smoke marijuana" ranged from never (73%), almost never (10%), sometimes (7%), to fairly often or often (10%).

Health-promoting behavior. There was considerable variability in endorsement of the health-promoting behaviors. Responses to "exercise" ranged from never or almost never (45%), sometimes (25%), to fairly often or often (30%). Similarly, responses to "stretch" ranged from never or almost never (42%), sometimes (31%), to fairly often or often (27%). Responses to "eat a balanced diet" ranged from never or almost never (36%), sometimes (40%), to fairly often or often (24%). Responses to "drink water" ranged from never or almost never (11%), sometimes (27%), to fairly often or often (62%). Responses to "get enough sleep" ranged from never (2%), almost never (20%), sometimes (30%), to fairly often or often (48%).

Uncontrollable eating. For the item, "I find myself consuming certain foods even though I am no longer hungry," responses ranged from 4+ times per week (16%), 2-3 times per week (32%), 2-4 times per month (31%), to once a month or never (21%). For the item, "I have physical withdrawal symptoms when I cut down on certain foods" responses ranged from 4+ times per week (3%), 2-3 times per week (5%), 2-4 times per month (10%), to once a month or never (83%). For the item, "my behavior with food causes me significant distress," responses ranged from 4+ times per week (8%), 2-3 times per week (9%), 2-4 times per month (15%), to once a month or never (65%). For the item, "I have spent time dealing with negative feelings from overeating instead of spending time on important activities" responses ranged from 4+ times per week (8%), 2-3 times per week (9%), 2-4 times per month (19%), to once a month or never (63%).

Table 1 provides ethnicity, age, and gender information categorized by each of the six moderator groups: low/high stress, negative/positive mood, and low/high fatigue. There were no differences in age between any of the moderator groups. Gender distributions in these groups were approximately equal to the gender composition of the sample, with slight overrepresentation of women in the high stress, high fatigue, and negative mood groups. For example, the low stress group was comprised of 73% women and 27% men and the high stress group was comprised of 79% women and 21% men. Ethnicity of participants was also distributed across the moderator groups in approximately the same proportion as in the entire sample.

Descriptive statistics of study variables including means, standard deviations, and correlations are provided in Table 2. The three moderator variables were correlated (*r*'s ranging from -.28 to .42) but still displayed sufficient independence to be examined separately. Bivariate

associations of the self-control and health behavior variables were also in the expected directions. For example, substance use was moderately associated with lower levels of self-control (r = -.22), and substance use was weakly associated with lower levels of mindfulness (r = -.12) and with higher impulsivity (r = .18). Uncontrollable eating was moderately associated with trait self-control (r = -.37), mindfulness (r = -.34), and impulsivity (r = .30). Compared to men, women were more likely to report uncontrollable eating (r = -.14), higher stress (r = -.12), poorer mood (r = .12), and lower trait self-control (r = .12). However, men were more likely than women to use substances (r = .12). Age was not correlated with any study variables.

Hypothesis Testing: Primary Hypotheses

Measurement Model. One of the primary objectives of the current study was to examine whether measures of trait self-control, impulsivity, and mindfulness can serve as indicator variables for a latent factor representing dispositional self-control. Total scores of each of these three indicators were standardized to produce comparable variances, and to allow comparisons between the different scales representing the latent factor. In the measurement model for the latent variable representing latent dispositional self-control, all standardized path coefficients were significant at $^{**}p < .01$. However, fit indices suggested that there were sizable residuals among the three indicators ($\chi^2(1) = 37.27$, $p < .01$; CFI = .93; RMSEA = .24; see Figure 10). Modification indices suggested correlating the residuals of two of the latent factor indicators (trait self-control and impulsivity). Correlating these residuals led to an inadmissible solution, as the model was just identified. As a result, no modifications were made to the measurement model.

Exploratory Analyses. To explore whether differences exist in the extent to which the three indicator variables contribute to the latent factor, the model was tested to determine

whether $DSC_1 = DSC_2 = DSC_3$ (where DSC_n is the path from the latent factor representing dispositional self-control to an indicator variable). The critical ratio difference method was used to determine whether any of these paths could be constrained as equal. The path to trait self-control (DSC_1) was not significantly different from the path to impulsivity (DSC_2; $p < .01$). However the path to mindfulness (DSC_3) was significantly smaller than the paths to trait self-control ($p < .05$) and impulsivity ($p < .05$).

Structural Models. As elaborated in Hypotheses 2a and 2b, latent dispositional self-control was predicted to be strongly and inversely associated with substance use and uncontrollable eating. Latent dispositional self-control moderately and inversely predicted substance use ($\beta = -.23$). The model was an excellent fit to the data ($\chi^2[2] = 5.08$, $p = .08$; CFI = .99; RMSEA = .05; see Figure 11). Latent dispositional self-control also moderately and inversely predicted uncontrollable eating ($\beta = -.41$). This model offered an adequate fit to the data ($\chi^2[2] = 38.88$, $p < .01$; CFI = .94; RMSEA = .17; see Figure 12). All standardized path coefficients for both of these models were significant at $p < .01$.

Hypothesis Testing: Moderation Hypotheses Using SEM

Perceived Stress. Perceived stress was predicted to moderate the relationship between latent self-control and substance use. It was hypothesized that self-control would have a strong inverse relationship with substance use for those with low perceived stress; and for those with high perceived stress, self-control would have a weaker association with substance use. The path from dispositional self-control to substance use was significant for both the low stress group ($\beta = -.24$, $p < .01$) and the high stress group ($\beta = -.16$, $p < .05$; see Figure 13). Although the magnitude of these two coefficients differed in the hypothesized direction (greater for low stress than for high stress), the Chi-Square difference test comparing the model between low and high stress

groups was not significant ($x^{2Diff}[1] = .48$, $p > .05$) indicating that there was not significant moderation by perceived stress.

Perceived stress was also predicted to moderate the relationship between latent self-control and uncontrollable eating. It was hypothesized that self-control would have a strong inverse relationship with uncontrollable eating for those with low perceived stress; for those with high perceived stress, self-control was hypothesized to have a weaker association with uncontrollable eating. The path from dispositional self-control to uncontrollable eating was significant for both the low stress group ($\beta = -.25$, $p < .01$) and the high stress group ($\beta = -.36$, $p < .01$; see Figure 14). A Chi-square difference test comparing the low and high stress groups was marginally significant ($x^{2Diff}[1] = 3.45$, $p < .10$). However, contrary to predictions, the association between dispositional control and uncontrollable eating was stronger for participants with high stress compared to low stress.

Mood. Mood was predicted to moderate the relationship between latent self-control and substance use. It was hypothesized that self-control would have a strong inverse relationship with substance use for those with positive mood; for those with negative mood, self-control was expected to have a weaker association with substance use. The path from dispositional self-control to substance use was significant for the negative mood group ($\beta = -.18$, $p < .05$) and the positive mood group ($\beta = -.30$, $p < .01$; see Figure 15). Although these coefficients appear to differ in the manner hypothesized (higher for positive than negative mood), the Chi-square difference test comparing the model for the two mood groups was not statistically significant ($x^{2Diff}[1] = .07$, $p > .05$). This result indicates that there was not moderation by mood.

Mood was also predicted to moderate the relationship between latent self-control and uncontrollable eating. It was hypothesized that self-control would have a strong inverse

relationship with uncontrollable eating for those with positive mood; for those with negative mood, self-control was hypothesized to have a weaker association with uncontrollable eating. The path from dispositional self-control to uncontrollable eating was equivalent and significant for both the negative mood group (β = -.38, p < .01) and the positive mood group (β = -.38, p < .01; see Figure 16). A Chi-square difference test comparing the two mood groups was not statistically significant (x^{2Diff} [1] = 1.12, p > .05), confirming that there was not moderation by mood.

Fatigue. Fatigue was predicted to moderate the relationship between latent self-control and substance use. It was hypothesized that self-control would have a strong inverse relationship with substance use for those with low fatigue; for those with high fatigue, self-control was expected to have a weaker association with substance use. The path from dispositional self-control to substance use was significant for both the low fatigue group (β = -.22, p < .01) and the high fatigue group (β = -.18, p < .05; see Figure 17). A Chi-square difference test comparing the low and high fatigue groups was not statistically significant (x^{2Diff} [1] = .05, p > .05), indicating that fatigue did not moderate the association of self-control with substance use, although the coefficient was slightly larger in the low fatigue group, as hypothesized.

Fatigue was also predicted to moderate the relationship between latent self-control and uncontrollable eating. It was hypothesized that self-control would have a strong inverse relationship with uncontrollable eating for those with low fatigue; for those with high fatigue, self-control was predicted to have a weaker association with uncontrollable eating. The path from dispositional self-control to uncontrollable eating was significant for the low fatigue group (β = -.31, p < .01) and the high fatigue group (β = -.28, p < .01; see Figure 18). A Chi-square difference test comparing the low and high fatigue groups was not significant (x^{2Diff} [1] = .03, p >

.05), indicating no moderation by fatigue. The association of self-control with uncontrollable eating appears to be slightly stronger for the less fatigued than more fatigued participants, as hypothesized, but this difference did not achieve statistical significance.

Exploratory Analyses. Latent dispositional self-control moderately and positively predicted health-promoting behavior (β = .30). The model was an excellent fit to the data ($\chi^2[2] = 9.44$, $p = .01$; CFI = .98; RMSEA = .08). Further analyses were conducted to explore whether stress, mood, or fatigue moderated the association of latent self-control with health-promoting behavior. Neither stress ($x^{2Diff}[1] = 1.9$, $p > .05$) nor mood ($x^{2Diff}[1] = .17$, $p > .05$) moderated the association between latent self-control and health-promoting behavior. However, fatigue was a statistically significant moderator. Consistent with the conceptual foundation for this study, among those with low fatigue (β = .26), latent self-control exhibited a stronger association with health-promoting behavior compared to those with high fatigue (β = .04), ($x^{2Diff}[1] = 5.58$, $p < .01$).

Remaining exploratory questions regarded whether or not gender moderates the relationship of self-control with health behaviors. The path from dispositional self-control to substance use was statistically significant both for men ($\beta = -.16$, $p < .01$) and women ($\beta = -.27$, $p < .01$). A Chi-square difference test comparing the male and female groups was not significant ($x^{2Diff}[1] = 1.45$, $p > .05$).

The path from dispositional self-control to uncontrollable eating was also significant for men ($\beta = -.50$, $p < .01$) and women ($\beta = -.38$, $p < .01$). A Chi-square difference test comparing the male and female groups was not significant ($x^{2Diff}[1] = 1.44$, $p > .05$).

Finally, the path from dispositional self-control to health-promoting behavior was significant for men ($\beta = .37$, $p < .01$) and for women ($\beta = .27$, $p < .01$). A Chi-square difference test comparing the male and female groups was not significant ($x^{2Diff}[1] = .89$, $p > .05$).

Table 3 contains a summary of all moderation analyses, both predicted and exploratory models.

Discussion

The primary goals of this study were to examine trait self-control, impulsivity, and mindfulness as measurable elements of a comprehensive, multidimensional model of dispositional self-control; to examine the predictive validity of the latent factor by examining its association with health-impairing behaviors (substance use and uncontrollable eating); to examine how contextual variables (stress, fatigue, and mood) moderate the association of latent self-control with health-impairing behaviors; and to explore whether dispositional self-control is associated with health-promoting behaviors (e.g., exercise and eating well), and whether gender moderates associations between latent control and health behaviors.

Defining Dispositional Self-Control

A multi-dimensional model of dispositional self-control consisting of trait self-control, impulsivity, and mindfulness as predicted in Hypothesis 1 was confirmed using structural equation modeling. This finding complements other studies (de Ridder et al., 2012; Duckworth & Kern, 2011; Verplanken & Orbell, 2003), which suggest that these indicators are conceptually similar elements of the definition of self-control. A multiply-indicated latent factor representing dispositional self-control is conceptually and statistically more powerful and more reliable than separate measures of self-control. These findings are important, as they demonstrate that there is a synthesis of trait self-control, impulsivity, and mindfulness when predicting health behavior,

and that these three psychological variables -- which tend to be examined separately by researchers -- may be elements of one domain. The results of this analysis must be interpreted with caution because of some departures from the hypothesized measurement model involving shared variance between trait self-control and impulsivity beyond what was incorporated in the latent factor. The additional shared variance between these two measured indicators of the latent factor is not surprising given the similarity of their content. For instance, a few of the items in the trait self-control measure (e.g., "I have trouble concentrating") overlap with items from the impulsivity scale (e.g., "I concentrate easily"). It is also likely that if a person is highly impulsive and not thinking before they act (e.g., "I do things without thinking" or "I act on the spur of the moment"), then this same person most likely does not possess the characteristics required for high trait self-control (e.g., "I am good at resisting temptation" or "I am able to work effectively toward my long-term goals"). Some prior research has equated impulsivity and trait self-control (de Ridder et al., 2012; Duckworth & Kern, 2011), although others contend they are not redundant concepts (Friese & Hofmann, 2009). Nevertheless, the paths from the latent factor to trait self-control and impulsivity were of equivalent magnitude, suggesting that these concepts contribute equally to the definition of dispositional self-control.

Mindfulness was not as strong an indicator of the latent factor as were the other two measured variables. Including mindfulness in the definition of dispositional self-control was a novel component of this study, as there has only been one prior study (Verplanken & Orbell, 2003) that has incorporated mindfulness into the operational definition of trait self-control. Additional empirical work substantiates the contribution of mindfulness to self-control, including one study which found that less mindful participants were less able to control binge drinking habits compared to more mindful individuals (Chatzisarantis & Hagger, 2007). Consistent with

predictions, participants in the present study with low self-control and those with high impulsivity were less mindful. Trait mindfulness is especially valuable to include in definitions of self-control applied to the context of health-impairing behaviors. Routinized, repetitive, and mindless behaviors can often lead to the development of poor health habits. When such behaviors are fully automatic, occurring without thought, or outside of awareness, they may also be antithetical to health goals. In order to override such unhealthful routines, one would need to be mindful of their behaviors and mindful of their reactions to environmental cues (Graybiel, 2005).

The Association of Self-Control with Health-Impairing Behaviors

The multi-dimensional model of dispositional self-control predicted frequency of substance use and of uncontrollable eating as hypothesized. Those with higher latent self-control used substances and engaged in uncontrollable eating less frequently than those with lower latent control. These findings corroborate prior research, as trait self-control has been correlated with numerous health-related outcomes including better psychological adjustment, reduced susceptibility to alcoholism, and lower scores on binge eating disorder (Tangney et al., 2004). It is important to note that that the association of latent self-control with reduced frequency of uncontrollable eating was almost twice as strong as with reduced frequency of substance use, suggesting that self-control may matter more in enabling someone to resist food than substances. This finding seems reasonable because food consumption is a behavior that every human being must enact for survival, and thus overeating is presumably a risk more familiar and common to most people than substance use. Another reason why the association between frequency of substance use and latent self-control may have been weaker than predicted is due to the possibility that substance use, especially in young adults, is motivated more by peer influences

than by weak self-control. That is, college students may be more likely to drink alcohol or smoke marijuana due to social factors, compared with older adults who may be more likely to engage in these behaviors as a result of well-learned habits that require self-control to break. Additionally, methodological features may help account for this pattern of findings, as there was low variability of the substance use behaviors (e.g., more than 80% of the sample reported never using tobacco or electronic cigarettes), but more variability in endorsement of uncontrollable eating items.

Moderation Effects

In the current study, several predictions were made about moderators that may influence the relationship between latent dispositional self-control and health-impairing behaviors. For those experiencing low contextual demands (i.e., low stress, low fatigue, and positive mood), latent dispositional self-control was predicted to have a stronger association with health-impairing behaviors. For individuals experiencing high contextual demands (i.e., high stress, high fatigue, and negative mood), latent dispositional self-control was predicted to have a weaker association with health-impairing behaviors. While the direct association between dispositional self-control and health-impairing behaviors has been well-demonstrated, little prior research has examined what variables may moderate this relationship. The pattern of associations for all but two of the moderation models were in the predicted direction; however, none of these achieved statistical significance. Surprisingly, the one moderation model that reached statistical significance was in the opposite direction than predicted: The association between latent self-control and frequency of uncontrollable eating was stronger for those with high stress compared to those experiencing low stress. In an additional model, examining moderation by mood of the association of self-control with uncontrollable eating frequency, associations were of equal

magnitude for individuals reporting high and low positive mood. Furthermore, exploratory analyses indicated that the association between latent self-control and health-promoting behavior was significantly higher for those with low fatigue compared to those with high fatigue, and to a lesser (non-statistically significant) extent, was also higher for people with low stress than high stress. Although these findings were not explicitly predicted, they do parallel the conceptual foundation for expecting greater benefits of self-control in less demanding contexts. Thus, overall, this study yielded a variety of evidence suggesting that self-control may be less efficacious in contexts involving high demands, although this evidence was not sufficiently strong. While weak, the fact that this pattern was observed with fairly high consistency across three moderators and with three different types of health behaviors is compelling.

Prior work helps explain why contextual factors like fatigue and stress may inhibit the health behavior benefits of self-control. Goal-oriented behaviors compete regularly with momentary desires or impulses (Schroder, Ollis, & Davies, 2013). Thus, when one is feeling particularly fatigued or stressed, the resources required to maintain control of momentary impulses become depleted. In depleted states, behaviors like drinking alcohol or eating junk food may become an attractive way to seek immediate relief, regardless of how good one's self-control is. Therefore, contextual demands can over-exhaust the resources one has to control their health behaviors.

One plausible explanation for the weakness of results, despite their nearly-consistent pattern in the expected direction, involves methodological limitations of the present study. One such limitation was the use of median splits which were used to transform the continuous moderators into dichotomous variables so that multi-group models could be examined. Dichotomization limits the range of the moderator variables and may distort the interaction. For

example, values just below and above the median of perceived stress, fatigue, and positive mood were considered unequal, even though those right above and below the median are most likely not very different. Including those individuals in the "high" and "low" categories may have diluted the two categories. Therefore, this approach may have masked potential differences between those who are truly at higher and lower levels of the moderator variables. It is also likely that the study's mood measure (i.e., "How positive do you feel at this very moment?") was inadequate, given that it consisted of a single item of unknown reliability and the absence of positive mood does not necessarily mean that a respondent is experiencing negative mood. Positive and negative mood have been shown previously to be somewhat independent (Diener, Larsen, Levine, & Emmons, 1985). Also, this measure was logically problematic because mood at the present moment cannot moderate behaviors that occurred over the last month. Finally, as noted above, the study was limited due to the particularly low endorsement of some of the substance use behaviors (e.g., smoking tobacco or electronic cigarettes). There was little variance in substance use to be moderated, which may help explain why moderation analyses involving this health behavior outcome were not statistically significant.

In addition to methodological reasons, there are some conceptually meaningful reasons that may help explain some of the departures from hypothesized moderation effects. For example, contrary to predictions, the association between dispositional control and uncontrollable eating frequency was stronger for participants with high stress compared to those with low stress. It may be that people who experience little stress are bored, and boredom may be a risk factor for uncontrollable eating. Boredom is an aversive state brought about by monotony, and acts such as eating can help alleviate this monotony. Higher levels of boredom can thus increase one's susceptibility to uncontrollable eating. Research has shown that people who are

highly bored are more susceptible to overeating compared to those who are less bored (Havermans, Vancleef, Kalamatianos, & Nederkoorn, 2015). Therefore, for those experiencing low stress, boredom may be overpowering the relationship between self-control and uncontrollable eating. This possibility demonstrates the importance of considering the types of participants and the circumstances in which they are studied: Low stress in a college student sample may reflect a lack of concern about or attention to academic and other pressures that signifies boredom or disengagement, whereas low stress in a different type of sample may have different meaning. Future studies examining these possibilities would help extend current study findings

Exploratory Analyses. These findings complement prior research testing the limited strength model, which suggest that self-control can become depleted or overpowered by cognitive resources like fatigue (Ginis & Bray, 2010; Vohs & Heatherton, 2000) and thereby inhibit behaviors that are especially demanding such as exercising and healthy eating which require planning and effort. This may help explain why fatigue more strongly affected the association of self-control with health-promoting than health-impairing behaviors, and is consistent with dual-process theory (Metcalfe & Mischel, 1999), suggesting that the resources required to carry out healthful behaviors may be distinct from the resources used to restrain engagement in unhealthful behaviors.

Gender was also not a significant moderator for any of the analyses. It is important to note that one can have greater confidence in the validity of these non-significant interactions compared to the other moderation analyses since the split of the sample was based on an irrefutable categorical variable (male vs. female) and doesn't have the same methodological uncertainty inherent to the other group categorizations (i.e., high/low stress, high/low fatigue,

and negative/positive mood). No gender differences were predicted; processes involving self-control and its influence on behaviors would not be expected to differ for men and women, and the findings here corroborate this similarity across gender. As has been noted by many scholars, the assumption of gender differences without a well-reasoned theoretical explanation has contributed to misperceptions that men and women are largely different, when in fact, many meta-analyses of important behaviors in men and women demonstrate greater similarity than difference (Eagly & Wood, 2013; Hyde, 2005).

Study Limitations, Strengths, and Future Research

Study results offer preliminary evidence that self-control may be less efficacious in contexts involving high demands but future testing is imperative to replicate and explain these findings, particularly in samples more diverse in age, ethnicity and race, and socioeconomic status. Future research should also include a broader range of contextual moderators when examining influences on the relationship between self-control and health-impairing behaviors. For example, this association may be enhanced by salutary psychological resources, such as situated optimism (Armor & Taylor, 1998). More investigation is also necessary to understand how contextual demands influence individuals over time. It is possible that those experiencing high contextual demands can habituate to the effects of high stress, fatigue, or negative mood. Future analyses using longitudinal repeated-measures designs should be conducted to examine how contextual demands and their impact fluctuate within individuals over time. For example, implementing a 30-day electronic daily diary could be helpful, as this type of self-report instrument offers the opportunity to investigate psychological and physical processes within everyday situations. Daily reporting may also enhance the accuracy of self-reports of health behaviors (Bolger, Davis, & Rafaeli, 2003). The unknown reliability of the health behavior and

uncontrollable eating measures as used in the present study limits confidence in the findings. Daily reporting would also be useful as it enables investigation of the timing and contexts in which these processes unfold. Multi-level modeling, the statistical analysis commonly used with diary studies, would allow researchers to estimate within-person change over time, as well as individual differences.

Experimental evidence may also be valuable to elucidate the ways in which context may moderate the influence of self-control on health behaviors. For example, controlled studies creating high and low fatigue or positive versus negative mood conditions could be conducted to examine whether these conditions affect the ability of participants to exercise self-control when offered highly enticing, appetizing foods. The correlational nature of the present study prevents drawing causal conclusions about the influence of self-control and the moderators examined here. For example, poorly controlled individuals may self-select into stressful situations. As evidence, perceived stress was correlated in this study with low self-control, low mindfulness, and with impulsivity.

Despite these limitations, the study possessed a variety of strengths. The study tested and confirmed a comprehensive multidimensional model of dispositional self-control. This study is also one of the first to examine the interactive effects of variables reflecting the state of individuals with dispositional control. This is important because emerging theories suggest the value of integrating state and trait perspectives in conceptualization of self-control. Also, by identifying the impact of modifiable contextual factors including stress, mood, and fatigue, the study offers groundwork to advance health behavior theory and interventions. Given the influence of high fatigue in this study in attenuating the benefits of self-control for all three health behavior outcomes, and the typically poor sleep hygiene of college students, interventions

to reduce fatigue in this population may be particularly important. Sleep health is a burgeoning area of study showing widespread effects of sleep deprivation in young people, including effects on eating (Kruger, Reither, Peppard, Krueger, & Hale, 2014).

Summary and Conclusions

This study yielded a variety of evidence suggesting that self-control may be less efficacious in contexts involving high demands, as this pattern was observed with high consistency across three moderators and with three different types of health behaviors. The study also suggests that the resources required to carry out healthful behaviors may be distinct from the resources used to restrain from unhealthful behaviors. Study findings are important as they demonstrate that there is value in integrating trait self-control, impulsivity, and mindfulness when predicting health behavior. An innovative component of the study is the inclusion of mindfulness in the definition of dispositional self-control. Study findings indicate that those with higher latent self-control use substances and engage in uncontrollable eating less frequently than those with lower latent control. Moderation findings offer tentative evidence that there may be greater health-behavior benefits of self-control in less demanding contexts. However, there were some counter-intuitive findings, such as the observation that self-control was more beneficial for those with higher than lower stress with respect to how frequently they eat uncontrollably. Additional research is necessary to determine whether these patterns of findings are replicable in other samples. Also valuable would be in-depth studies to examine the specific cognitive, behavioral, and emotional mechanisms that are triggered when self-control is disrupted by factors such as fatigue, negative mood, or stress. Examining young adults would be particularly important, as risk-taking during this age tends to be high which can increase the likelihood of developing poor health habits. Furthering our understanding of young adults and the mechanisms

underlying their health behaviors may lead to more effective early interventions and ultimately prevent problems with addiction later in adulthood.

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Table 1

Participant characteristics across 6 moderator groups

Variable	Total Sample *n* = 611	Low Stress Group *n* = 316	High Stress Group *n* = 295	Low Fatigue Group *n* = 327	High Fatigue Group *n* = 284	Negative Mood Group *n* = 390	Positive Mood Group *n* = 221
Age	20.26 (2.07)	20.38 (2.41)	20.11 (1.61)	20.12 (2.07)	20.43 (2.07)	20.34 (2.15)	20.11 (1.97)
Gender							
Women	75%	73%	79%	73%	79%	78%	72%
Men	25%	27%	21%	27%	21%	22%	29%
Ethnicity							
White	42%	43%	41%	45%	38%	42%	42%
Asian or Pacific	35%	35%	35%	30%	38%	33%	36%
Latino	9%	9%	8%	9%	10%	9%	9%
Black	8%	6%	10%	8%	9%	9%	8%
Multiethnic	6%	7%	6%	8%	5%	7%	5%

Table 2

Means, standard deviations, and correlations among study variables

	1	2	3	4	5	6
1. Substance Use	_	.06	-.06	-.22**	-.12*	.18*
2. Uncontrollable Eating		_	-.19**	-.37**	-.34**	.30**
3. Health-Promoting			_	.29**	.16*	-.22**
4. Self-Control Trait				_	.40**	-.64**
5. Mindfulness					_	-.49**
6. Impulsivity						_
7. Perceived Stress						
8. Mood						
9. Mental Fatigue						
10. Gender						
11. Age						
M	2.52	16.84	15.06	28.80	56.83	17.68
(*SD*)	(2.95)	(6.27)	(4.88)	(5.69)	(10.21)	(3.77)

Note. Table 2 continues on the next page.

Table 2 (continued)

Means, standard deviations, and correlations among study variables

	7	8	9	10	11
1. Substance Use	.11*	-.09*	.12*	.13*	.04
2. Uncontrollable Eating	.36**	-.28**	.47**	-.14*	.02
3. Health-Promoting	-.26**	.24**	-.43**	.10	-.01
4. Self-Control Trait	-.44**	.28**	-.36**	.12*	.05
5. Mindfulness	-.45**	.22**	-.45**	-.01	-.02
6. Impulsivity	.31**	-.15**	.30**	.03	-.02
7. Perceived Stress	_	-.35**	.42**	-.12*	-.05
8. Mood		_	-.28**	.12*	-.07
9. Mental Fatigue			_	-.03	.07
10. Gender				_	.02
11. Age					_
M (*SD*)	20.49 (6.02)	2.97 (1.07)	9.07 (4.85)	1.24 (.43)	20.26 (2.07)

Table 3

Coeffcient values of the path from latent dispositional self-control to dependent variables, based on each predicted moderator. x^{2Diff} values are also included, which indicate whether or not the paths within each moderator analysis are statistically significant.

	Stress Moderator			Mood Moderator		
Dependent Variables Associated with DSC	Low Stress	High Stress	x^{2Diff}	Positive Mood	Negative Mood	x^{2Diff}
Substance Use	-.24**	-.16*	.48 (NS)	-.30**	-.18*	.7 (NS)
Uncontrollable Eating	-.25**	-.36**	3.45 ($p < .10$)	-.38**	-.38**	1.12 (NS)
Health-Promoting Behavior	.27**	.15*	1.9 (NS)	.25**	.27**	.17 (NS)

Note: Table 3 continues on next page

Table 3 (continued)

Coeffcient values of the path from latent dispositional self-control to dependent variables, based on each predicted moderator. x^{2Diff} values are also included, which indicate whether or not the paths within each moderator analysis are statistically significant.

	Fatigue Moderator			Gender Moderator		
Dependent Variables Associated with DSC	Low Fatigue	High Fatigue	x^{2Diff}	Men	Women	x^{2Diff}
Substance Use	-.22**	-.18*	.05 (NS)	-.16*	-.27**	1.45 (NS)
Uncontrollable Eating	-.31**	-.28**	.03 (NS)	-.50**	-.38**	1.44 (NS)
Health-Promoting Behavior	.26**	.04	5.58 ($p < .01$)	.37*	.27**	.89 (NS)

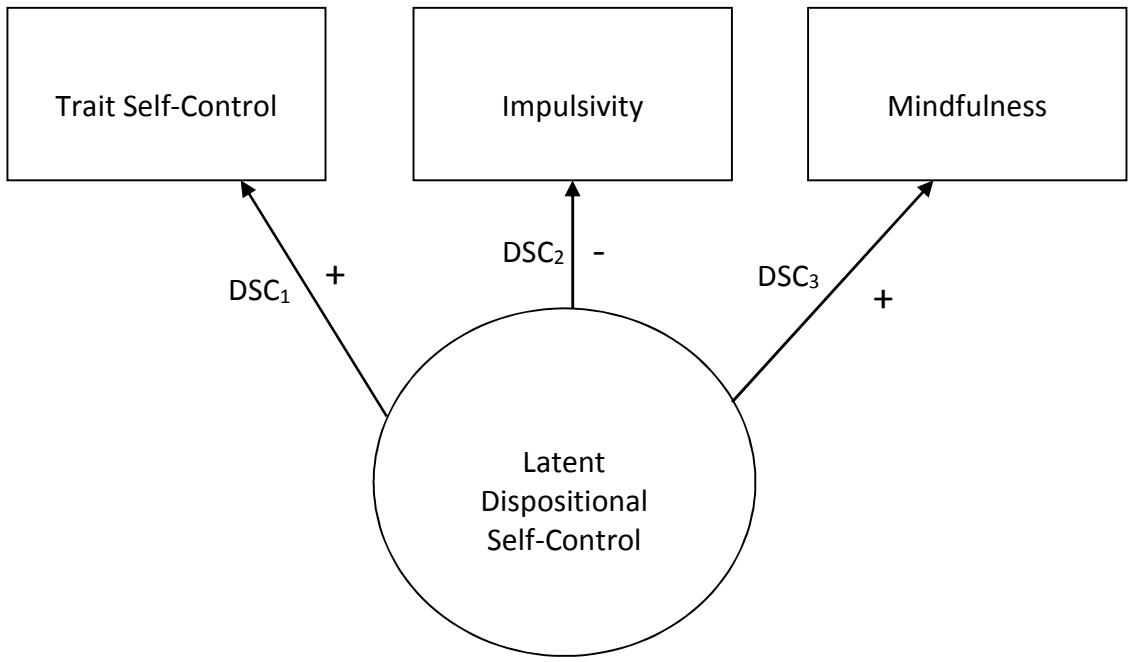

Figure 1. Predicted comprehensive model for the latent variable representing latent dispositional self-control. The circled variable is latent; the variables in rectangles are measured. Signs to the right of the paths indicate the predicted direction of the association between study variables. Labels for each path are located to the left of the path.

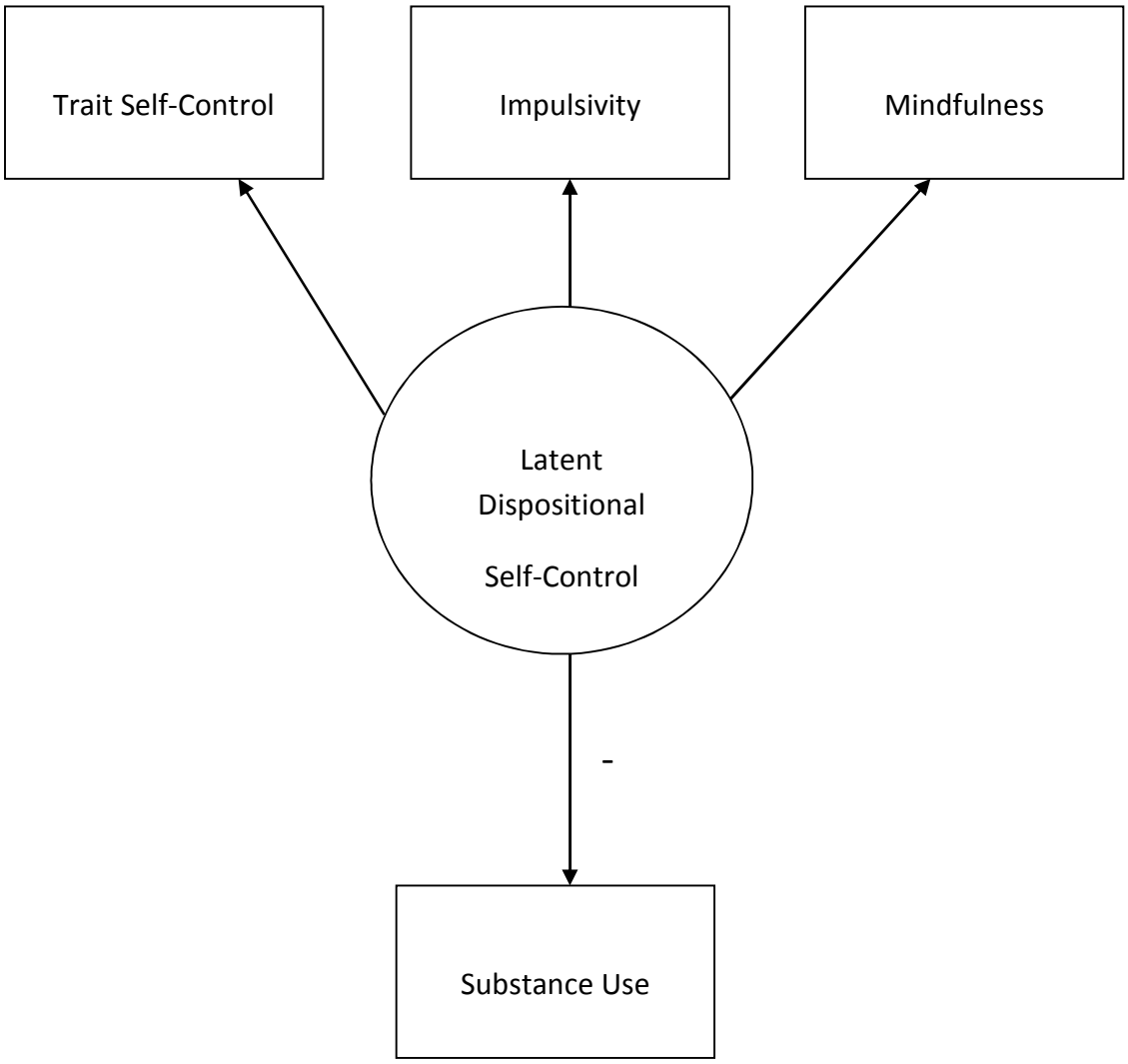

Figure 2. Predicted relationship between latent dispositional self-control and substance use.

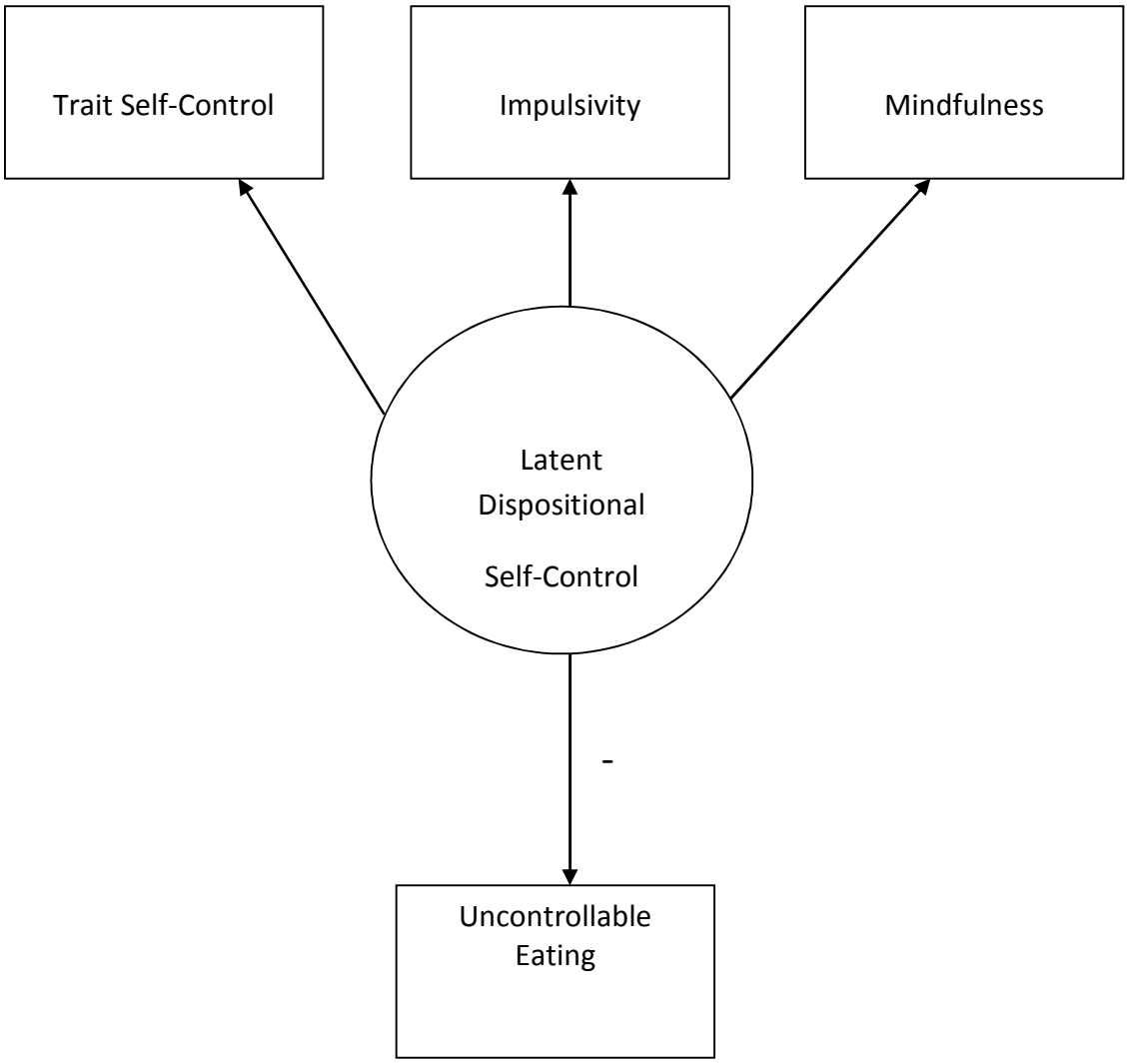

Figure 3. Predicted relationship between latent dispositional self-control and uncontrollable eating.

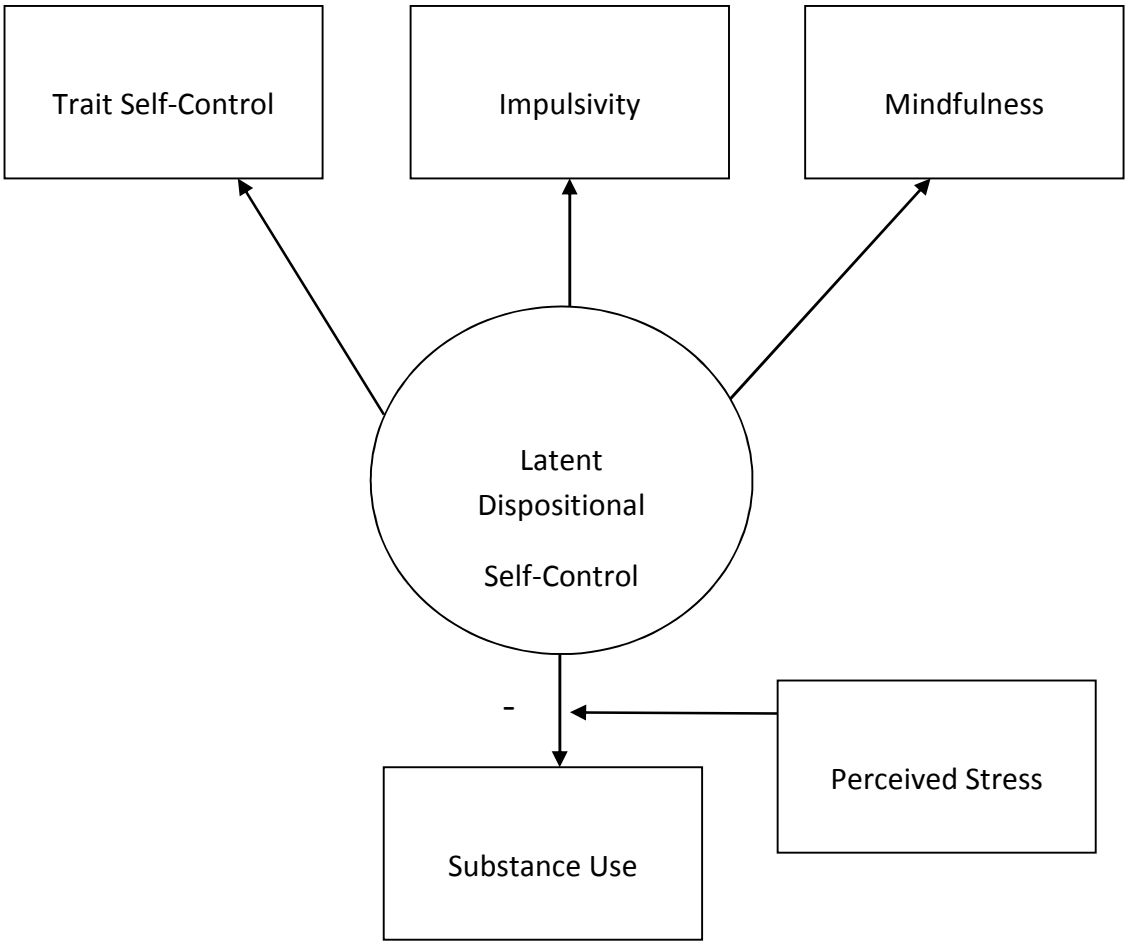

Figure 4. Predicted moderation model for the relationship between latent dispositional control, perceived stress, and substance use.

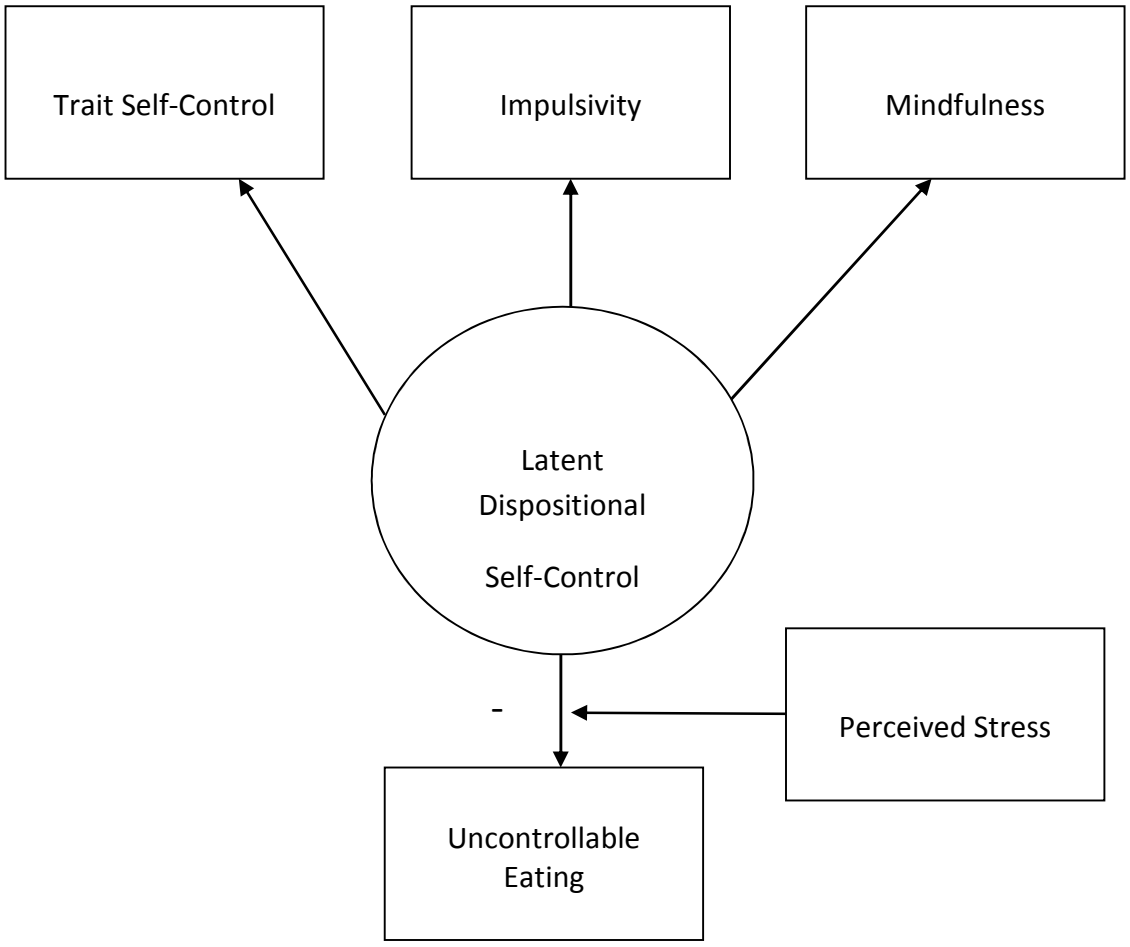

Figure 5. Predicted moderation model for the relationship between latent dispositional control, perceived stress, and uncontrollable eating.

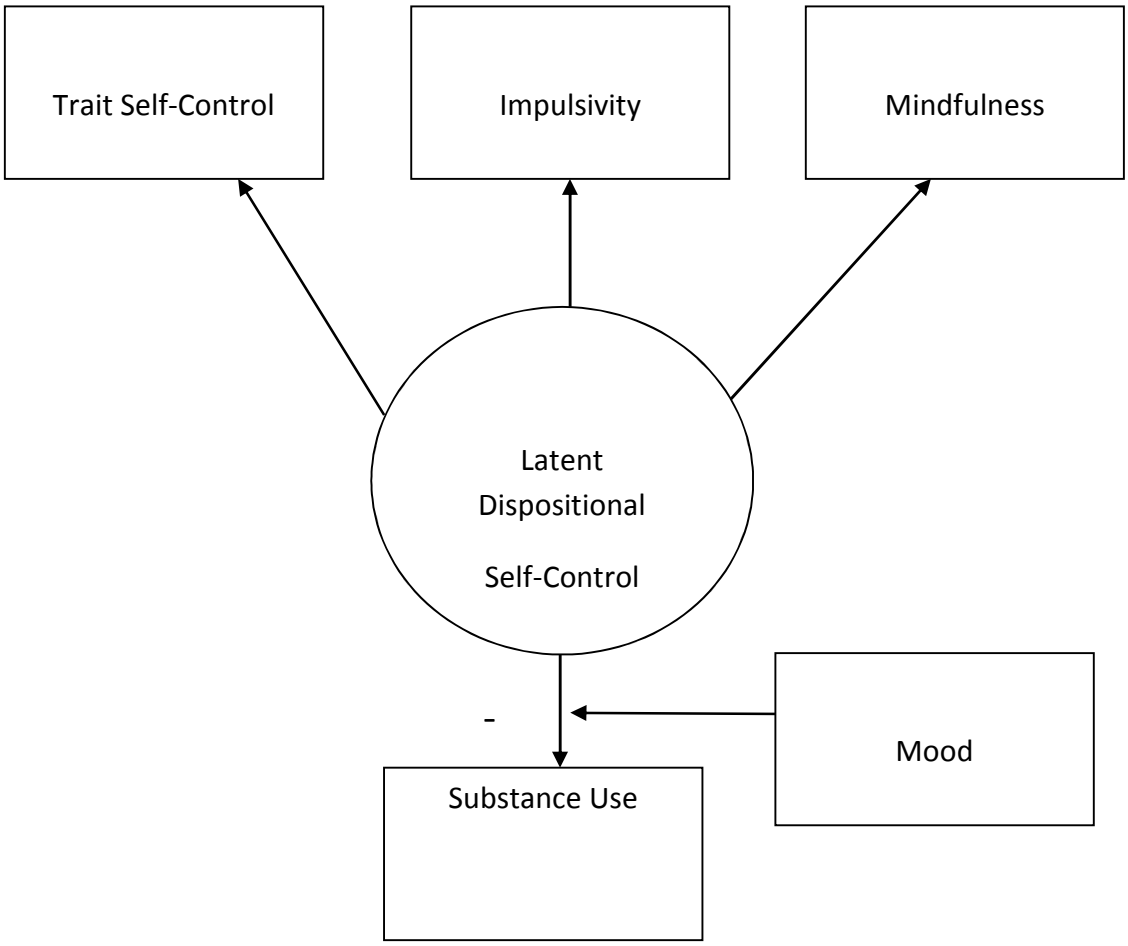

Figure 6. Predicted moderation model for the relationship between latent dispositional control, mood, and substance use.

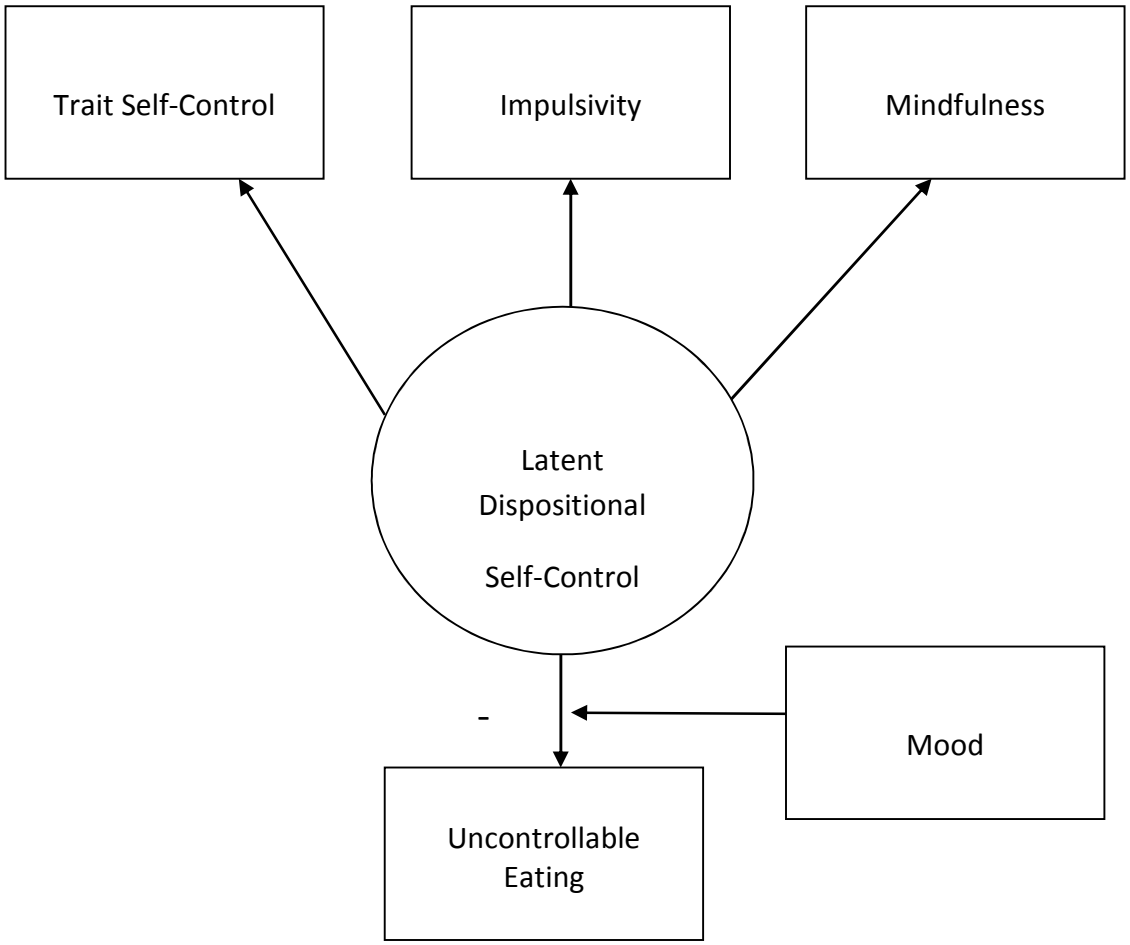

Figure 7. Predicted moderation model for the relationship between latent dispositional control, mood, and uncontrollable eating.

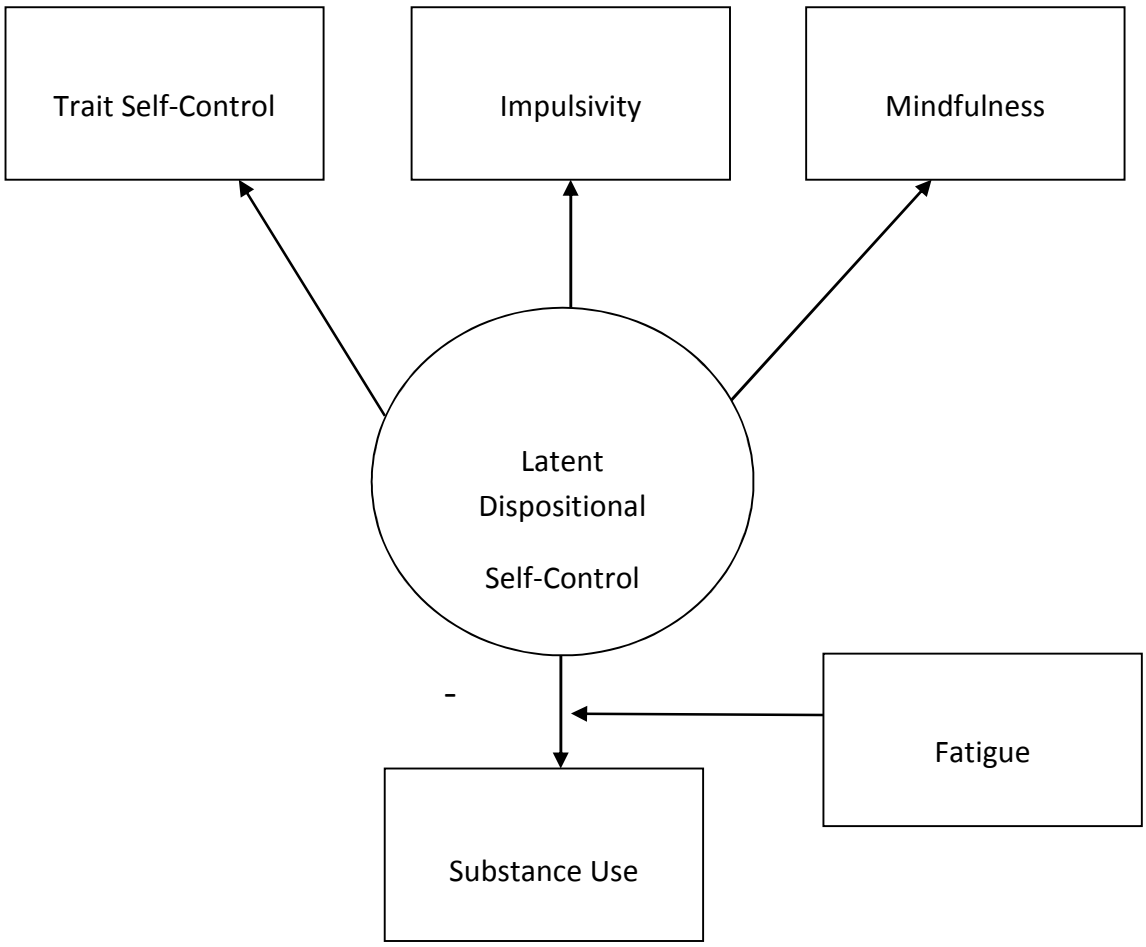

Figure 8. Predicted moderation model for the relationship between latent dispositional control, fatigue, and substance use.

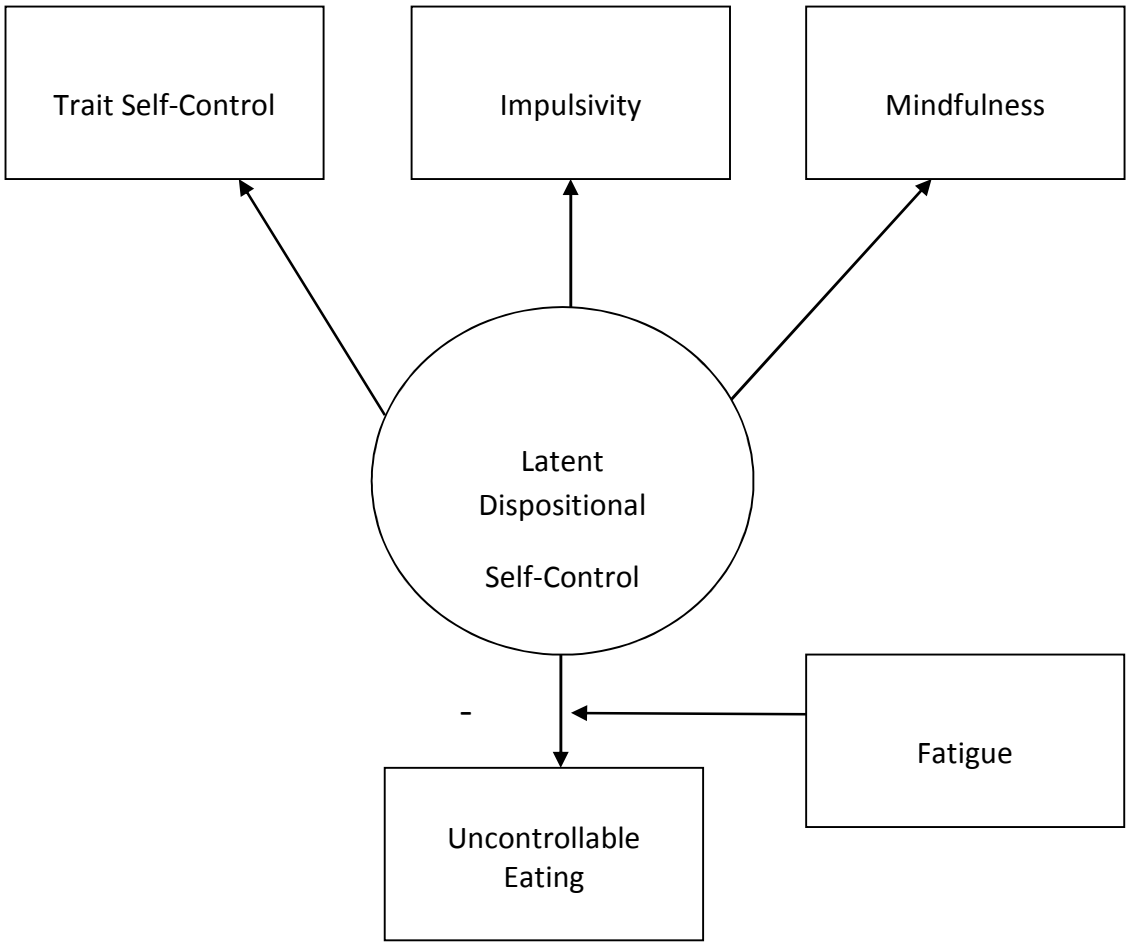

Figure 9. Predicted moderation model for the relationship between latent dispositional control, fatigue, and uncontrollable eating.

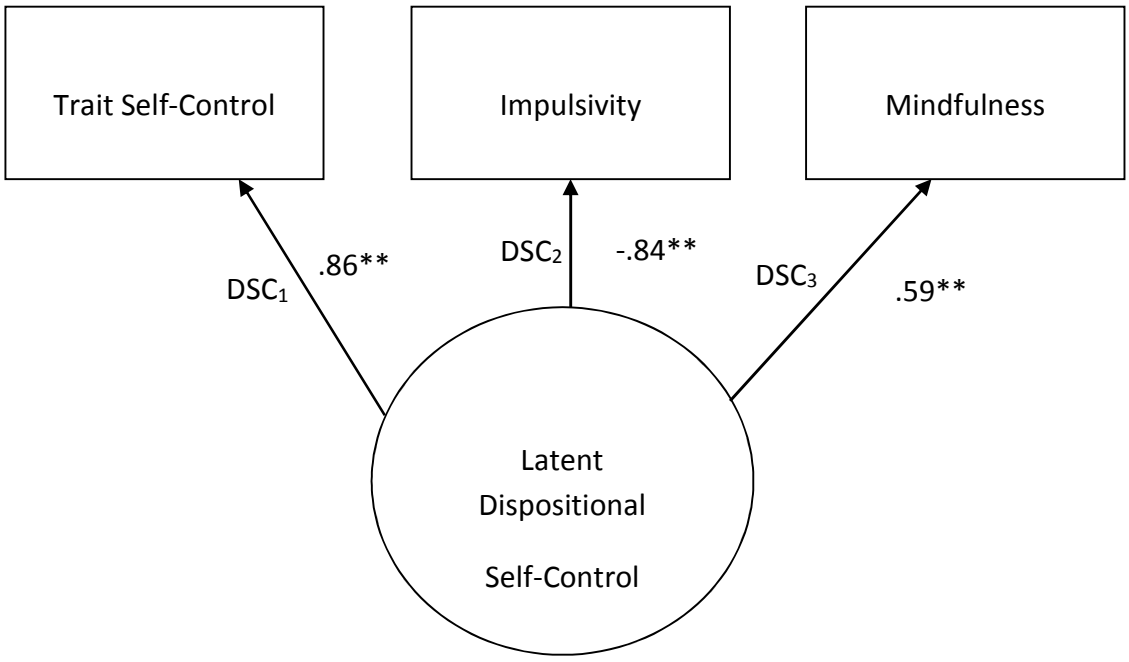

Figure 10. Final measurement model for the latent variable representing latent dispositional self-control. All standardized path coefficients are significant at $^{**}p < .01$. Model was a poor fit to the data ($\chi^2[1] = 37.27$, $p < .01$; CFI = .93; RMSEA = .24). The indicator path for trait self-control (DSC_1) was not significantly different for the impulsivity path (DSC_2) ($p < .01$). However the indicator path for mindfulness (DSC_3) was significantly different from both trait self-control ($p > .05$) and impulsivity ($p > .05$).

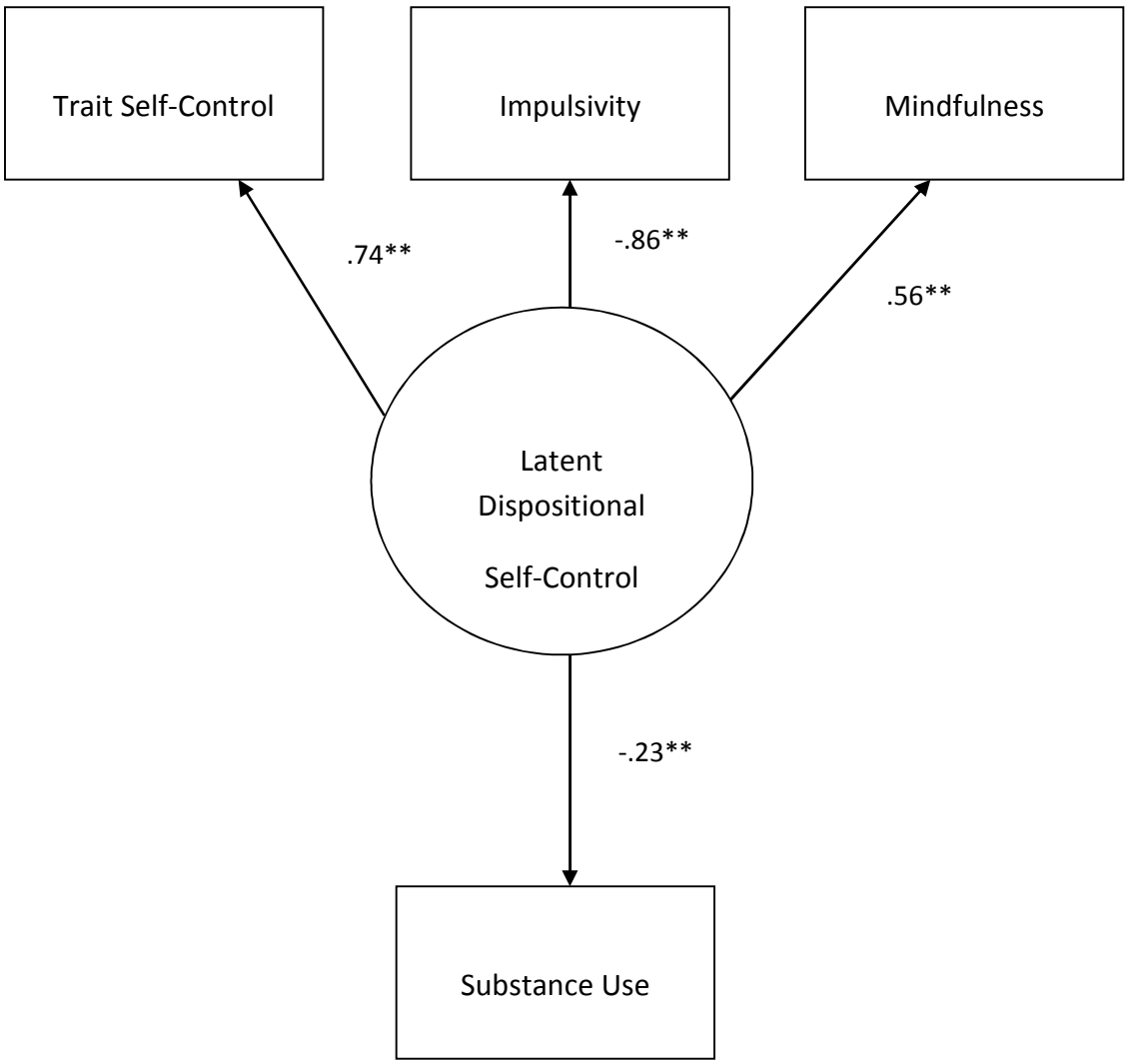

Figure 11. Final structural model of latent dispositional self-control predicting substance use. Model was an excellent fit to the data ($\chi^2[2] = 5.08$, $p = .08$; CFI = .99; RMSEA = .05). All standardized path coefficients are significant at $^{**}p < .01$

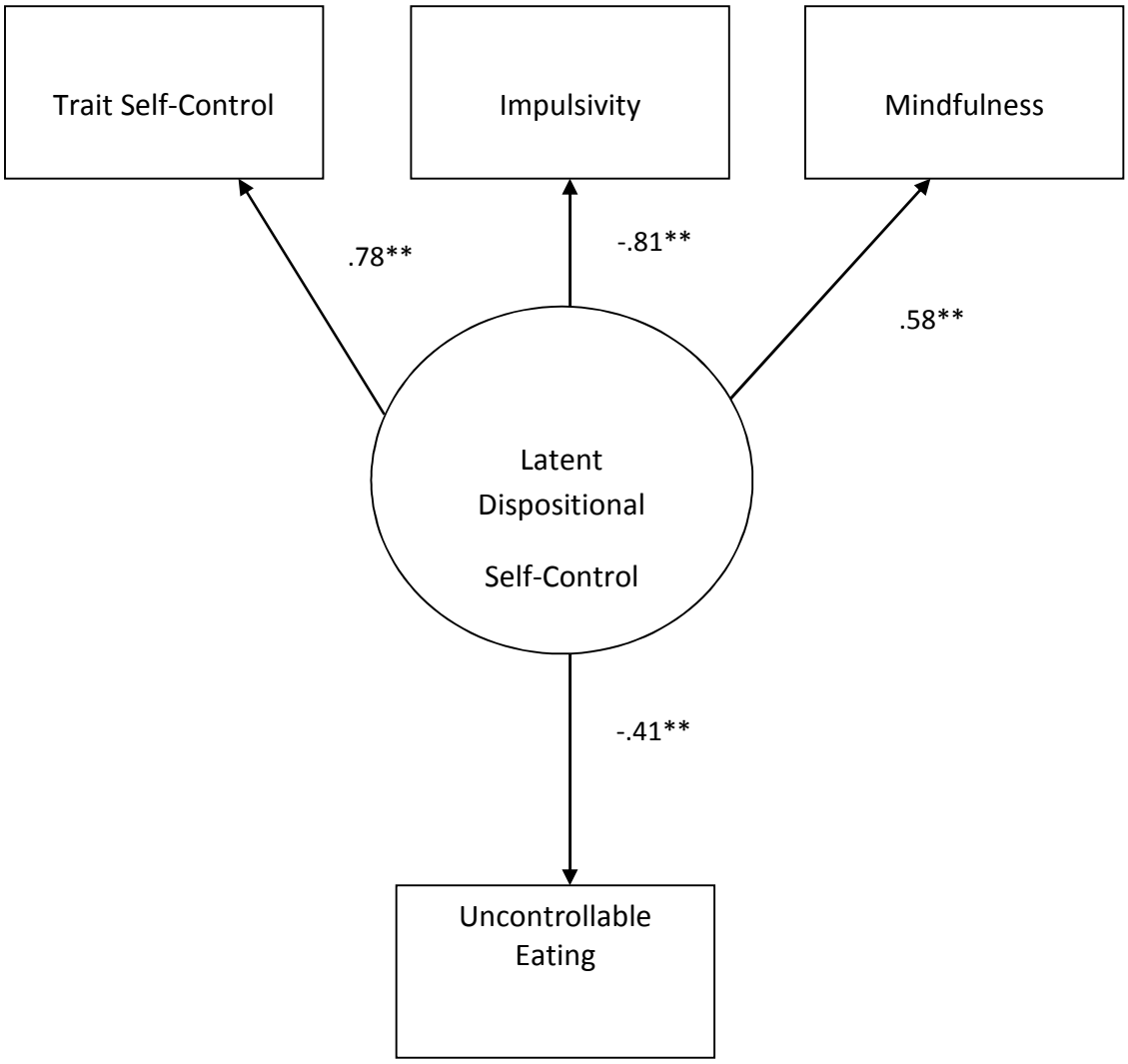

Figure 12. Final structural model of latent dispositional self-control predicting uncontrollable eating. Model was an adequate fit to the data ($\chi^2[2] = 38.88$, $p < .01$; CFI = .94; RMSEA = .17). All standardized path coefficients are significant at $^{**}p < .01$.

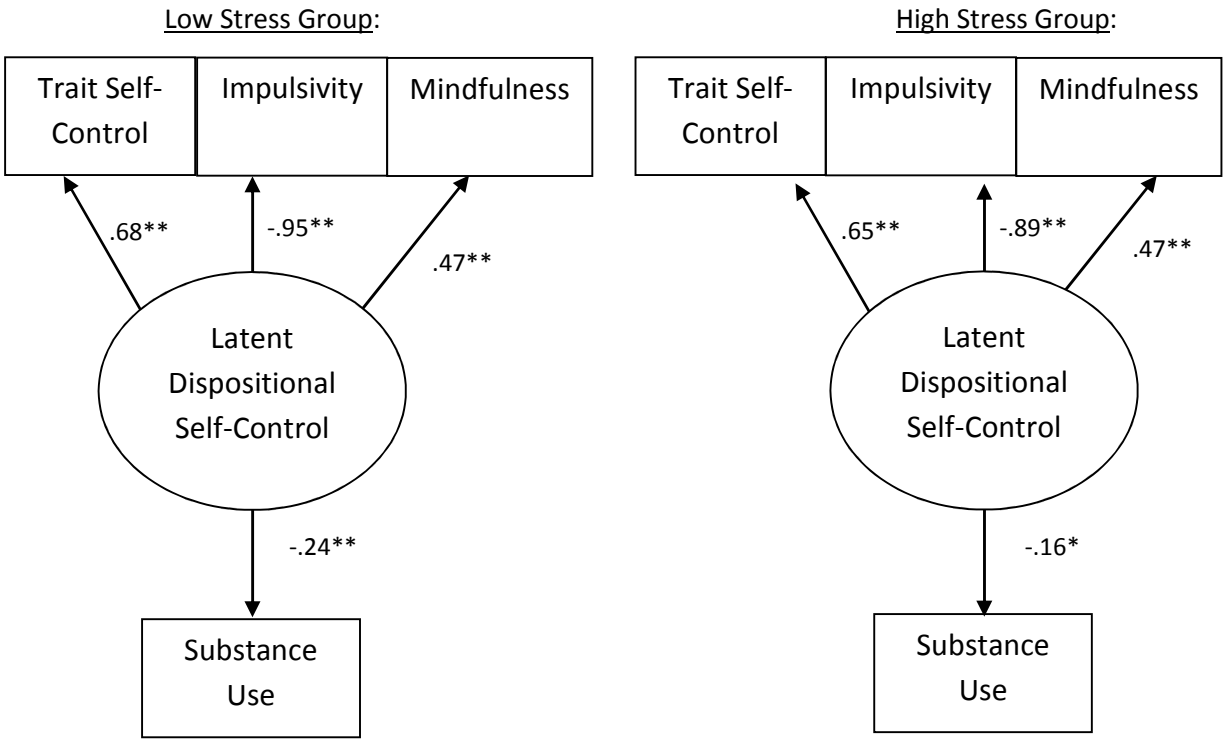

Figure 13. Final moderation model for the relationship between latent dispositional control, perceived stress, and substance use. Results did not support the predicted moderation model. The partially constrained model was an excellent fit to the data ($\chi^2[7] = 15.93$, $p = .03$; CFI = .98; RMSEA = .04) as well as the fully constrained model ($\chi^2[8] = 16.61$, $p = .03$; CFI = .98; RMSEA = .04). All standardized path coefficients are significant at $^{**}p < .01$ or $^{*}p < .05$.

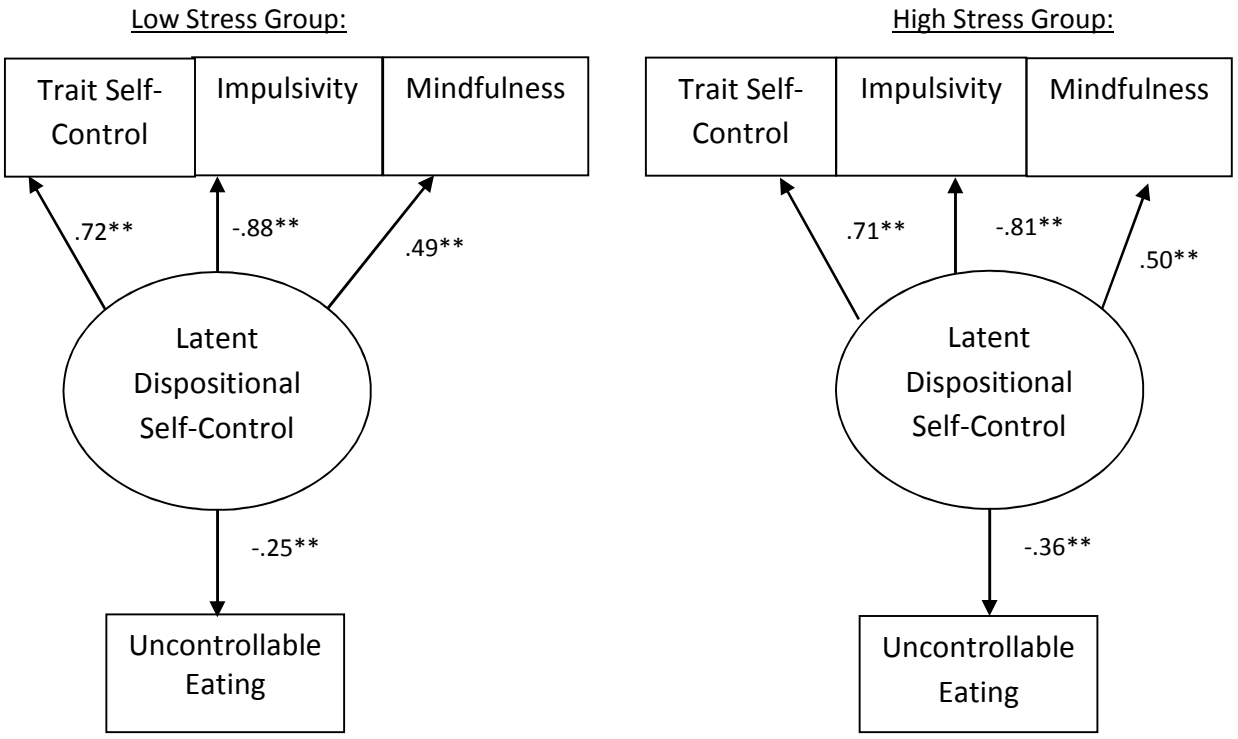

Figure 14. Final moderation model for the relationship between latent dispositional control, perceived stress, and uncontrollable eating. The moderation was trending significance ($p < .10$). The partially constrained model was a good fit to the data ($\chi^2[7] = 44.08$, $p = .01$; CFI = .92; RMSEA = .09) as well as the fully constrained model ($\chi^2[8] = 47.53$, $p = .01$; CFI = .92; RMSEA = .09). All standardized path coefficients are significant at $^{**}p < .01$.

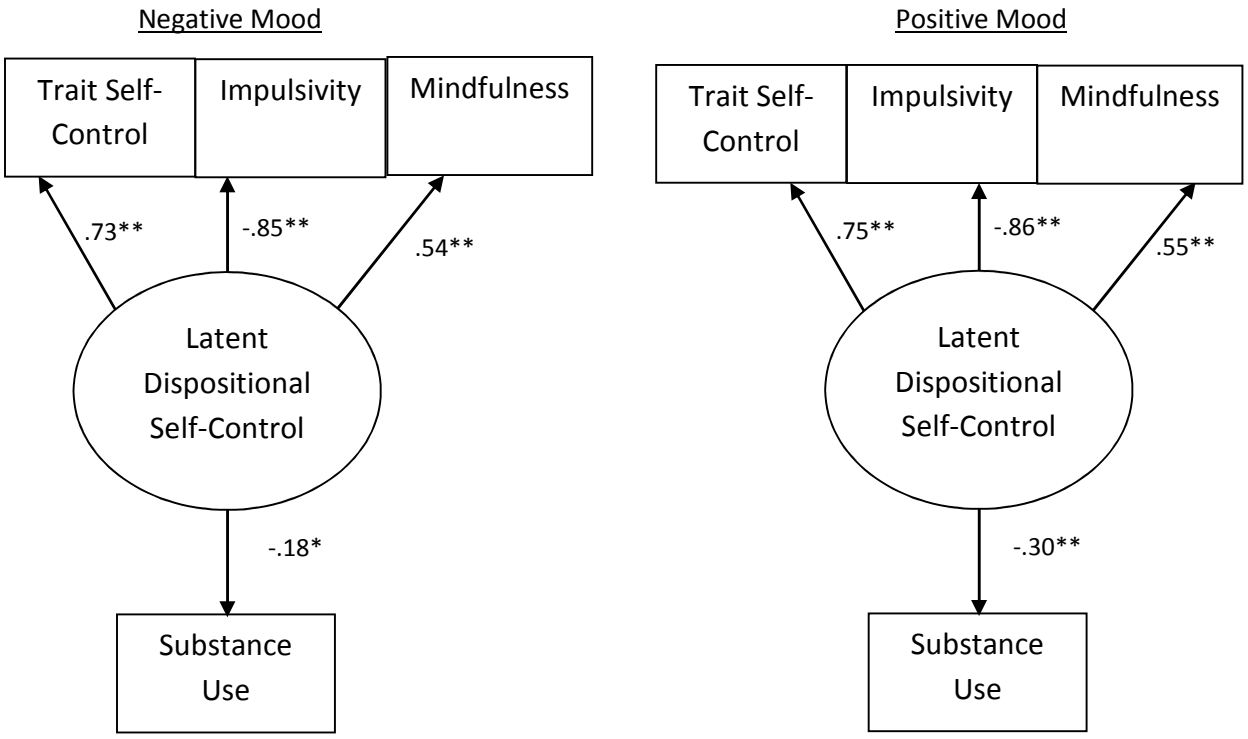

Figure 15. Final moderation model for the relationship between latent dispositional control, mood, and substance use. Results did not support the predicted model. The partially constrained model was an excellent fit to the data ($\chi^2[7] = 8.91$, $p = .26$; CFI = .99; RMSEA = .02) as well as the fully constrained model ($\chi^2[8] = 9.61$, $p = .29$; CFI = .99; RMSEA = .02). All standardized path coefficients are significant at $^{**}p < .01$.

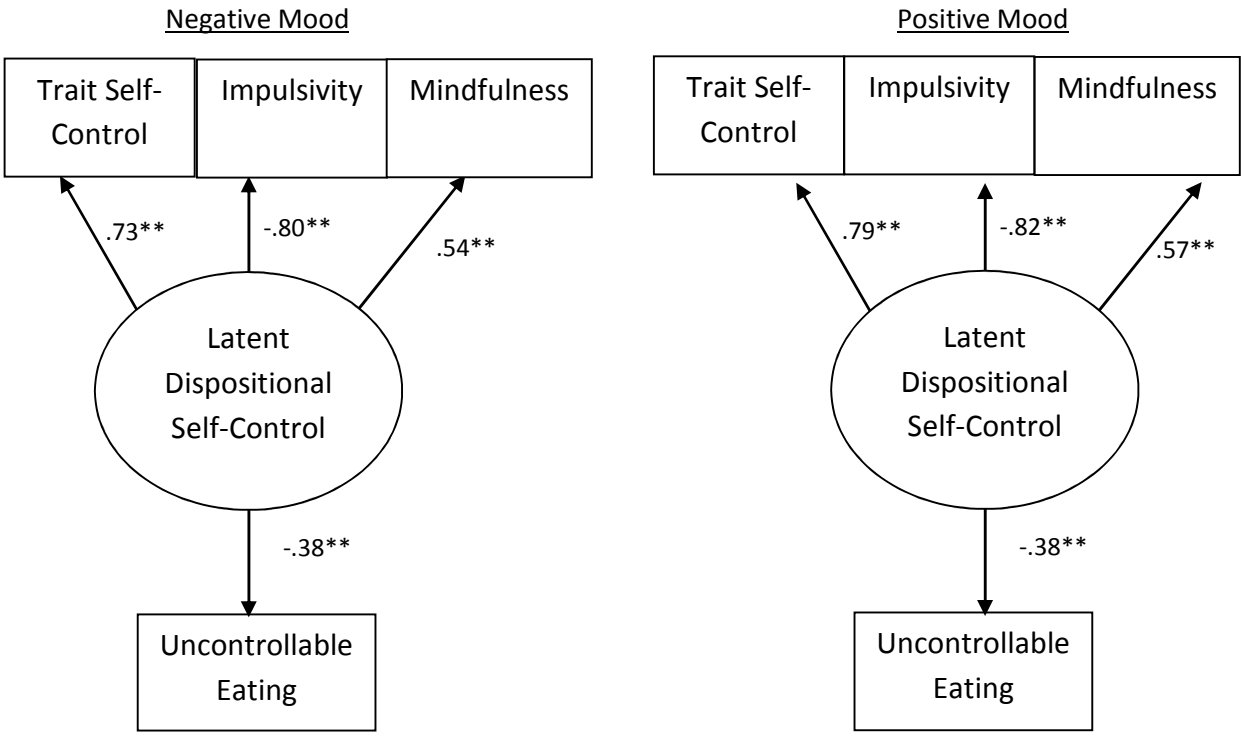

Figure 16. Final moderation model for the relationship between latent dispositional control, mood, and uncontrollable eating. Results did not support the predicted model. The partially constrained model was an adequate fit to the data ($\chi^2[7] = 40.58$, $p < .01$; CFI = .94; RMSEA = .09) as well as the fully constrained model ($\chi^2[8] = 41.70$, $p < .01$; CFI = .94; RMSEA = .09). All standardized path coefficients are significant at $^{**}p < .01$.

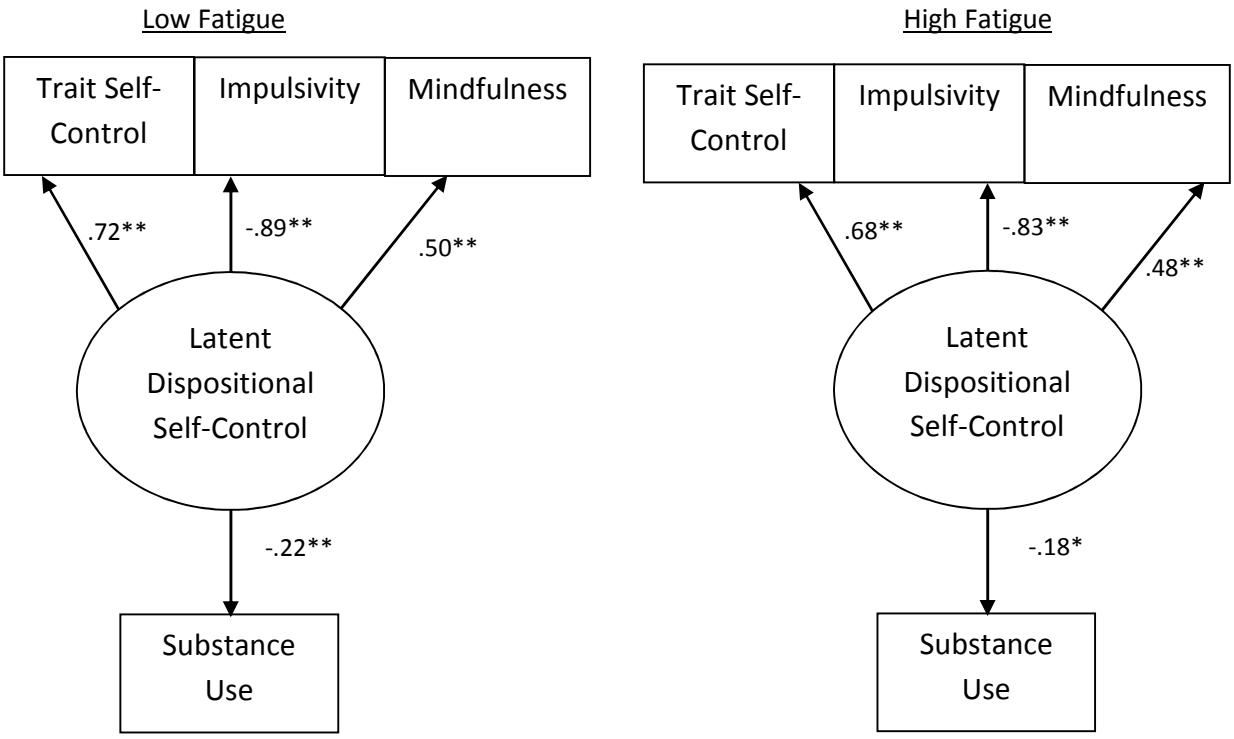

Figure 17. Final moderation model for the relationship between latent dispositional control, fatigue, and substance use. Results did not support the predicted model. The partially constrained model was an excellent fit to the data ($\chi^2[7] = 14.33$, $p = .05$; CFI = .98; RMSEA = .04) as well as the fully constrained model ($\chi^2[8] = 14.38$, $p = .05$; CFI = .98; RMSEA = .04). All standardized path coefficients are significant at $^{**}p < .01$ or $^{*}p < .05$.

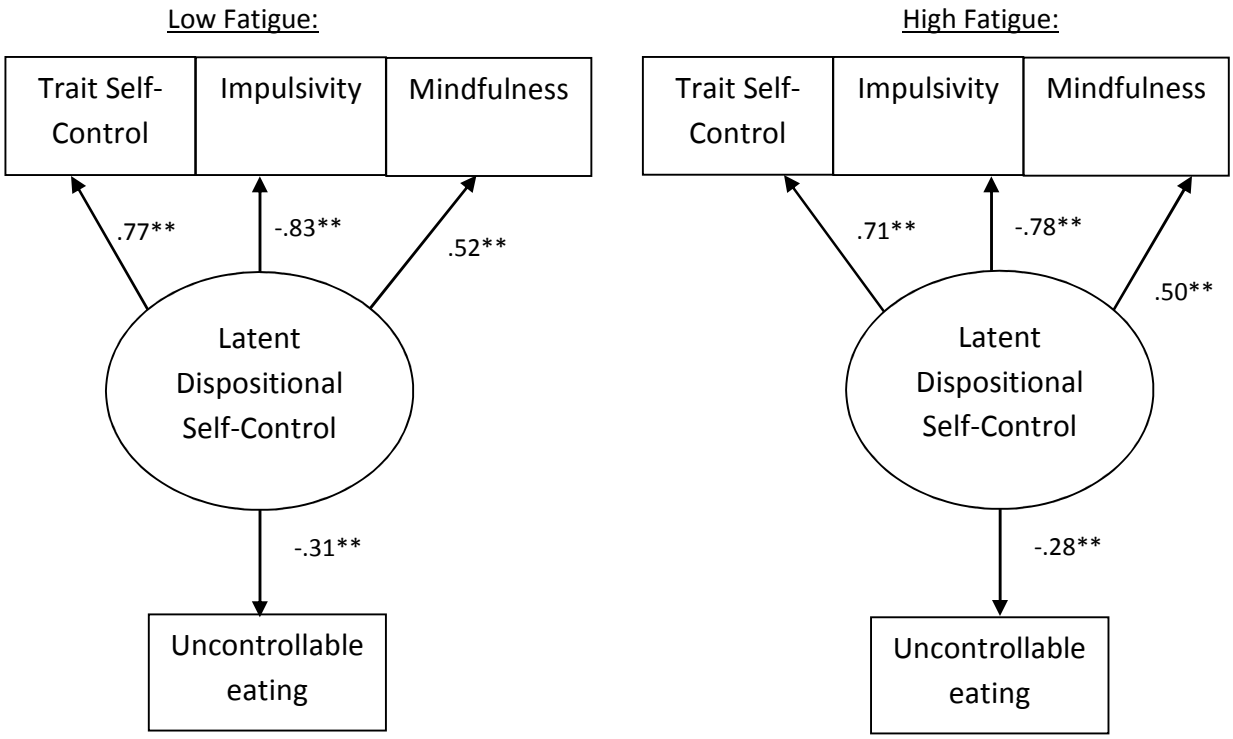

Figure 18. Final moderation model for the relationship between latent dispositional control, fatigue, and uncontrollable eating. Results did not support the predicted model. The partially constrained model was a good fit to the data ($\chi^2[7] = 33.19$, $p < .01$; CFI = .95; RMSEA = .07) as well as the fully constrained model ($\chi^2[8] = 33.22$, $p < .01$; CFI = .95; RMSEA = .07). All standardized path coefficients are significant at $^{**}p < .01$.

Appendix A: Study Questionnaire

Section 1: Background Questions

Please answer all questions as accurately as you can.

1) In what country were you born? _____

2) How long have you lived in the United States? _____ years (OR) _____ months

3) Which best describes your race?
_____ African-American or Black
_____ White
_____ Latino or Hispanic
_____ Asian or Pacific Islander
_____ Native American
_____ Other; please specify: _____
_____ A combination; please specify: _____

4) How old are you? _____

5) What is your gender?
_____ Female
_____ Male

6) What is your major at Stony Brook? _____

7) What is your GPA? _____

Section 2: Listed below are questions regarding your perceptions about school. Please provide a response for each item.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I have a great deal of control over my academic performance in my psychology courses.	0	1	2	3	4
2. The more effort I put into my courses, the better I do in them.	0	1	2	3	4
3. No matter what I do, I can't seem to do well in my courses.	0	1	2	3	4
4. I see myself as largely responsible for my performance throughout my college career.	0	1	2	3	4
5. How well I do in my courses is often the "luck of the draw."	0	1	2	3	4
6. There is little I can do about my performance in college.	0	1	2	3	4
7. When I do poorly in a course, it's usually because I haven't given it my best effort.	0	1	2	3	4
8. My grades are basically determined by things beyond my control and there is little I can do to change that.	0	1	2	3	4

Section 3: The following questions are about some of your general attitudes. Please rate how much you agree with each statement by choosing one of the following answers:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1) In uncertain times, I usually expect the best.	1	2	3	4	5
2) It's easy for me to relax.	1	2	3	4	5
3) If something can go wrong for me, it will.	1	2	3	4	5
4) I'm always optimistic about my future.	1	2	3	4	5
5) I enjoy my friends a lot.	1	2	3	4	5
6) It's important for me to keep busy.	1	2	3	4	5
7) I hardly ever expect things to go my way.	1	2	3	4	5
8) I don't get upset too easily.	1	2	3	4	5
9) I rarely count on good things happening to me.	1	2	3	4	5
10) Overall, I expect more good things to happen to me than bad.	1	2	3	4	5

Section 4: Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	Never	Rarely	Sometimes	Often	All the Time
1. I am good at resisting temptation.	1	2	3	4	5
2. I have a hard time breaking bad habits.	1	2	3	4	5
3. I am lazy.	1	2	3	4	5
4. I change my mind fairly often.	1	2	3	4	5
5. I get carried away by my feelings.	1	2	3	4	5
6. I'm not easily discouraged.	1	2	3	4	5
7. I wish I had more self-discipline.	1	2	3	4	5
8. I have trouble concentrating.	1	2	3	4	5
9. I am able to work effectively toward long-term goals.	1	2	3	4	5
10. Sometimes I can't stop myself from doing something, even if I know it's wrong	1	2	3	4	5

Section 5: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way:
In the Last Month, How Often Have You….

		Never	Almost Never	Sometimes	Fairly Often	Often
1	Been upset because of something that happened unexpectedly?	1	2	3	4	5
2	Felt that you were unable to control the important things in your life?	1	2	3	4	5
3	Felt nervous and "stressed"?	1	2	3	4	5
4	Felt confident about your ability to handle your personal problems?	1	2	3	4	5
5	Felt that things were going your way?	1	2	3	4	5
6	Found that you could not cope with all the things that you had to do?	1	2	3	4	5
7	Been able to control irritations in your life?	1	2	3	4	5
8	Felt that you were on top of things?	1	2	3	4	5
9	Been angered because of things that were outside of your control?	1	2	3	4	5
10	Felt difficulties were piling up so high that you could not overcome them?	1	2	3	4	5

Section 6: Please read each item below and indicate, by using the following rating scale, to what extent you used it in a stressful situation:

When Dealing with Stressful Situations, How Often Have You …

		Never	Almost Never	Sometimes	Fairly Often	Very Often
1.	Wished that the situation would go away or somehow be over with?	0	1	2	3	4
2.	Hoped a miracle would happen?	0	1	2	3	4
3.	Had fantasies or wishes about how things might turn out?	0	1	2	3	4
4.	Tried to make yourself feel better by eating, drinking, using drugs or medication, etc..?	0	1	2	3	4
5.	Avoid being with people in general?	0	1	2	3	4
6.	Took it out on other people?	0	1	2	3	4
7.	Slept more than usual?	0	1	2	3	4

Section 7: Please answer the following questions about your mental habits by rating how frequently you do the following:

	Almost Always	Very Often	Fairly Often	Sometimes	Very Infrequently	Almost Never
1. I could be experiencing some emotion and not be conscious of it until sometime later.	1	2	3	4	5	6
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
3. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
6. I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6

Section 7 Continued….	Almost Always	Very Often	Fairly Often	Sometimes	Very Infrequently	Almost Never
7. It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
8. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
9. I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
10. I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
11. I drive or walk to places on 'automatic pilot' and then wonder why I went there.	1	2	3	4	5	6
12. I find myself preoccupied with the future or the past.	1	2	3	4	5	6
13. I find myself doing things without paying attention.	1	2	3	4	5	6
14. I snack without being aware that I'm eating.	1	2	3	4	5	6

Section 8: The following items are things people sometimes do that affect their health. Please think about what you did in the last two weeks. Keep in mind that YOUR REPSONSES WILL REMAIN CONFIDENTIAL AND ANONYMOUS. Please be honest with your responses.

In the last two weeks, how often did you…

		Never	Almost Never	Sometimes	Fairly Often	Very Often
1.	…exercise for at least 20 minutes?	0	1	2	3	4
2.	…get enough sleep?	0	1	2	3	4
3.	…eat fatty or oily foods?	0	1	2	3	4
4.	…take vitamins?	0	1	2	3	4
5.	…drink things with caffeine such as coffee, sodas, or energy drinks?	0	1	2	3	4
6.	…stretch your muscles?	0	1	2	3	4
7.	…drink alcohol, including wine, or beer or liquor?	0	1	2	3	4
8.	…drink enough water?	0	1	2	3	4
9.	…eat more food than you needed to?	0	1	2	3	4
10.	...smoke cigarettes or use tobacco products?	0	1	2	3	4
11.	…smoke electronic cigarettes?	0	1	2	3	4
12.	...skip a meal, such as breakfast?	0	1	2	3	4
13.	…eat a balanced meal, including fruits or vegetables?	0	1	2	3	4
14.	…smoke marijuana?	0	1	2	3	4

Section 8 Continued.		**In the last two weeks, how often did you…**				
		Never	Almost Never	Sometimes	Fairly Often	Very Often
15.	...use amphetamine substances recreationally (speed, diet pills, ecstacy, meth, Ritalin)?	0	1	2	3	4
16.	…use sedatives or sleeping pills (Valium, Serepx, Rohypnol)?	0	1	2	3	4
17.	…use cocaine or crack?	0	1	2	3	4
18.	…use opiates (heroin, morphine, methodadone, codene)?	0	1	2	3	4

Section 9: Please answer the following questions regarding how much control you feel you have over certain behaviors.

	Not at All	Somewhat	Moderately	Very Much	Not Applicable
1. To what extent do you feel that you are in control of your drinking?	1	2	3	4	5
2. To what extent do you feel that you could stop your drinking tomorrow if you wanted to?	1	2	3	4	5
3. To what extent do you feel that you are in control of your smoking?	1	2	3	4	5
4. To what extent do you feel that you could stop your smoking tomorrow if you wanted to?	1	2	3	4	5
5. To what extent do you feel that you are in control of your marijuana use?	1	2	3	4	5
6. To what extent do you feel that you could stop your marijuana use tomorrow if you wanted to?	1	2	3	4	5
7. To what extent do you feel that you are in control of your amphetamine use (speed, diet pills, ecstasy, meth, recreational ritalin?)	1	2	3	4	5
8. To what extent do you feel that you could stop your amphetamine use tomorrow if you wanted to?	1	2	3	4	5
9. To what extent do you feel that you are in control of your opiate use (heroin, morphine, codene)?	1	2	3	4	5
10. To what extent do you feel that you could stop your opiate use tomorrow if you wanted to?	1	2	3	4	5
11. To what extent do you feel that you are in control of your sedative use (Valium, Serepx, Rohypnol?)	1	2	3	4	5
12. To what extent do you feel that you could stop your sedative use tomorrow if you wanted to?	1	2	3	4	5

Section 10: People sometimes have difficulty controlling their intake of certain foods such as sweets, starches, salty snacks, fatty foods, sugary drinks, and others.

The following question asks about your eating habits **in the past year.**

	Never	Once per month	2-4 times per month	2-3 times per week	4+ times per week
1. I find myself consuming certain foods even though I am no longer hungry.	1	2	3	4	5
2. I worry about cutting down on certain foods.	1	2	3	4	5
3. I feel sluggish or fatigued from overeating.	1	2	3	4	5
4. I have spent time dealing with negative feelings from overeating certain foods, instead of spending time on important activities such as time with family, friends, work, or recreation.	1	2	3	4	5
5. I have had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods.	1	2	3	4	5
6. My behavior with respect to food and eating causes me significant distress.	1	2	3	4	5
7. Issues related to food and eating decrease my ability to function effectively (daily routine, job/school, social or family activities, health difficulties).	1	2	3	4	5

Section 11: Please answer the following questions by rating how much you agree or disagree with the following statements.

	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
1. I plan tasks carefully.	1	2	3	4
2. I do things without thinking.	1	2	3	4
3. I don't "pay attention."	1	2	3	4
4. I am self-controlled.	1	2	3	4
5. I concentrate easily.	1	2	3	4
6. I am a careful thinker.	1	2	3	4
7. I say things without thinking.	1	2	3	4
8. I act on the spur of the moment.	1	2	3	4

Section 12: <u>In the past month,</u> how often have you done each of these things to COPE WITH STRESS IN YOUR LIFE?

	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. Treated myself to dinner at one of my favorite restaurants.	0	1	2	3	4
2. Ate boxed or canned foods because I had less time to cook.	0	1	2	3	4
3. Ate even when I was not hungry, particularly before bedtime or late at night.	0	1	2	3	4
4. Ate beyond the point of fullness because the food was so satisfying.	0	1	2	3	4
5. Ate “comfort food” like bread, chips, chocolate, or sweets.	0	1	2	3	4
6. Got together with friends to eat.	0	1	2	3	4
7. Ate out or ordered take-out because didn’t have time or energy to cook.	0	1	2	3	4

Section 13: <u>In the past month,</u> how often have you felt the following?

	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. Physical activity brings on my fatigue.	0	1	2	3	4
2.I start things without difficulty but get weak as I go on	0	1	2	3	4
3. I lack energy	0	1	2	3	4
4. I find it difficult to make good decisions about what I eat because I am too fatigued.	0	1	2	3	4
5. I find it difficult to make good decisions regarding school because I am too fatigued.	0	1	2	3	4
6. I find it difficult to make good general health decisions because I am too fatigued.	0	1	2	3	4

Section 14: How do you feel in This Moment:

	Not at all	Slightly	Somewhat	Moderately	Extremely
1. How hungry do you feel at this moment?	0	1	2	3	4
2. How positive do you feel at this very moment?	0	1	2	3	4