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Health Promotion in Multiple Domains: Capitalizing on the Spillover Effect

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HEALTH PROMOTION IN MULTIPLE DOMAINS:

CAPITALIZING ON THE SPILLOVER EFFECT

by

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ABSTRACT

HEALTH PROMOTION IN MULTIPLE DOMAINS: CAPITALIZING ON THE SPILLOVER EFFECT

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Lifestyle behaviors, such as physical activity and food consumption choices, play a critical role in the development of chronic diseases and ultimately mortality. Optimally, multiple health-related behaviors are changed to reduce risk rather than targeting only one risk behavior. The purpose of the current research was to examine the potential utility of the spillover effect in the application of a multiple health behavior intervention. The online intervention developed in this study aimed primarily to foster self-regulation, bolstered by impulsivity control and self-efficacy, in one health-related behavior (i.e., physical activity) in order to potentially affect change in other health-related behaviors (e.g., fruit consumption). Through retrospective pre-post design and daily diary design, data was analyzed for differences in behavior change over thirty days between the spillover effect condition and the traditional intervention condition. Exploratory analyses indicated initial support for further application and testing of the spillover effect as a practical, less resource dense and potentially less overwhelming, alternative to traditional direct intervention on multiple health behaviors.

This dissertation is dedicated to my family, especially my father, Venancio Joseph D'Lima, whose encouragement and support never falters.

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CHAPTER I

INTRODUCTION

In the United States, one in every four deaths is due to heart disease and about one in five deaths is a result of cancer (Kochanek, Xu, Murphy, Minino, & Kung, 2011). Lifestyle behaviors, such as not smoking, healthy diet, limited alcohol consumption, and adequate physical activity, powerfully reduce a person's risk for all-cause mortality, major cardiovascular disease, cancer, and other causes of death. Further, these lifestyle behaviors have an additive effect in which risk for all-cause mortality strongly decreases as number of low-risk behaviors are reported (Ford, Zhao, Tsai, & Li, 2011). Yet approximately 80% of American adults do not consume the daily recommended amount of fruits and vegetables (State Indicator Report, 2009). Moreover, about half of all U.S. adults age 18 and older do not meet the physical activity guidelines for aerobic exercise (National Center for Health Statistics, 2013). Poor lifestyle behaviors can lead to other disease risk factors like excess weight; for instance, an estimated 33% of American adults are overweight, and an additional 36% are obese (Centers for Disease Control and Prevention [CDC], 2012). Between 1960-1962, the percentage of Americans overweight ($25\ kg/m^2 \leq BMI < 30\ kg/m^2$), obese ($30\ kg/m^2 \leq BMI < 40\ kg/m^2$), or extremely obese ($BMI \geq 40\ kg/m^2$) was estimated at 45% of the adult population; by 2009-2010, 75% of Americans were estimated to be overweight, obese, or extremely obese (Fryar, Carroll, & Ogden, 2012). The proportion of overweight persons remained relatively stable between these time points (31.5% to 32.7%), but trends in obesity (13.4% to 36.1%) and extreme obesity (0.9% to 6.6%) categories dramatically increased. Furthermore, the list of rising health problems continues to increase health care costs for treatment and loss

productivity. In 2006, excessive alcohol consumption alone (e.g., binge drinking which is defined as consuming five/four or more drinks in one sitting for men/women respectively) cost the United States 223.5 billion dollars due to loss of workplace productivity, healthcare expenses, law and criminal justice, and automobile accidents (CDC, 2011a). Similarly, the annual medical care cost for the treatment for obesity was estimated to be 147 billion dollars (CDC, 2009a). Benjamin Franklin (1735) is credited with the adage, "An ounce of prevention is worth a pound of cure." Targeting risky unhealthy lifestyle behaviors, such as poor diet, alcohol use, and sedentary behaviors in young adults may curtail the increasing trend of behaviors associated with risk for early mortality.

Risk Behavior Selection

Prevalence and comorbidity of problematic risk behaviors. The uniform rise of multiple chronic diseases can be partly attributed to the evidence that many types of risky health behaviors and problems (e.g., the "big four": smoking, alcohol use, sedentary lifestyle, eating behaviors; Pronk, Peek, & Goldstein, 2004) have high comorbidity rates (Centers for Disease Control and Prevention [CDC], 2012b; Driskell et al., 2008; Liangpunsakul, 2010; Mistry et al., 2009; Poortinga, 2007). After tobacco use, the leading causes of preventable lifestyle-related death are poor diet, physical inactivity, and alcohol consumption (CDC, 2012a; Mokdad, Marks, Stroup, & Gerberding, 2004). In the college student population, 95% of young adults do not consume at least five servings of fruits and vegetables daily (American College Health Association [ACHA], 2012), 80% do not engage in moderate aerobic exercise more than four days a week (56% do not engage in aerobic exercise for more than three days; ACHA, 2012), and 65% reported

being drunk in the previous year with 36% consuming five drinks in one sitting within the past two-weeks (Johnston, O'Malley, Bachman, & Schulenberg, 2012). Although a major contributor to disease and mortality, smoking would not be feasible to target in the current exploratory study given that cigarette smoking is relatively less prevalent in college students (13% within past 30 days; American College Health Association, 2012). Given that the majority of emerging adults are typically in optimal health (e.g., most do not present with chronic diseases; CDC, 2009b) and most unhealthy behaviors have not been formed into steadfast habits, this stage in life is particularly advantageous for prevention aims.

Health behaviors targeted in the present study (i.e., poor diet, sedentary behavior, and binge drinking) have been shown to be correlated (Nelson, Lust, Story, & Ehlinger, 2009). Specifically, Nelson and colleagues (2009) found a tendency for university students who engage in binge drinking to rarely eat breakfast or fruit/vegetables; binge drinkers also engaged in sedentary behaviors and fast food consumption more regularly than those who did not binge drink. Similarly, sedentary behavior has been linked to unhealthy eating behaviors (Lowry, Wechsler, Galuska, Fulton, & Kann, 2002) and alcohol use (Tucker, 1985). Moreover, Mistry et al. (2009) found several clusters across smoking, drinking, physical inactivity, and low fruit and vegetable consumption behaviors; however, one cluster, in which individuals engaged in all "big four" risk behaviors, were at particular risk. It should be noted that although previous research demonstrates that alcohol use is associated with lower physical activity (Tucker, 1985), contradictory evidence indicates greater alcohol quantity and frequency was associated with higher levels of exercise (Moore & Werch, 2008). The pattern of the relationship

between alcohol use and physical activity has not been demonstrated consistently. In another study, engaging in structured physical activity (e.g., sports) was related to higher alcohol consumption and binge drinking; however, unstructured physical activity was not related to frequency of alcohol use (Ruffin, 2012). Typically, individuals who report heavy engagement in one health compromising behavior may engage in other health compromising behaviors as well (e.g., cross-sensitivity between sugar and alcohol, Fortuna, 2010; poor eating habits and amount of television viewing, Lowry et al., 2002; poor diet and lack of physical activity, Nelson et al., 2009; heavy television viewing and alcohol use, Tucker, 1985). Given that these behaviors often occur in tandem, interventions that address multiple behaviors simultaneously may be ideal.

Consequences of comorbid risk behaviors. An important rationale for efforts that target multiple health-related behaviors change [MHBC] is the belief that simultaneous engagement in multiple health compromising behaviors may fuel worse health consequences than the risk conferred from engaging in each behavior independently. For instance, a higher proportion of dieting female students reported various types of alcohol consequences (i.e., done something they regretted, physically injured themselves, and had forced intercourse) compared to non-dieting female students (Dams-O'Connor et al., 2006). It is important to note that maintaining a healthy diet is important, but dieting behaviors, such as caloric restriction, are associated with negative health outcomes (e.g., depression, body dissatisfaction; Ogden, 1995). Many diseases are impacted by multiple risk behaviors. Moreover, risk behaviors such as excessive eating and alcohol consumption may amplify existing health problems or lead to new ones (Baumeister & Heatherton, 1996). This multiplicative effect is especially illustrated in the interaction of

poor dietary habits and sedentary behavior with an estimated one-third of all cancer deaths considered to be preventable through improving nutrition, decreasing sedentary behavior, and losing excessive weight (American Cancer Society, 2009). Lack of regular physical activity and poor diet are associated with overweight and obesity outcomes, which are profoundly linked to higher risk for depression, Type 2 diabetes, hypertension, coronary heart disease, stroke, and sleep apnea among other serious health outcomes (National Heart Lung and Blood Institute, 1998). Further, alcohol consumption, obesity, and sedentary behavior have been linked to colorectal cancer incidence (for a review, see National Cancer Institute, 2012). Comorbid alcohol and tobacco use results in a greater likelihood of various cancers (e.g., cancers of the mouth, larynx, and esophagus; American Cancer Society, 2009) than either substance use independently. In fact, the American Cancer Society (2009) found that oral cancer rates were 30 times more likely for those engaged in both alcohol and tobacco use than those who only used tobacco. Likewise Manson and colleagues (1990) found that women who were overweight and smokers were five times as likely to be diagnosed with heart disease compared to non-smoking women of normal weight. Consequently, given the comorbidity of risk behaviors and their interactive effects on health, prevention and intervention efforts should focus on targeting change in multiple comorbid behaviors. Although health interventions have primarily and historically focused on a single behavior, in the past decade, a growing movement has developed to address multiple risk behaviors in the same effort.

Simultaneous Intervention on Multiple Risk Behaviors

Theoretical framework. Given the increasing comorbidity rates of preventable health problems and the amount of resources expended for treatment, the benefits of multiple health-related behavior change (MHBC) interventions targeted at co-occurring risk behaviors cannot be overstated. In fact, simultaneously examining multiple health-related behaviors is currently the focus of preventive medicine research (de Vries et al., 2008; Prochaska, 2008). With the movement of health-related behavior interventions from singular to simultaneous multiple behavior change, theoretical frameworks that guide multiple behavior change must be further refined and tested. At present, relatively few models have been put forth that directly integrate the theoretical framework with the application to multiple behavior change (Noar, Chabot, & Zimmerman, 2008) and more concerning, many MHBC interventions may operate with little or no explicit empirical or theoretical support (e.g., Fernald et al., 2012; Rosenberg, Norman, Sallis, Calfas, & Patrick, 2007; Waters, Winkler, Reeves, Fjeldsoe, & Eakin, 2011). Several models have been applied to multiple health-related behavior change efforts, but, to be clear, the interventions targeting multiple health behavior change are based on theoretical models originally aimed at singular behavior change (e.g., Self-Determination Theory, Williams et al., 2006; Transtheoretical Model, di Noia, Contento, & Prochaska, 2007; Nitzke et al., 2007; Prochaska et al., 2008). Other models (e.g., Behavior-Image Model, Werch, Moore, DiClemente, Bledsoe, & Jobli, 2005; Integrated-Change Model, de Vries, Mesters, van de Steeg, & Honing, 2005) have drawn from existing theoretical frameworks (e.g., Health Belief Model, Rosenstock, 1974; Theory of Planned Behavior, Ajzen, 1991; Social Cognitive Theory, Bandura, 1986) in order to meet the demand of

multiple behavior change, but these models are typically saturated with constructs that may prove difficult for application in a multiple health behavior change intervention. Additionally, these models undersell the role of self-regulation in multiple behavior change. Specifically, self-regulatory failure, or the inability to regulate behaviors to a set goal, has been implicated in the under-regulation of multiple health-related behaviors (e.g., relapses in diet, exercise, and binge drinking; see Hagger et al., 2009 for a review). Of the models applied to multiple health behavior change, the model put forth by Annesi (2010) most closely resembles the framework advocated in the present study.

Annesi model of behavior change. Annesi (2011a) argues that MHBC requires a different approach than the standard education components provided by most interventions. In fact, he proposes a rather simple intervention model compared to the other models applied to multiple health behavior change. Annesi's model (2011a) targets self-regulation and self-efficacy to bring about behavior change. Annesi further argues that education components of intervention models are beneficial, but the leap to action from knowledge is not addressed. Thus, the context and method in which components are designed to teach self-regulatory skills are key. That is, once a person is knowledgeable about the health behavior, self-regulatory skills can be used to facilitate behavior change. Further, the development of self-regulation skills may cut across multiple areas of behavior change so that individuals develop a set of general behaviors to engage and maintain health behavior change (e.g., skills for responding to impulsive behaviors across health domains like alcohol or diet choices). Related to the development or initiative of self-regulation is self-efficacy. Self-efficacy should reinforce individuals' ability to regulate their behaviors. In fact, Annesi (2011b) found that higher levels of self-efficacy

were related to better self-regulatory skills. High self-efficacy has been linked with high self-regulation (Rovniak, Anderson, Winett, & Stephens, 2002). In fact, the Annesi model highlights the role of self-regulation and self-efficacy in multiple health behavior change. This model has been successfully applied to eating and physical activity previously (e.g., Annesi & Marti, 2011). However, a limitation of the Annesi model is that it does not address factors, like impulsivity, that may reduce individuals' ability to self-regulate. This oversight is a critical shortcoming of the model. If interventionists only focus on building self-regulatory skills and self-efficacy, but fail to address impulsivity, then individuals may remain susceptible to relapse and ultimately fail to change behavior. The model developed in the current study addresses impulsivity by teaching mindfulness techniques.

The Keystone Model for Multiple Health Behavior Change

The proposed Keystone Model combines several prominent and evidence-based components selected from traditional (e.g., Health Belief Model, Rosenstock, 1974; Strength Model of Self-Regulation, Baumeister et al., 1998) and well-tested (Annesi, 2011a, 2011b, Annesi & Marti, 2011) models shown to be effective in either single behavior change interventions or both singular and multiple behavior change interventions. The Keystone Model, proposed and to be tested in the current study, extends the Annesi model such that self-regulation and self-efficacy remain fundamental elements for behavior change; however, the Keystone Model also addresses the importance of targeting factors, such as impulsivity, that may inhibit self-regulation. Furthermore, in the Keystone Model, self-regulation is highlighted as the critical piece in the behavior change puzzle, with self-efficacy and impulsivity acting as secondary

constructs to reduce self-regulatory failure and barriers to successful behavior change. More importantly, targeting self-efficacy and impulsivity in a behavior change intervention potentially reduces the likelihood of relapse stemming from the amount of control and effort required for multiple health behavior change. Therefore, the aims of the current model are 1) to address the gap in available MHBC models by highlighting the potential and importance of integrating self-regulation, self-efficacy, and impulsivity for multiple health behavior change intervention efficacy, and 2) to provide a model that prioritizes parsimony, practicality, and effectiveness for intervention implementation specific to multiple health behavior change.

Self-regulation

The key to successful multiple health behavior change interventions may be the identification of a shared resource that promotes healthful behaviors across the target behaviors; self-regulation could be this common resource across the health-related behaviors by directing thoughts and behaviors toward being compliant with health goals. Baumeister (2003) summarized three major understandings behind most theories of self-regulation: 1) self-regulation is willpower that must overcome impulses in order to regulate behavior; 2) self-regulation is principally a cognitive procedure in which decisions must be made to pursue the appropriate goal-aligned behaviors; and 3) self-regulation is a developmentally progressive skill. Although there are several theories establishing characteristics of self-regulation (e.g., Self-determination Theory, Deci, 1972; Temporal Self-regulation Theory, Hall & Fong, 2007), the Strength Model of self-regulation (Baumeister et al., 1998) and understanding of self-regulation as a cyclical

process (Zimmerman, 2000) are particularly relevant in terms of creating a process for improving and building stronger self-regulation for multiple behavior change goals.

Self-regulation has been theorized (Zimmerman, 2000) and applied (Perels, Otto, Landmann, Hertel, & Schmitz, 2007) as a cyclical process to regulate thoughts, behaviors, and beliefs based on previous self-regulatory behavior. The cyclical theory of self-regulation is captured by the following phases: forethought or planning phase, volitional performance or action phase, and self-reflection phase (Zimmerman, 2000). In this framework, self-regulation is viewed as a proactive trait in which a person's actions determine the strength of their self-regulatory ability (Zimmerman, 2008). This cyclical model engages the individual 1) to develop a personalized plan of strategies for reaching their goals, 2) to implement strategies and monitor behaviors, and 3) to assess and to modify strategies based on effectiveness. Successful self-regulation of behaviors for goal achievement can be reached through proceeding through these phases in a cyclical manner in which plans and consequent actions are judged for effectiveness leading to further refined planning and action (Zimmerman, 2000). According to the Strength Model of self-regulation, intervention on at least one health behavior, to improve self-regulation in one domain, is theorized to have a secondary effect on other target health behaviors (Baumeister et al., 1998). Self-regulation has been targeted for health behavior interventions targeting diet (e.g., Chapman, Armitage, & Norman, 2009; de Nooijer et al., 2006; Johnson, Pratt, & Wardle, 2012), physical activity (e.g., Pomp, Fleig, Schwarzer, & Lippke, 2013), and alcohol use (e.g., Oaten & Cheng, 2006), and combinations of health-related behaviors (e.g., Annesi, 2011a); however, researchers have called for further testing of self-regulation for behavior changes (Stadler, Oettingen, & Gollwitzer, 2009).

Specific to a multiple health behavior intervention, at least two concerns related to self-regulation must be addressed: 1) the threat of ego depletion given the amount of self-regulation that must be exerted for multiple behaviors; and 2) the efficacy of global self-regulation compared to behavior-specific self-regulation.

Self-regulation and ego depletion. Energy depletion is a serious aspect to consider in self-regulation based MHBC interventions (Annesi, 2011a, Cooper et al., 2003). Self-regulatory failure, or poor regulatory behavior, has been implicated in the under-regulation of multiple health-related behaviors (e.g., relapses in diet choices, exercise engagement, and alcohol misuse; see Hagger et al., 2009 for a review). Specifically, ego depletion has been posited as the primary reason for self-regulation failure (Baumeister, Gailliot, DeWall, & Oaten, 2006). Efforts to modify two behaviors simultaneously might decrease self-regulatory capabilities for one or both behaviors (Cooper et al., 2003). Interestingly, recent research has demonstrated that the degree a person is experiencing ego depletion may be subjective, and in fact, a person's perception of their willpower is predictive of performance on self-regulation tasks and eating behaviors (Job, Dweck, & Walton, 2010). Similarly, Baumeister and Vohs (2007) argued that strong reserves of motivation could stave off ego depletion for a temporary period; however, it is important to note the authors do not characterize ego depletion as a lack of motivation. In fact, Gailliot and colleagues (2007a; 2007b) found that physical characteristics, like low glucose levels, could negatively influence self-control performance (Gailliot, Plant, Butz, & Baumeister, 2007c). Regular training in engaging self-regulation skills can weaken the ego-depletion effect by strengthening self-regulation (Gailliot et al., 2007c; Hui et al., 2009; Oaten & Cheng, 2006).

Global versus domain-specific self-regulation. Although self-regulation has been implemented in all domains of behavior change targeted here (i.e., poor diet, physical inactivity, alcohol misuse), a question that remains unanswered is whether domain-specific self-regulation (e.g., exercise self-regulation) or global self-regulation is more effective in producing change in the specific domain behavior (e.g., exercise). Furthermore, can domain-specific self-regulation (exercise self-regulation) affect change in a different domain (alcohol use)? Self-regulation can be said to underlie all behaviors targeted for change. Stronger global self-regulation is associated with better fruit/vegetable consumption and less sedentary behavior (Wills et al., 2007). On the other hand, exercise self-regulation has been demonstrated to be highly correlated with eating self-regulation (Annesi & Marti, 2011). Self-regulation, in an exercise context, has been shown to transfer across a variety of behavior domains (e.g., significant reduction in alcohol, cigarette, and caffeine use; significant increase in healthy eating, emotion control, and financial monitoring; Oaten & Cheng, 2006). For this reason, an intervention that strengthens self-regulation, globally or specifically for one behavior, may be ideal for the amount of time and resources invested given that it could produce positive change in other behaviors without additional resources or required interactions. Prochaska et al. (2008c) agrees that, ideally, interventions will simultaneously improve multiple risk behaviors according to an individual's particular risks; an intervention strongly based in self-regulation augmentation could meet this goal.

On the other hand, targeting self-regulation specific to the behavior may offer a uniquely stronger power to change behaviors beyond the effect of global self-regulation. Annesi (2011a) found that initial self-regulation did not significantly predict behavior

change in eating, but training in self-regulated skills specific to eating did significantly predict change. Moreover, Annesi (2011b) found that a component focused on nutrition self-regulation can provide an additive effect on diet choice beyond increases in exercise self-regulation. Self-regulation of eating behaviors have been found to contribute to higher fruit/vegetable intake two years following an intervention compared to an education-only condition (Stadler et al., 2010). In fact, exercise-specific self-regulation increased physical activity twice that of an information-only condition (Stadler et al., 2009). Specifically with respect to alcohol use, an entire line of research has developed around teaching self-regulation specific to alcohol use such as protective behavioral strategies (i.e., PBS; Pearson, 2013). In a recent article, D'Lima and colleagues (2012) found domain-specific self-regulation (i.e., self-regulation specific to alcohol use), in comparison to global self-regulation, was more strongly associated with experiencing less alcohol-related consequences. However, the protective effect of alcohol-specific self-regulation was moderated by individuals' global self-regulation such that those with poor general self-regulation particularly benefited more from behavior-specific skills than those with good self-regulation in general.

Recently, the importance of self-regulation in health behavior change has been highlighted in which strategies to promote self-regulation have been identified, such as, prospection and planning through mental rehearsal, and automatic behavior plans through implementation intentions (Mann, de Ridder, & Fujita, 2013). Collectively, these findings indicate the need for investigators to examine the effectiveness of each approach, in consideration of general or domain-specific self-regulation, in longitudinal experimental

research in which causal claims can be made in regards to which approach is more effective for multiple health behavior change.

Impulsivity

Impulsivity is argued to be a distinct construct from self-control or behavior regulation (King, Lengua, & Monahan, 2013), although some opposing research may suggest that impulsivity and self-regulation are antipodes (Bickel, Jarmolowicz, Mueller, Gatchalian, & McClure, 2012). DeYoung (2010) voiced the concern identified by other researchers that there is difficulty in establishing a universal definition for impulsivity. As such, DeYoung (2010) proposed a working definition of impulsivity as a personality trait characterized by the "tendency to act on immediate urges, either before consideration of possible negative consequences or despite consideration of likely negative consequences" (pp. 487-488). The varied definitions of impulsivity as a personality trait create difficulty, but impulsive actions have been more clearly identified as including two components: 1) "an impulse or urge" and 2) "a lack of restraint or control" (DeYoung, 2010, p. 486 as cited in Carver, Johnson, & Joormann, 2009; Hofmann, Friese, & Strack, 2009). Impulsivity is a multidimensional construct and possibly more complex when examining different subgroups (e.g., age groups; Lesham & Glicksohn, 2007). Researchers Wu and Clark (2003) identified two underlying components of impulsivity as spontaneity or carefree behaviors and non-planning factors; however, an extensive hierarchical factor analysis found more than eight dimensions across 11 descriptive measures of impulsivity (e.g., impetuous, divertible, thrill and risk-seeking, happy-go-lucky, impatiently pleasure seeking; Kirby & Finch, 2009). These dimensions shed light on the reason why impulsivity has an overwhelmingly negative

effect on proponents of successful behavior change. The UPPS-P model of impulsivity (Negative Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency; Whiteside & Lynam, 2001) indicates that five major factors subsume impulsivity (Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007): 1) unfinished or incomplete tasks; 2) engaging in behaviors without planning or thinking; 3) sensation or pleasure seeking; 4) tendency to act without thought in response to negative events/emotions; and 5) tendency to act without thought in response to positive events/emotions. As the discussion on ego depletion indirectly alluded, impulsivity is a major obstruction to self-regulation processes and behavior change. Impulsivity is strongly believed to inhibit intentional behavior change as evidenced in previous research targeting alcohol consumption (e.g., Kazemi, Wagenfeld, Van Horn, Levine, & Dmochowski, 2011). Further, impulsivity is a moderator of the relationship between self-regulation and improving diet (Churchill & Jessop, 2011).

Impulsivity may be triggered by factors related to emotions, visceral states, and environmental cues. Targeting impulsivity as part of the Keystone Model is supported by previous research. For example, engaging in self-compassion (Terry & Leary, 2011) and self-affirmation (Harris, 2011) have been found to relate a lower likelihood of self-regulation failure. Further, mood may affect self-regulation (Hagger et al., 2010) and higher levels of neuroticism may make one more susceptible to impulsive actions (Fetterman et al., 2010) and also lower self-control (Tangney et al., 2004). Similarly, higher levels of impulsivity were linked to eating greater amounts of food and reporting the experience of "eating disordered" thoughts (Guerrieri, Nederkoorn, & Jansen, 2007). Visceral states like hunger or drug craving can increase likelihood of engaging in a

behavior (Nordgren & Chou, 2011). For instance, individuals with substance dependence showed impaired self-regulation and higher impulsivity compared to healthy adults (Verdejo-Garcia, Rivas-Perez, Vilar-Lopez, & Perez-Garcia, 2007); similarly, substance use (Henges & Marczinski, 2012) and related-problems (Stoltenberg, Lehmann, Christ, Hersrud, & Davies, 2011) were related to impulsivity. In correlational studies, ego strength, composed of traits like dependability, trust, and lack of impulsivity, has been linked to reduced likelihood to engage in drug use (i.e., excessive alcohol use or smoking; Temcheff et al., 2010) and to longer life expectancy (Deary, Batty, Pattie, & Gale, 2008). Physiologically, low glucose is believed to influence self-regulation efficacy (for a review, see Gailliot & Baumeister, 2007). In addition, environmental factors like food cues can promote impulsive actions (e.g., impulsive eating; Fedoroff, Polivy & Herman, 1997). Due to these factors, mood, emotions, and environmental cues, affecting a person's tendency toward impulsive behaviors, it appears necessary to address these triggers.

Self-efficacy

The belief that individuals can be successful in changing individual health-related behaviors is even more essential for multiple health behavior change than with traditional single behavior change efforts. Specific self-efficacy skills have been developed within health domains (e.g., ability to avoid overeating or to exercise when faced with barriers; Byrne, Barry, & Petry, 2012; ability to refuse heavy drinking, Cicognani & Zani, 2011). Beliefs of global self-efficacy were negatively related to measures of impulsivity (Carver, Sinclair, & Johnson, 2010), and while impulsivity inhibits self-regulation, self-efficacy bolsters self-regulatory ability (e.g., Koestner et al., 2006; Wieber, Odenthal, &

Gollwitzer, 2010). For instance, self-efficacy has been shown to moderate the change from baseline levels of self-regulation to post-intervention self-regulation (Annesi, 2011b; Kololo, Guszkowska, Mazur, & Dzielska, 2012). Additionally, self-efficacy may be the driving force behind the positive mood experienced after exercise opposed to the neurochemical and biological explanations (e.g., endorphins, serotonin; Annesi, 2012). Individuals with strong self-efficacy adhere more closely to health behaviors than those with poor self-efficacy. For example, planning self-efficacy partially mediated an intervention effect on exercise (Murru & Ginis, 2010). Further, self-efficacy has been identified as a critical moderator in the translation of intentions into action through planning (Schwarzer, Richert, Kreausukon, Remme, Wiedemann, & Reuter, 2010).

The effectiveness of self-efficacy for individual behavior change has been well-evidenced, and documented, in relatively fewer studies, to be a key factor for multiple health behavior change. If individuals believe they have no ability to change their behaviors, the lack of self-efficacy may have a strong negative effect on the other components of the model. That is, self-regulation skills may be difficult to build, and participants may feel more susceptible to relapse and impulsive behaviors. Due to contradicting results, additional research is warranted to test the utility of self-efficacy in the MHBC context. For instance, Guillaumie et al. (2012) did not find significant differences in fruit and vegetable consumption between an implementation intention condition and a combined implementation intentions and self-efficacy condition. Given that Guillaumie et al. did not demonstrate improvement in self-efficacy from baseline to follow-up in the combined condition, it may be that the self-efficacy manipulation was not effective. On the contrary, Hatzigeorgiadis, Zourbanos, Goltsios, and Theodorakis

(2008) demonstrated that increases in self-efficacy are related to performance improvement.

Approach to Multiple Behavior Change Process

In consideration of multiple behavior change, interventionists must additionally consider the approach of behavior change; should multiple behavior change occur simultaneously or in sequence? A simultaneous approach targets multiple health behaviors concurrently; a sequential approach targets one health behavior at a time (Schulz, Schneider, de Vries, van Osch, van Nierop, & Kremers, 2012). Few studies have examined the difference in effectiveness for multiple health-related behavior change intervention comparing these two approaches (Simultaneous vs. Sequential). The impetus for the application of the spillover effect in a multiple behavior change framework is threefold: 1) self-regulation of thoughts and behaviors are focused on one primary intervention goal to limit the effect of ego depletion; 2) the intervention is relatively more practical with a single behavior requiring less energy exerted initially compared to simultaneous behavior change; and 3) cost of intervention resources may be minimized if intervention-learned skills are transferrable without additional resources as evidenced in previous research (e.g., Oaten & Cheng, 2006). As shown in Figure 1, the focused components approach implies individually targeting multiple behaviors for change in which each behavior is targeted with parallel components to address self-regulation, impulsivity, and self-efficacy. In comparison to a traditional focused components intervention targeting each behavior with independent resources dedicated to each behavior, the spillover effect design simply targets one behavior with the strong intention of indirectly affecting change in additional behaviors. As seen in Figure 2, the Keystone

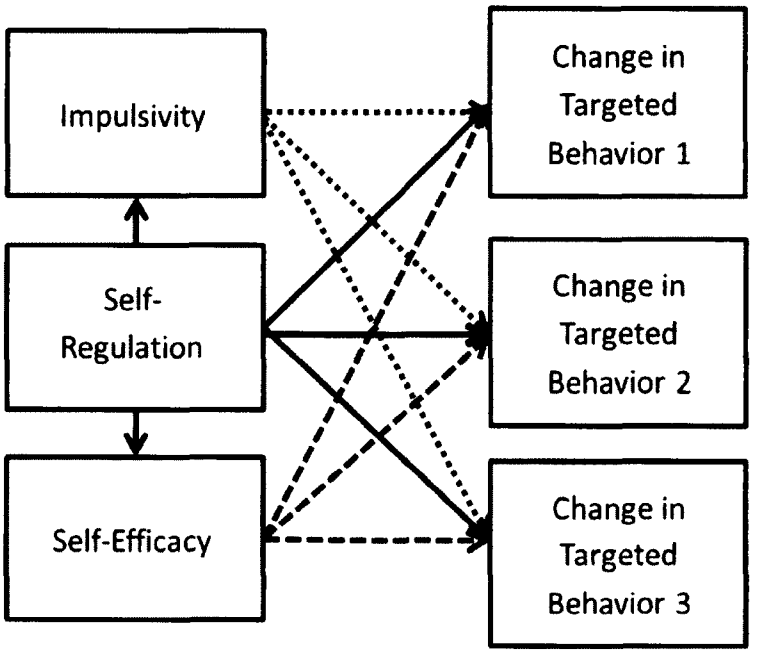

Figure 1. Keystone model: Focused Components (Direct effects)

Model is modified to incorporate the potential "spillover effect" in which the theorized transference of the intervention effect from one to another target health behavior is supported by the strength model of self-regulation (Baumeister et al., 1998).

Focused components approach. A multifaceted focused components intervention is a direct approach of MHBC. In fact, in 2002, the Society of Behavioral Medicine formed a special coalition to promote and develop a science of MHBC (Prochaska, Spring, & Nigg, 2008c); simultaneously examining multiple health behaviors is currently the focus of preventive medicine research (de Vries et al., 2008; Prochaska, 2008a). Rosenberg and colleagues (2007) argue that specific program components are needed for multiple behavior programs to be successful. In fact, in older adult populations, interventions that targeted multiple health behaviors were determined to be more effective than those focusing on only one behavioral component (Aalbers et al., 2011). The focused components approach has been promoted by several lines of research

(e.g., Stubbs et al., 2012; Werch et al., 2008). For instance, Werch et al. (2008) successfully promoted alcohol reduction and physical activity with focused subcomponents. Later, Werch and colleagues (2011) targeted a number of health behaviors and found improvement in several of the behaviors such as alcohol use, consumption of fruits and vegetables, and use of relaxation techniques. Similarly, Hyman, Pavlik, Taylor, Goodrick, and Moye (2007) concluded that simultaneous multiple behavior change was more effective in changing at least one behavior than addressing the behaviors individually. Although interventions focused on too many behaviors may suffer from conflicting directional behavior goals (e.g., goal conflict, Dahr & Fort, 2008; Presseau, Tait, Johnston, Francis & Sniehotta, 2013), or create a sense of being overwhelmed, presenting MHBC as moving towards the goal of a rebalanced healthy lifestyle may be an appealing way to frame the intervention.

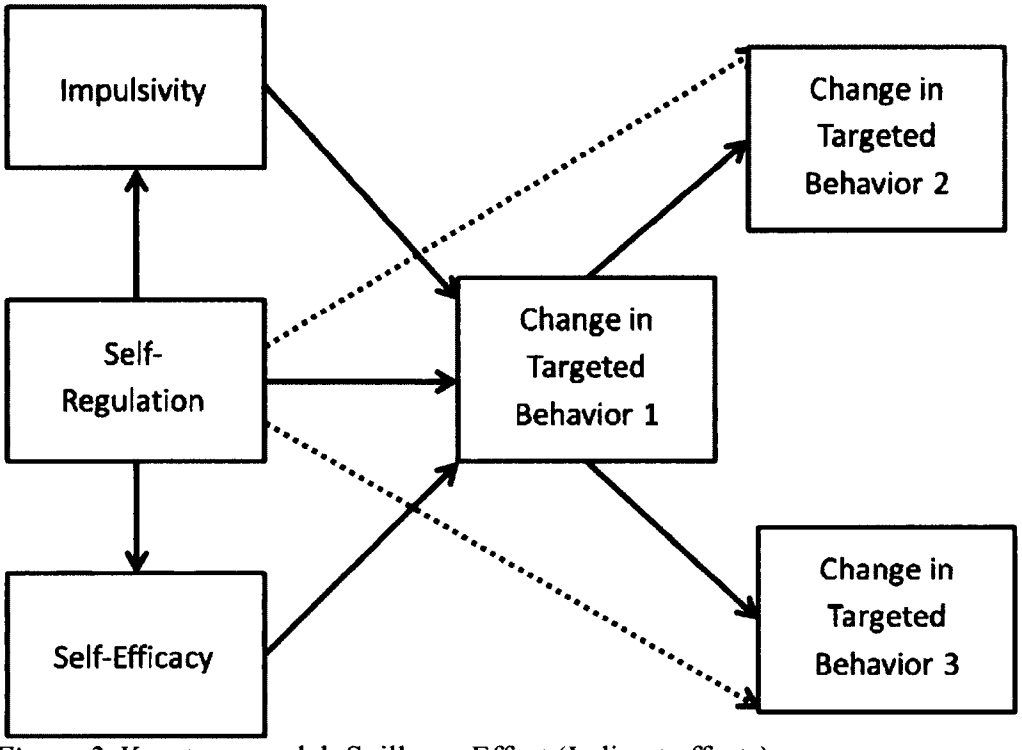

Figure 2. Keystone model: Spillover Effect (Indirect effects)

Spillover effect approach. Whereas the majority of MHBC interventions implement a focused component for each targeted health behavior, Nigg and colleagues (2002) raised an alternative method that intervening on one behavior may provide a protective "spillover effect" that relates to engaging in one or more alternate health behaviors (e.g., engaging in exercise may prompt choosing to eat more vegetables). The spillover effect, or coaction, suggests changes in one behavior are related to being proactive to change another behavior (Paiva et al., 2012). Relying on the spillover effect or targeting a specific gateway behavior (Nigg et al., 2002) and simply assessing other health-related behaviors has been empirically supported as beneficial for multiple health behavior change. For instance, a dieting intervention via mental contrasting evidenced improvement in diet and also an increase in physical activity (Johannessen, Oettingen, & Mayer, 2012). Similarly, Fleig et al. (2011) improved exercise self-regulation, which was accompanied with increased consumption of fruits and vegetables.

Exercise has far reaching benefits (e.g., control weight, reduce risk of various illnesses, improve mental health, and improve mood; CDC, 2011b) and its unique spillover effect may better extend to other health behaviors making it an ideal gateway behavior for change. Supporting this notion, Mata and colleagues (2009) targeted exercise motivation and found significant increases in eating regulation as well. Engagement in exercise is linked with improved eating behaviors (Annesi & Marti, 2011); however, Annesi (2011b) suggested that although exercise is often recommended as part of weight loss programs, the majority of programs do not systematically reinforce exercise. Particularly, a spillover effect, in which exercise self-regulation is transferred across other behaviors as evidenced in previous research, may be more efficient than

targeting each behavior and perhaps be perceived as less overwhelming. Overall, if a less resource-dense single behavior intervention can affect change in other health compromising behaviors without additional intervention resources, materials, and manpower, it may be an inexpensive alternative to the multiple components intervention. Although mixed support exists for either approach (direct or indirect method), intervening on multiple health behaviors is essential and appears to be an important direction for preventive medicine. For this reason, the proposed model takes into account the MHBC goal via the spillover effect as an additional exploratory mechanism for change.

For example, Schulz and colleagues (2012) argue that in comparison to the sequential health behavior intervention, the simultaneous health behavior intervention approach is more demanding and evidenced a higher rate of non-completion. Schulz et al. also suggested the difference in completion rate may be due to information overload (Prochaska, 2008a) and that the length of time was twice that of the sequential intervention. If the Keystone Model adopts a traditional, focused component design, it would conceptually appear as in Figure 1, in which the intervention would specifically and simultaneously target each behavior. Marlatt and George (1988) discuss the technique of lifestyle rebalancing in which health behavior change is not restricted to one behavior, but rather part of a global change in behaviors toward a healthier lifestyle such that behaviors that do not align with healthy behaviors will become extinct over time. The spillover effect in the current study would focus on one behavior as in the sequence approach, but would be used to potentially prime change in other behaviors, which has been demonstrated in previous research showing that people who progress to the action

stage for one behavior are more likely to make changes in other behaviors (Alahuta et al., 2011). Further, this spillover effect is supported by research in which those who progressed to action or maintenance stages for one behavior, were more likely to successfully engage in a second behavior (e.g., Paiva et al., 2012; Prochaska et al., 2012). In one study, a higher percentage of participants receiving either a telephone or internet-based intervention targeting exercise and stress management progressed to the action stage for these health behaviors, but were also more likely to improve their diet (Prochaska et al., 2012). Given that engagement in one risk reduction behavior may stimulate the reduction of other risk behaviors not specifically targeted, this is a viable intervention approach requiring less resources, and improved return on investment.

Intervention Development

The intervention techniques selected are identified in several comprehensive behavior change taxonomies and empirical research studies (Michie et al., 2013). Specifically, the current study utilizes goal identification (Component 1.3), mental contrasting (Component 9.2), implementation intention formation (Component 1.4), mental rehearsal and visualization (Component 15.2), mindfulness, self-talk (Component 15.4), and self-monitoring (Component 2.3) techniques (Michie et al., 2013). Self-regulation is addressed by mental contrasting, implementation intention formation, and mental rehearsal/visualization techniques. Impulsivity is addressed through a mindfulness technique. Self-efficacy is addressed through teaching effective self-talk. Operationalization of mental contrasting and implementation intention strategies of the current intervention are modeled after Stadler, Oettingen and Gollwitzer's intervention (2009) for women's physical activity. The implementation intentions have been adapted

based on research supporting the inclusion of additional situational information such as motivational cues (i.e., "why"; Adriaanse, de Ridder, & de Wit, 2009). The control group only participated in the self-monitoring aspect of the intervention that naturally occurs when reporting on behaviors. In the identification of effective techniques for healthy eating and promotion of physical activity across 122 evaluations in a meta-analysis, prompt self-monitoring of behavior was demonstrated to have the strongest explanation of variance in intervention effectiveness (Michie et al., 2009; reducing excessive alcohol consumption, Michie et al., 2012). Furthermore, Michie et al. (2009) found that the combination of self-monitoring with any one of four other self-regulation techniques, such as goal setting and intention formation, demonstrated even larger effects on intervention effectiveness. The current intervention did not include an educational component (e.g., information on health behaviors), because healthy eating is relatively common knowledge among adolescents (Croll et al., 2001). Furthermore, college students have typically received several years of health education prior to college (National Association of State Boards of Education [NASEBE], 2008); however, it is the development of self-regulation abilities, in particular, that are needed to meet goals (Annesi 2011a; Craciun, Taut, & Baban, 2012).

Self-regulation. The intervention tested in the present study began with the goal setting process developed by Cullen, Baranowski, and Smith (2001) for dietary behavior change. Specifically, Cullen et al. (2001) outlined four steps in the goal setting process: 1) be aware of the need for change; 2) identify a goal; 3) engage in a goal-directed behavior; and 4) self-reward goal attainment. In the current study, participants engaged in each of the three phases of the self-regulation process (Perels et al., 2007), starting with

the planning phase of the self-regulation process. The planning phase involved anticipating when barriers would arise that would threaten participants' ability to engage in behavior aligned with their health goals by forming implementation intentions and rehearsing their planned implementation intentions through mental rehearsal and visualization. The action phase, the second phase, would be evident by participants' engagement either in the goal-aligned implementation intentions formed or in goal-unaligned alternate behaviors. Next, participants engaged in the reflection phase by expressing an evaluation of their ability to engage in implementation intentions, and self-monitoring their health-related behaviors through daily reporting. Self-regulation improves from regular use (Muraven, Baumeister, & Tice, 1999), and, with a daily dairy intervention, participants would be constantly reminded of their goals and self-regulation strategies.

Mental contrasting. Mental contrasting is the process of initially naming a feasible behavior change goal, and identifying, and then imagining, the most positive outcome followed by the most critical obstacle that may stand in the way of the goal (Stadler et al., 2009). According to researchers, goals should be challenging but reasonable, specific rather than broad, and accomplishable in the short-term instead of long-term (de Vet, Oenema, & Brug, 2011; Locke & Latham, 1985; Mann, de Ridder, & Fujita, 2013). Mental contrasting has been demonstrated as effective in dieting and physical activity (e.g., Johannessen et al., 2012). For example, Stadler et al. (2009) found that the combination of implementation intentions with mental contrasting in a brief one-time intervention achieved an immediate two-fold increase in weekly exercise time for a self-regulation intervention group and was maintained through 16 weeks after the

intervention was delivered. Mental contrasting has been commended for its feasibility and low-cost approach (diabetes self-management, Adriaanse, De Ridder, & Voorneman, 2013).

Implementation intentions. As described earlier, the intention to change behavior often falls short of actual engagement in behavior change (Fortier, Kowal, Lemyre, & Orpana, 2009). One way to target the gap between intention and behavior change is by targeting preparatory behaviors or strategies that lead to the achievement of goal behavior. For example, Bryan, Fisher, and Fisher (2002) investigated safer sexual practices and found that the preparatory actions of buying, carrying, and talking about condoms mediated the relationship between intention to use condoms and actual condom use. These preparatory behaviors that lead to the goal behavior may be facilitated by implementation intentions. Gollwitzer (1999) defined implementation intentions as predetermined plans for goal-aligned behaviors to occur when situational cues (e.g., when, where, and how; Webb & Sheeran, 2007) are present. For example, a person might form an "if-then" implementation intention of, "If it is Thursday and after class, then I will go to the gym and run for thirty minutes." When this person is faced with these situational cues (i.e., Thursday, after class), then they should plan on engaging in the associated automatic behavior (i.e., go to the gym and run for thirty minutes). A meta-analysis of over 90 studies demonstrated implementation intentions revealed medium to large effects on goal attainment on a large range of behaviors and self-regulatory problems (Gollwitzer & Sheeran, 2006). Furthermore, Gollwitzer and Sheeran (2006) found this effect across student and non-student populations, suggesting implementation intentions benefit non-student populations. Similarly, Webb and Sheeran's review (2006)

found small to medium effects of implementation intentions on changes in behavior. In a meta-analysis of more than 20 studies, Belanger-Gravel, Godin, and Amireault (2011) found specific support of the utility of implementation intentions for adherence to physical activity.

A number of studies have focused on how implementation intentions work and how to make these intentions more effective. In addition, Webb and Sheeran (2007) demonstrated implementation intentions are effective for goal behavior when there is strong cue accessibility (i.e., awareness of the "if" cues) and link between the cue-response (i.e., the association between "if" cues and "then" behavior). Papies, Aarts, and de Vries (2009) compared learning cue-behavior associations (if-then statements) to actually forming implementation intentions (if-then plans). Initially, each condition yielded similar rates of goal completion, but after one week only the implementation intention condition continued to meet successful goal completion. The findings by Papies et al. suggest that, in addition to the cue-behavior association, planning may be uniquely critical. Similarly, Rhodes, Blanchard, Matheson, and Coble (2006) established discriminant validity for motivation and implementation intentions (i.e., specific planning), but more general intentions did not evidence discriminant validity from the other two constructs. Implementation intentions should be more specific in when, where, and how a behavior should occur in order to provide higher quality intentions (de Vet, Oenema, & Brug, 2011). Gollwitzer (1999) theorized that greater specificity in implementation intentions will lead to quicker cue recognition for action compared to vague parameters for behavioral intentions. Previous research has found that a critical piece of the implementation intention's effect is supplying a more detailed identification

of "when to act" (de Vet et al., 2011). Automatic behavior is less likely to occur if the "when to act" cue of the implementation intention is too broad or missing (de Vet et al., 2011). De Vet et al. (2011) found that both the quality and quantity of implementation intentions were important predictors of physical activity. Further, in as little as two weeks, those who formed three specified implementation intentions experienced the greatest gains in physical activity compared to other conditions. Additionally, implementation intentions have been found to be more effective when their formation is guided by the researcher in comparison to when intentions are purely self-generated by participants (Armitage, 2009; Ziegelmann, Lippke, & Schwarzer, 2006). Chapman et al. (2009) found instructions to form implementation intentions in the "if-then" format produced stronger increases in fruit/vegetables intake than an open-ended, free-response format. Therefore, guided instruction can promote formation of more specific and higher quality implementation intentions. In the promotion of fruit and vegetable consumption, Kellar and Abraham (2005) found that implementation intentions focused on preparatory actions were especially beneficial for increasing vegetable consumption. With this in mind, Chapman and Armitage (2012) further demonstrated each behavior should be targeted independently with implementation intentions. Moreover, Chapman and Armitage (2012) found that fruit consumption benefited more from target-directed implementation intentions (e.g., number of servings being eaten) whereas preparatory strategies (e.g., when and how vegetables will be prepared) greatly improved vegetable consumption. Although research does not exist that examines the role of target-directed (e.g., weekly exercise duration) versus preparatory strategies (e.g., when/ where to exercise, buying supplies like workout clothes/shoes) for physical activity

implementation intentions, complex behaviors such as physical activity initiation and adherence may require more preparatory intentions to bridge the gap between intention and actual goal behavior. The same could be said in regard to alcohol reduction efforts; however, many self-control strategies are preparatory actions to reduce unsafe alcohol consumption such as leaving a party at a predetermined time or assigning a designated driver before others consume alcohol.

Adriaanse, Vinkers, de Ridder, Hox, and de Wit's meta-analysis (2011) concluded that implementation intentions are indeed promising with demonstrated medium effect sizes for interventions promoting healthy behaviors; however, fewer interventions have attempted the reduction of unhealthy behaviors and those that have, have reported smaller effect sizes. Although the majority of interventions target the increase of healthy behaviors, implementation intentions have successfully been used to reduce unhealthy behaviors (e.g., saturated fat intake; Prestwich, Ayres, & Lawton, 2008; binge drinking, Murgraff, White, & Phillips, 1996). In as little as two weeks, undergraduate students in an implementation intention condition reported lower drinking frequency than an education-only control condition (Murgraff et al., 1996). Similarly, in a multinational European sample of undergraduate students, implementation intentions were successful in reducing alcohol consumption (Hagger et al., 2012).

Adriaanse et al. (2009) argue that because unhealthy behaviors may not be primarily linked to situational cues (i.e., times or places), inclusion of motivational reasons behind targeted actions for change (e.g., unsafe alcohol consumption) may be critical to improve effectiveness of implementation intentions for the reduction of unhealthy behaviors. For example, alcohol consumption provides the motivational effect

of feeling intoxicated and is typically associated with having a good time and other positive social perceptions (e.g., more outgoing and courageous, positive sexual expectancies; LaBrie, Grant, & Hummer, 2011). Excessive consumption of sugar, fat, or calories may be rewarded with elevated energy, the pleasant sensory taste of food, and stimulation of hedonic regions in the brain similar to those activated in substance abuse (Fortuna, 2010). Engagement in sedentary behavior, or conversely the avoidance of physical activity, may be hedonically related to the satisfaction of relaxing one's body or engaging in desired sedentary activities. More generally, motivational cues for alcohol use have been characterized by two overarching dimensions, valence (positive/negative) and source (internal/external), which cross to form four categories of motivational cues (positive-internal, positive-external, negative-internal, and negative-external); however, limited research has incorporated motivational cues in implementation intentions for reducing alcohol use. Motivational cues for unhealthy eating were modeled from Cooper's categories for alcohol use and included coping with negative emotions, being social, compliance with others' expectations, and for pleasure (Jackson, Cooper, Mintz, & Albino, 2003). In fact, Adriaanse et al. (2009) found that implementation intentions including motivational cues (i.e., why someone performs a behavior) significantly decreased unhealthy snack consumption compared to the basic implementation intentions that focused only on "where" and "when" the behavior is performed. Guided suggestions for motivational cues provided to participants for behaviors in the current study will be extended from those identified previously for alcohol consumption (Cooper, 1994) and unhealthy eating (Adriaanse et al., 2009; Jackson et al., 2003) to sedentary behavior.

Mental rehearsal and visualization. Mental rehearsal is a practice that uses mental imagery to visualize situations, emotions, and actions (Knauper, Roseman, Johnson, & Krantz, 2009; Lang, 1979). Similar to the interactive effect of combining mental contrasting with implementation intentions, adding mental rehearsal and visualization could further boost the strength of implementation intentions (Knauper et al., 2009). In fact, Cumming and Williams (2013) introduced an applied model for imagery use that closely mirrors the factors (e.g., who, what, when, where) of implementation intentions. In addition to the previously mentioned self-regulation strategies, mental rehearsal and visualization are techniques that have demonstrated benefits for improved retention and transfer of a new skill (Spittle & Kremer, 2010; VaezMousavi & Rostami, 2009), confidence (Callow, Hardy, & Hall, 2001), pre-performance anxiety (Mellalieu, Hanton, & Thomas, 2009). Mental simulation did not demonstrate a significant effect in reducing alcohol consumption (Hagger et al., 2012). In a study of the promotion of physical activity, Anderson and Moss (2011) compared a guided imagery condition to an implementation intentions condition. Although participants did not significantly differ in exercise self-efficacy or exercise frequency, each condition resulted in better outcomes compared to a control condition. This research finding supports visualization as a strategy potentially as effective as implementation intentions.

Impulsivity.

Mindfulness techniques. One intervention method to inhibit impulsive behavior is through mindfulness training. In previous applications of mindfulness training, participants are taught a quick strategy that should be encouraged for daily use (Kabat-

Zinn & Santroelli, 2010). The exercise included in the current study is based on the "Take STOCK" strategy in which a person will "Stop, Take a slow deep breath, Observe thoughts and behaviors, Consider intention, and Keep going" (Take STOCK; Larkin-Wong, 2012). Take STOCK was developed by Leonard Riskin and has been taught to college students in the same vein as contemplative pedagogy (Vanderbilt University Center for Teaching, n.d.). Although the Take STOCK strategy lacks empirical studies to validate its effectiveness, it is almost identical to the strategy of "Stop, Take a deep breath, Observe and then Proceed" (STOP; Stahl, Goldstein, Kabat-Zinn, & Santorelli, 2010) which was adapted for the general public as a brief daily mindfulness exercise. Further, the general philosophy behind these two specific strategies has been incorporated into Mindfulness Based Stress Reduction programs. In the current intervention, participants were taught a slightly modified "Take STOCK" mindfulness strategy: Stop, Take a slow deep breath, Observe thoughts, emotions, and bodily sensations, Consider intention, and Keep going" (Take STOCK; Larkin-Wong, 2012).

Self-efficacy.

Cognitive Restructuring and Self-Talk. One method of increasing self-efficacy is through cognitive restructuring and self-talk. Experts Grave, Calugi, Centis, Ghoch, and Marchesini (2011) have recommended cognitive restructuring to correct cognitive biases (all-or-nothing thinking about behavior change) or unrealistic expectations, and the use of cognitive credits (i.e., positive self-talk phrases). Self-talk is one of the most prevalent strategies used to enhance performance (Hatzigeorgiadis, Zourbanos, Goltsios, & Theodorakis, 2008; Weinberg, Grove, & Jackson, 1992). Self-talk relates to externalized private speech in early childhood that is used to guide behavior to meet goals (Diaz, Neal,

& Amaya-Williams, 1990). Similarly, self-talk can be externalized or internalized and can promote goal-directed behavior through providing instructions or motivation throughout a behavior or action (Hardy, 2006; Zervas, Stavrou, & Psychountaki, 2007). Additionally, self-talk can be expressed in either positive or negative valence (Hardy, 2006). Negative thoughts and self-talk have been linked to poor performance (Hardy, Roberts, & Hardy, 2009). Self-talk has been shown to be positively correlated to self-efficacy (Hardy, Hall, Gibbs, & Greenslade, 2005). Moreover, preliminary results from a meta-analysis indicated that as compared to negative self-talk, 60% of the research studies available found positive self-talk led to more beneficial effects on performance (Tod et al., 2011). Furthermore, self-talk was shown to improve self-efficacy and performance (Hatzigeorgiadis et al., 2008). Theodorakis, Weinberg, Natsis, Douma, and Kazakasz (2006) suggested that instructional and motivational self-talk may be more beneficial for fine motor and gross motor skills, respectively. Awareness of the use and content of negative self-talk is the essential first step in controlling self-talk (Hardy, Roberts, & Hardy, 2001; Zinsser, Bunker, & Williams, 2010). Particularly, Zinnser, Bunker, and Williams (2010) recommend thought stoppage in which individuals should say "Stop" and imagine a stop sign or red light meaning to stop that train of thinking. Similarly, Zinnser et al. (2010) recommend self-affirmations.

Research Aims

The purpose of the current study was to expand the intervention research conducted on multiple health behavior change primarily through self-regulation augmentation, but with a supplemental focus on impulsivity control and self-efficacy enhancement. To test the value of an intervention with this focus, a new model (i.e., the

Keystone Model) was developed and served as the guiding theoretical framework. The Keystone Model is based on Annesi's (2011a) model. The primary aim of the study was to examine whether a Spillover Effect could increase self-regulatory ability for multiple health behavior change as compared to the traditional intervention methodology (i.e., Focused Components) approach. In addition, the Spillover Effect model was compared to a control condition. That is, a condition in which subjects only completed the survey instruments but did not receive any intervention. Also known as the Hawthorne effect (Roethlisberger & Dickson, 1939), self-monitoring effects often occur when individuals are asked to report on their health behaviors. Including a control condition would allow for a test of an intervention based on Spillover Effect as compared to the completing questionnaires that assessed health behaviors. An advantage of the Keystone Model is that it addressed the gap in other models applied to multiple health behavior change by highlighting the importance of the integration of self-regulation, impulsivity, and self-efficacy. The Keystone Model prioritizes parsimony, practicality, and optimization specific to MHBC.

Pre-Post Design (PPD) Sample Hypotheses

Hypothesis 1 (H1). The Spillover Effect condition was hypothesized to report more improvement in self-regulation (global and specific to health behaviors), self-efficacy, and impulsivity than the Focused Components or control conditions.

Hypothesis 2 (H2). The Spillover Effect condition was expected to report more improvement in physical activity behaviors than the Focused Components or control conditions.

Hypothesis 3 (H3). The Spillover Effect condition was hypothesized to report more improvement in fruit and vegetable consumption than the Focused Components or control conditions.

Hypothesis 4 (H4). The Spillover Effect condition was hypothesized to report more improvement in health-related outcomes, such as sleep, weight, hours spent on media entertainment, and positive and negative affect, than the Focused Components or control conditions.

Daily Diary (DD) Sample Hypotheses

Hypothesis 1 (H1). The Spillover Effect condition was hypothesized to report more improvement in global self-regulation and self-efficacy than the Focused Components or control conditions.

Hypothesis 2 (H2). The Spillover Effect condition was hypothesized to report more improvement in physical activity behaviors than the Focused Components or control conditions.

Hypothesis 3 (H3). The Spillover Effect condition was hypothesized to report more improvement in fruit and vegetable consumption than the Focused Components or control conditions.

Hypothesis 4 (H4). The Spillover Effect condition was hypothesized to report more strategy use from the intervention training techniques (e.g., if-then implementations) than the Focused Components condition.

Hypothesis 5 (H5). The Spillover Effect condition was hypothesized to report more improvement in health-related outcomes over time, such as sleep, and positive and negative affect, than the Focused Components or control conditions.

Hypothesis 6 (H6). The intervention effect from either approach (i.e., Spillover Effect or Focused Components) was hypothesized to result in more improvements for all outcomes compared to the self-monitoring (i.e., Hawthorne Effect) potentially experienced in the control condition.

CHAPTER II

METHOD

Sample Overview

Participants were recruited from a pool of undergraduate and graduate students at a large, southeastern Virginian university through advertisements posted in the online university announcements, online and print student housing announcements, student union building, recreation and wellness center (i.e., gym), student health clinic, health promotion office, office of counseling services, university television advertisements, online pool of undergraduate psychology students, and campus events such as health fairs. Interested participants completed a brief prescreen survey to determine for which health-related behaviors (fruit and vegetable consumption, physical activity, and alcohol use) they were eligible to receive intervention training.

The following inclusion criteria were used: 1) consumption of less than the nationally recommended guidelines for servings of fruits/vegetables (less than four servings each of fruit/vegetables daily, USDHHS, 2010); 2) engagement in less than 60-90 minutes of moderate or vigorous exercise daily (American College of Sports Medicine [ASCM] guidelines to achieve or maintain weight loss; Donnelly, Blair, Jakicic, Manore, Rankin, & Smith, 2009); and 3) participants' age must be within the young adult age range 18 and 35 (National Institutes of Health, 2008). Although alcohol use was originally included as part of the inclusion criteria, many participants in the pre-post design and completing the daily diaries did not meet the minimum for alcohol use. For this reason, alcohol use was eliminated as an inclusion criteria. Furthermore, this health-related behavior was removed from the intervention and study focus. Given the duration

of the current study (30 days) and the cumulative effort of the daily diary method, participants were provided with multiple incentives such as several cash and prize raffles based on study completion.

Participants completed the following measures to assess their eligibility: 1) age ("What is your age?"); 2) current aerobic physical activity frequency ("How many days per week do you engage in aerobic physical activity [e.g., running, jogging, elliptical, walking])?"; 3) "What is the typical duration you engage in aerobic physical activity per physical activity session (in minutes)?"; and 4) current consumption of fruits and vegetables (Rapid Eating Assessment for Participants-Shortened version (REAP-S; Segal-Isaacson, Wylie-Rosett, & Gans, 2004). The REAP-S was used to assess whether participants typically consume less than two servings of fruits or vegetables a day (see Appendix A).

Pre-post design (PPD) sample. Participants' reported data at prescreen were examined to determine eligibility based on study inclusion criteria. Students who met the study inclusion criteria assessed in the initial prescreen survey voluntarily self-selected into the study and were randomly assigned to one of the three conditions (Spillover Effect, Focused Components, or control). If participants failed to complete the intervention training, they were reassigned to the control group. Of the total number of participants who successfully completed the baseline survey (N=104), 39 completed the one-month follow-up survey for a completion rate of 38%. Although participants were expected to be representative of the larger university student population, the sample was predominantly female (n=34; 87%). Given that there were only five men in the original pre-post design (PPD) sample, after careful consideration, the PPD sample was filtered to

include only female university students. The decision to filter the sample was deemed necessary to provide a homogenous set of data for inferences to be made. The final PPD sample consisted of four participants in the control condition, 17 participants in the Spillover Effect condition, and 13 participants in the Focused Components condition. As there were only four participants in the control, analyses compared only those in the two intervention conditions and resulted in a final PPD sample of 30 participants. See Table 1 for the pre-post design (PPD) sample demographics.

Daily diary (DD) sample. In addition to the pre-post design (PDD) sample, a smaller sample of participants eligible for the study were randomly selected and invited to participate in a daily diary survey for 30 days spanning the time between the baseline and follow-up pre-post surveys. Participants were instructed to begin completing the daily diaries starting immediately after the baseline survey and continue completing the daily surveys until the 30-day follow-up survey. To be included in the daily diary analyses, participants must have had completed at least seven days of pre-intervention surveys and at least four post-intervention surveys. For control subjects, surveys were split such that the first seven days were considered as pre-intervention surveys; surveys completed after the first seven days were considered as part of the post-intervention time period.

Of the 55 participants who began completing daily diary surveys, only 42% (n=23) completed a sufficient number of days to analyze behaviors before and after the intervention training. Of the 23 participants with sufficient daily diary data, only three participants were men. Given that only three men completed sufficient daily diary surveys, data from men were dropped from the final daily diary sample in pursuit

Table 1

Pre-Post Design Sample Demographics

	Spillover Effect		Focused Components		Total Sample	
	n	%	*n*	%	*n*	%
Class Status						
Freshman	1	5.9%	0	0.0%	1	3.3%
Sophomore	2	11.8%	1	7.7%	3	10.0%
Junior	3	17.6%	4	30.8%	**7**	23.3%
Senior	**6**	35.3%	**5**	38.5%	**11**	36.7%
Graduate	5	29.4%	3	23.1%	8	26.7%
Racial/ethnic group						
African American/Black	1	5.9%	**5**	38.5%	6	20.0%
Caucasian/White	**11**	64.7%	**5**	38.5%	**16**	53.3%
Asian	3	17.6%	0	0.0%	3	10.0%
Latino/a	0	0.0%	1	7.7%	1	3.3%
Other	2	11.8%	2	15.4%	4	13.3%
Age						
18	1	5.9%	0	0.0%	1	3.3%
19	1	5.9%	1	7.7%	2	6.7%
20	**4**	23.5%	1	7.7%	**5**	16.7%
21	1	5.9%	1	7.7%	2	6.7%
22	1	5.9%	**2**	15.4%	3	10.0%
23	1	5.9%	1	7.7%	2	6.7%
24	0	0.0%	1	7.7%	1	3.3%
25	1	5.9%	0	0.0%	1	3.3%
26	1	5.9%	1	7.7%	2	6.7%
27	1	5.9%	1	7.7%	2	6.7%
28	0	0.0%	0	0.0%	0	0.0%
29	1	5.9%	1	7.7%	2	6.7%
30-34	4	23.5%	3	23.1%	7	23.2%
Living Status						
University Housing	2	11.8%	3	23.1%	5	16.7%
Off-campus Residence	**10**	58.8%	**9**	69.2%	**19**	63.3%
With family	5	29.4%	1	7.7%	6	20.0%
Total	17	56.7%	13	43.3%	30	100.0%

Note. Modes are in bold type face for emphasis.

of a more homogenous sample. Of the final daily diary sample analyzed (N=20), all but one participant completed the baseline survey, and all but four participants completed the follow-up survey; the participants (n=16) that completed both the baseline and follow-up surveys were included in the PPD sample. On average, the daily diary sample completed 7.55 (SD=0.60) days of pre-intervention surveys, and 15.90 (SD=6.00) days of post-intervention surveys. All participants reported at least seven days of baseline daily diary surveys; in comparison, more variation was noted in the number of post-intervention surveys completed (25%=10 days, 50%=19 days, 75%= 21.00 days). Total days of completed daily diaries ranged from 11 to 30 days, with an average of 23.45 days (SD=6.25). Those with less than average post-intervention daily diaries (n=6) were primarily in the control condition (n_{Control}= 4, $n_{\text{Spillover Effect}}$= 1, $n_{\text{Focused Components}}$= 2). Demographics of the daily diary (DD) sample (N=20) are reported in Table 2.

The daily diary collection method differentiates the daily diary sample (DD) pre-post intervention analyses from the pre-post design sample (PDD) pre-post intervention analyses in that the daily diary data may have been influenced by self-monitoring (i.e., the Hawthorne effect; Roethlisberger & Dickson, 1939). However, the daily diary data is beneficial as it provides a report of recent behavior less likely to be subjected to recall bias, and could be examined for changes within the thirty days opposed to only day one and day thirty behavior reports.

Design and Procedure

The study was conducted entirely online providing a real world context such that participants had to contact the researcher for intervention material, and to a certain extent, depend on themselves to maintain their progress in the health intervention. In line with

the Keystone Model, participants were randomly assigned to one of three conditions: 1) "Spillover Effect" condition in which participants received instruction in self-regulation, impulsivity, and self-efficacy techniques tailored specifically to physical activity; 2) "Focused Components" condition in which participants received instruction in self-regulation, impulsivity, and self-efficacy techniques tailored to each health behavior (fruit consumption, vegetable consumption, physical activity, and alcohol use) for more than one behavior; or 3) "Control-only" in which participants did not receive any intervention materials.

The intervention techniques included: 1) goal setting; 2) mental contrasting; 3) self-regulation practice; 4) mindfulness practice; and 5) positive self-talk. All participants were asked to complete a baseline survey (Day 1) and a one-month follow-up survey (Day 30). Participants in the Spillover Effect or Focused Components conditions received their online training material one week after completing the baseline survey. The Spillover Effect and Focused Components conditions followed the exact same procedure with the exception that the participants in the Spillover Effect condition were asked to only complete the intervention in regard to exercise and participants in the Focused Components condition additionally completed the intervention in regard to fruit and vegetable consumption. Participants in the control condition completed assessments at baseline, and one-month follow-up, but did not receive any training. Furthermore, while the majority of participants participated in the pre-post design (i.e., baseline and one-month follow-up), those who also participated in the daily diary sample, were instructed to complete a brief 5-10 minute online daily survey regarding the previous day's health behaviors for thirty days (i.e., seven days prior to and 23 days following the intervention

Table 2

Daily Diary (DD) Sample Demographics

	Control		Spillover Effect		Focused Components		Total Sample	
	n	%	*n*	%	*n*	%	*N*	%
Class Status								
Freshman	0	0.0%	1	11.1%	0	0.0%	1	5.0%
Sophomore	0	0.0%	**3**	33.3%	1	16.7%	4	20.0%
Junior	**2**	40.0%	0	0.0%	1	16.7%	3	15.0%
Senior	**2**	40.0%	**3**	33.3%	**2**	33.3%	**7**	35.0%
Graduate	1	20.0%	1	11.1%	**2**	33.3%	4	20.0%
Missing	0	0.0%	1	11.1%	0	0.0%	1	5.0%
Racial/ethnic group								
African American/Black	1	20.0%	0	0.0%	2	38.5%	3	15.0%
	3	60.0%	**5**	55.6%	**3**	38.5%	**11**	55.0%
Caucasian/White								
Asian	1	20.0%	2	22.2%	0	0.0%	3	15.0%
Latino/a	0	0.0%	0	0.0%	1	7.7%	1	5.0%
Other	0	0.0%	1	11.1%	0	15.4%	1	5.0%
Missing	0	0.0%	1	11.1%	0	0.0%	1	5.0%
Age								
18	0	0.0%	1	11.1%	0	0.0%	1	5.0%
19	0	0.0%	1	11.1%	1	16.7%	2	10.0%
20	1	20.0%	**2**	22.2%	0	0.0%	3	15.0%
21	1	20.0%	1	11.1%	1	16.7%	3	15.0%
22	1	20.0%	1	11.1%	0	0.0%	2	10.0%
23	1	20.0%	1	11.1%	**2**	33.3%	**4**	20.0%
24	0	0.0%	0	0.0%	1	16.7%	1	5.0%
25	1	20.0%	0	0.0%	0	0.0%	1	5.0%
26	0	0.0%	1	11.1%	0	0.0%	1	5.0%
27	0	0.0%	1	11.1%	1	16.7%	2	10.0%
Living Status								
University Housing	0	0.0%	2	22.2%	2	33.3%	4	20.0%
Off-campus	2	40.0%	**4**	44.4%	2	33.3%	**7**	35.0%
With family	**3**	60.0%	2	22.2%	2	33.3%	**8**	40.0%
Missing	0	0.0%	1	11.1%	0	0.0%	1	5.0%
Total	5	25.0%	9	45.0%	6	30.0%	20	100.0%

Note. Modes are bolded. One Spillover Effect participant did not complete the baseline or follow-up survey thus complete data is unavailable; age was pulled from the prescreen.

training day). The control group was not instructed in self-regulation, mindfulness, or positive self-talk exercises.

Measures

Participants completed the same measures at baseline and follow-up survey time points. At baseline and follow-up, participants completed the following measures: self-regulation (global and specific), impulsivity, self-efficacy, fruit and vegetable consumption, physical activity, and alcohol use. For the daily diary sample, the following measures were completed daily: global self-regulation, self-efficacy, fruit and vegetable consumption, physical activity, alcohol use, strategy use (after the intervention, only participants in the Spillover Effect or Focused Components interventions), and other health-related constructs.

Self-regulation. Global self-regulation was measured with the Short Self-Regulation Question (SSRQ; Carey, Neal, & Collins, 2004). The 31-item SSRQ, a short version of the 63-item Self-Regulation Questionnaire (see Appendix B), was administered with a Likert response scale (1= *Strongly disagree* and 5 = *Strongly agree*). The SSRQ is highly correlated with the longer questionnaire version (r=.96; Self-Regulation Questionnaire, Neal & Carey, 2005), and has demonstrated excellent internal reliability (Cronbach's alpha = .92; Neal & Carey, 2005) and test-retest reliability (r=.94; Carey et al., 2004). Items are summed to create an overall score that reflects global self-regulatory ability. The current study evidenced excellent internal consistency with Cronbach's alphas of .95 and .96 at baseline and follow-up, respectively.

Self-regulation of physical activity. The Physical Activity Self-Regulation Strategies questionnaire (Annesi, 2011b) is a parallel measure to the Eating Self-

Regulation Strategies questionnaire also modified from the original Saelens et al. (2000) items. The 10-item scale has previously demonstrated appropriate internal reliability (Cronbach's alpha = .79; Annesi, 2011b; Annesi & Gorjala, 2010). Similar to the Eating Self-Regulation Strategies questionnaire, the current study used the Physical Activity Self-Regulation Strategies questionnaire as previously administered, but also included additional items modified from the original source (Saelens et al., 2000) for a total of 17 items (1 = *Never* to 5= *Almost always*) that were summed to create a self-regulation score specific to physical activity. See Appendix C. The Cronbach's alpha for the current study evidenced excellent validity with values of .93 and .94 for baseline and follow-up, respectively.

Self-regulation of eating. The Eating Self-Regulation Strategies questionnaire (Annesi, 2011b) was a modified form of a subset of behavioral and cognitive strategies from a validated scale for physical activity self-regulation (Saelens, Gehrman, Sallis, Calfas, Sarkin, & Caparosa, 2000). The 10-item scale has previously demonstrated appropriate internal reliability (Cronbach's alpha = .81; Annesi, 2011b; Annesi & Gorjala, 2010). The current study used the Eating Self-Regulation Strategies items as previously administered, but also included additional items modified from the original source (Saelens et al., 2000) for a total of 17 items (see Appendix D). The response options are listed on a 5-point Likert scale (1 = *Never* to 5= *Almost always*) and summed to create a self-regulation score specific to eating behavior. The Cronbach's alpha for the current study indicated high internal validity with values of .90 and .92 at baseline and follow-up, respectively.

Impulsivity. The UPPS-P measure (Negative Urgency, Premeditation, Perseverance, Sensation Seeking, and Positive Urgency; Whiteside & Lynam, 2001) was included to assess impulsivity traits (see Appendix E). Specifically, the UPPS-P contains five subscales: 1) lack of perseverance (10 items); 2) lack of premeditation (11 items); 3) negative urgency (12 items); 4) positive urgency (14 items); and 5) sensation seeking (12 items). The response scale is from 1 (*Agree strongly*) to 4 (*Disagree strongly*). The UPPS-P measure has been validated for use with young adults (Coskunpinar, Dir, & Cyders, 2013) and has demonstrated appropriate internal reliability (Cronbach's alphas for all subscales > .79; Pearson, Murphy, & Doane, 2013). The Cronbach's alphas for the current study were all within an acceptable range: lack of perseverance (Baseline α=.91, Follow-up α=.91), lack of premeditation (Baseline α=.79, Follow-up α=.79), negative urgency (Baseline α=.87, Follow-up α=.83), positive urgency (Baseline α=.90, Follow-up α=.91), and sensation seeking (Baseline α=.91, Follow-up α=.93).

Self-efficacy. Self-efficacy was measured on the Global Self-Efficacy questionnaire (GSE; Schwarzer & Jerusalem, 1995). The GSE is a ten-item questionnaire with a 4-point Likert-type response scale ranging from 1 (*Not at all true)* to 4 (*Exactly true).* The Global Self-Efficacy questionnaire has demonstrated excellent internal reliability (Cronbach's alpha = .93; Schwarzer et al., 2010). See Appendix F. The Cronbach's alpha for the current study were .90 at baseline, and .95 at follow-up.

Physical activity engagement. At baseline and one-month, participants were asked to report on their level of aerobic activity. Specifically, participants were asked, "How many days in a typical week do you engage specifically in aerobic physical activity (e.g., running, jogging, elliptical, walking)?" and "What is the typical duration you

engage in aerobic physical activity per physical activity session?" in order to calculate total minutes of aerobic physical activity. Additionally, participants were asked to complete a physical activity chart with the days of the week as the columns, and two rows requesting the participants to identify 1) the total minutes of moderate or vigorous exercise typically engaged in during the morning, afternoon and evening, and 2) the frequency or number of times they typically engage in moderate or vigorous exercise during the morning, afternoon, or evening throughout the week; this measurement was used to create total weekly minutes of moderate of vigorous exercise.

Daily physical activity for the daily diary sample was assessed with the Point-Based Physical Activity Log (PAL; Largo-Wight, Todorovich, & O'Hara, 2008), which is a modified version of the Bouchard's PAL (Bouchard, Tremblay, Leblanc, Lortie, Savard, & Theriaualt, 1983). The Bouchard PAL is intended to be completed every 15 minutes; however, the Point-Based PAL was created to be completed once a day (Largo-Wight et al., 2008; see Appendix G). Participants also completed a table representing typical engagement in physical activity for the previous week (see Appendix H). Participants were instructed to indicate the number of physical activities they engage in (at a moderate-vigorous level of intensity) per day along with the total minutes they engage in physical activity. Additionally, the following item was included: 1) "In a typical week, how many days do you spend at least 30 minutes at a time in moderate or vigorous physical activity (defining moderate-vigorous activity as that which increases heart rate and makes you out of breath for at least part of the time;" Serec, Kolsek, Svab, Moesgen, & Klein, 2012).

Baseline measures of total weekly minutes of aerobic exercise [r(27)= .61, p<.001], total days in which aerobic exercise occurs [r(28)= .47, p=.009] and total weekly minutes of any moderate or vigorous physical activity [r(28)= .84, p<.001] were correlated with follow-up measurements respectively. Total weekly minutes of moderate or vigorous physical activity was correlated with total weekly minutes of aerobic exercise at baseline [r(28)= .70, p<.001] and at follow-up [r(27)= .46, p=.012].

Fruit and vegetable consumption. The number of servings reported was summed for fruits and vegetables separately. One serving of fruit is defined as eight ounces of juice, one medium piece of fruit (e.g., apple, pear, orange), one-half cup of cut fruit pieces, or one-quarter cup of dried fruit; one serving of vegetables is defined as eight ounces of vegetable juice, one-half cup of cooked vegetables, one cup of raw vegetables, two cups of raw leafy vegetables, or one medium vegetable (e.g., tomato, potato; Neuhouser, Patterson, Kristal, Eldridge, & Vizenor, 2000). Fruit and vegetable consumption were assessed with two measures. The first measure consists of four items: 1) How many different *types* of fruits do you eat on a typical day, 2) How many *servings* of fruits do you eat on a typical day, 3) How many different *types* of vegetables do you eat on a typical day, and 4) How many *servings* of vegetables do you eat on a typical day. The second measure asked participants to complete a chart representing typical fruit and vegetable consumption (number of types and servings) per day (see Appendix I); Chapman et al. (2009) used a similar format and found a correlation of .66 with a food frequency questionnaire. Cronbach's alpha could not be calculated for these measurements; instead, correlations between time points are reported. The correlation between the amount of fruit servings [$r(28)= .73$, $p < .001$] and the variety of different

fruit [$r(28) = .74, p < .001$] typically consumed at baseline and follow-up was found to be very strong. In parallel, the correlation between the amount of vegetable servings [$r(28) = .59, p = .001$] and the variety of different vegetables [$r(28) = .73, p < .001$] typically consumed at baseline and follow-up was also found to be strong. Further, strong correlations were found between the amount of servings and variety of healthy foods [$r_{Fruits}(28)=.97, p<.001$; $r_{Vegetables}(28)=.94, p<.001$] at baseline and at follow-up [$r_{Fruits}(28)=.94, p<.001$; $r_{Vegetables}(28)=.93, p<.001$].

Intention to change behaviors. Five questions, adapted from the single intention item in the Rapid Eating Assessment for Participants-Shortened version (REAP-S; Segal-Isaacson et al., 2004), were included to assess willingness to make changes (i.e., general changes to be healthier in life, in fruit consumption, vegetable consumption, and physical activity) in order to be healthier (see Appendix J). Responses were on a 5-point Likert scale ranging from *'Not at all willing'* to *'Very willing'*. Cronbach's alphas for the current study were .89 at baseline and .85 at follow-up.

Positive and negative affect. Participants were asked to respond to a list of positive (14 items) and negative (14 items) experiences on a scale ranging from 0 = *None of the time* to 4= *All the time* (see Appendix K). Items were primarily drawn from the Positive and Negative Affect Schedule scales (PANAS; Watson, Clark, & Tellegan, 1988); other items were extracted from the General Well-Being Schedule (Fazio, 1977) and Affect Balance Scale (Bradburn, 1969). Participants were asked to report based on the past week when completing the measure at baseline or follow-up. Those completing the daily diaries were asked to respond based only on the previous day. The Cronbach's

alphas for the current study for positive (Baseline α=.96, Follow-up α=.97) and negative (Baseline α=.90, Follow-up α=.89) affect scores were within acceptable range.

Demographic questionnaire. A brief questionnaire was included to assess a variety of participant characteristics including age, gender, current height and weight, current residence, and other socio-economic factors (see Appendix L).

CHAPTER III

RESULTS

Preliminary Analyses

Data were initially examined for normality and extreme outliers. However, given the small sample size and violation of parametric assumptions, nonparametric statistics were selected to analyze the data. The fact that the sample was small underlies the necessity that results are considered and interpreted as exploratory. Significance values are highly influenced by sample size (Cohen, 1992; Rosenthal, 1991); for example, Rosenthal states that the test of significance is determined by the size of the effect and the size of the study (p. 14). Consistent with an exploratory interpretation, more weight is placed on effect size interpretation relative to significance values. Mann-Whitney U tests were conducted for the between group differences analyses with Fisher's exact *p*-values reported. Mann-Whitney U tests were conducted instead of independent samples *t*-tests due to limitations of the data; specifically, the data evidenced non-normality, and relatively small group sample sizes (Skovlund & Fenstad, 2001). No universal effect size has been accepted for the Mann-Whitney U test (Leech & Onwuegbuzie, 2002); however, an effect size approximation ("*r*") is calculated by dividing the standardized estimate (i.e., "*Z*") by the square root of the total sample size (Rosenthal, 1991, p. 19). The "*r*" approximation effect size can be interpreted with cut-off values of .20, .50, and .80 representing recommended minimum (RMPE), moderate effect, and strong effect respectively (Ferguson, 2009). The recommended minimum effect size (RMPE) of r=.20 "represents a practically significant effect for social science data" (Ferguson, 2009, p. 533).

Pre-Post Design (PPD) Sample Hypotheses Testing

Change in model constructs over time. A series of Mann-Whitney U tests were conducted in order to test the hypothesis that the Spillover Effect condition would report better improvement in self-regulation (global and specific to health behaviors), self-efficacy, and impulsivity, from baseline to follow-up, compared to the Focused Components condition. See Tables 3 and 4 for descriptive statistics for study variables by Spillover Effect and Focused Component PPD samples respectively.

Global self-regulation. The Spillover Effect (*Mdn*=3.00, 25%=-3.00, 75%=11.00) and Focused Components (*Mdn*=-3.00, 25%=-5.50, 75%=4.00) conditions reported changes in global self-regulation that were not significantly different, U= 73.50, Z=-1.55, p=.123, r=.28. However, 70% of the participants in the Spillover Effect condition increased in global self-regulation (between 1 and 26 points out of a possible 155 points) compared to only 31% of the Focused Components condition (increased between 4 and 17 points). Furthermore, only 24% of the Spillover Effect condition decreased in reported global self-regulation scores (between 6 and 21 points; one score remained unchanged) compared to 69% of the Focused Components condition that reported lower global self-regulation at the follow-up measurement (between 2 and 14 points).

Behavior-specific self-regulation. Similarly to global self-regulation, no significant differences were found in self-regulation specific to exercise or eating health behaviors. Specifically, no significant intervention effect was found for change in exercise self-regulation across the study period between the Spillover Effect (*Mdn*=0.18, 25%=-0.18, 75%=0.56) and Focused Components (*Mdn*=0.00, 25%=-0.35, 75%=0.15) conditions, U= 84.00, Z=-1.11, p=.281, r=.20.

Table 3

Pre-Post Design (PPD) Spillover Effect: Descriptive Statistics for Study Outcomes

	Baseline					Follow-Up				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Keystone Model Constructs										
Global Self-Regulation	118.24	14.50	118.00	110.50	126.00	122.65	18.13	119.00	108.00	136.50
Exercise Self-Regulation	3.09	0.79	3.29	2.59	3.56	3.26	0.67	3.24	2.94	3.53
Eating Self-Regulation	2.82	0.68	2.82	2.26	3.32	3.09	0.64	2.94	2.74	3.68
Self-Efficacy	3.15	0.47	3.30	2.95	3.40	3.22	0.57	3.20	3.00	3.70
Lack of Perseverance	1.74	0.61	1.50	1.35	2.00	1.71	0.62	1.60	1.25	1.95
Lack of Premeditation	1.65	0.37	1.64	1.45	1.86	1.66	0.41	1.82	1.27	2.05
Negative Urgency	2.11	0.52	2.25	1.67	2.50	2.03	0.51	2.00	1.71	2.42
Positive Urgency	1.54	0.54	1.36	1.18	1.64	1.63	0.53	1.64	1.18	2.00
Sensation Seeking	2.59	0.78	2.58	1.79	3.21	2.73	0.80	2.83	2.04	3.21
Physical Activity										
Weekly Aerobic Physical Activity (mins)	105.88	105.35	60.00	30.00	177.50	114.38	93.36	110.00	41.25	165.00
Weekly Aerobic Physical Activity (days)	3.18	2.46	3.00	1.00	5.50	3.24	1.99	3.00	2.00	5.00
Weekly Total Physical Activity (mins)	180.88	163.13	120.00	85.00	260.00	196.76	274.64	110.00	70.00	257.50
Fruit and Vegetable Consumption										
Fruit Servings	9.76	6.74	7.00	5.00	14.00	6.71	4.45	7.00	4.00	10.50
Fruit Variety	9.12	5.75	8.00	4.50	13.00	6.18	3.78	7.00	4.00	9.50
Vegetable Servings	11.24	8.24	7.00	7.00	16.00	9.59	7.48	7.00	5.50	14.00
Vegetable Variety	10.18	6.85	7.00	7.00	12.50	9.94	7.59	8.00	5.50	14.00

Note. Sample size at baseline and follow-up was 17. Fruit servings and variety of fruit at baseline were highly correlated [$r(15)=.90$, $p<.001$].

Table 4

Pre-Post Design (PPD) Focused Components: Descriptive Statistics for Study Outcomes

	Baseline					Follow-Up				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Keystone Model Constructs										
Global Self-Regulation	117.23	20.67	116.00	98.50	133.50	116.23	16.45	125.00	100.00	128.50
Exercise Self-Regulation	3.44	0.76	3.47	3.03	3.91	3.45	0.84	3.59	2.74	4.18
Eating Self-Regulation	2.79	0.65	2.88	2.29	3.38	3.04	0.70	2.76	2.59	3.56
Self-Efficacy	3.32	0.51	3.30	2.85	3.80	3.26	0.58	3.00	2.85	3.90
Lack of Perseverance	1.99	0.61	2.10	1.45	2.35	1.98	0.57	2.00	1.50	2.40
Lack of Premeditation	1.65	0.34	1.55	1.45	1.82	1.71	0.35	1.73	1.45	1.91
Negative Urgency	1.94	0.59	1.92	1.33	2.46	1.87	0.45	1.83	1.46	2.29
Positive Urgency	1.40	0.31	1.43	1.14	1.61	1.37	0.32	1.29	1.14	1.64
Sensation Seeking	2.14	0.65	2.08	1.71	2.38	2.04	0.65	1.92	1.58	2.25
Physical Activity										
Weekly Aerobic Physical Activity (mins)	168.85	133.45	200.00	0.00	300.00	140.77	142.56	140.00	0.00	215.00
Weekly Aerobic Physical Activity (days)	3.31	2.53	5.00	0.00	5.00	2.77	2.20	3.00	0.00	5.00
Weekly Total Physical Activity (mins)	311.54	312.49	260.00	60.00	447.50	300.00	256.26	300.00	110.00	372.50
Fruit and Vegetable Consumption										
Fruit Servings	12.15	11.84	12.00	3.00	15.00	7.85	8.26	7.00	1.00	12.50
Fruit Variety	12.15	11.84	12.00	3.00	15.00	9.31	8.81	8.00	1.00	15.00
Vegetable Servings	9.62	7.58	10.00	2.50	16.00	9.00	6.92	7.00	4.00	13.50
Vegetable Variety	9.23	7.64	7.00	2.50	17.00	8.62	6.63	7.00	5.00	12.00

Note. Sample size at baseline and follow-up was 13. Fruit servings and variety of fruit at baseline were highly correlated [$r(11)=1.00$, $p<.001$].

No significant difference in eating self-regulation change from baseline to follow-up between the Spillover Effect (*Mdn*=0.29, 25%=0.03, 75%=0.53) and Focused Components (*Mdn*=0.06, 25%=-0.15, 75%=0.50) conditions was found, *U*= 88.50, *Z*=-0.92, *p*=.363, *r*=.17. Yet, 59% of the participants in the Spillover Effect condition reported increases in exercise self-regulation (between .18 and 1.06 points out of a possible average of 5 points) compared to only 46% of the Focused Components condition (increased between .06 and 1.18 points). Also, 76% of the Spillover Effect condition reported an increase in eating self-regulation (between .18 and 1.24 points out of a possible average of 5 points) compared to only 62% of the Focused Components condition (between .06 and 2.06 points). Globally and within each health-related behavior, there were no significant differences in self-regulation over time between the Spillover Effect and Focused Components conditions. However, the differences that did exist between the two conditions resulted in effect sizes that can be interpreted as meeting the recommended minimum effect size (RMPE). See Figure 3 for a visual representation of group differences.

Self-efficacy. Changes in self-efficacy from baseline through follow-up were examined between the Spillover Effect (*Mdn*=0.10, 25%=0.00, 75%=0.30) and Focused Components (*Mdn*=0.00, 25%=-0.25, 75%=0.15) intervention conditions. Although no significant difference was found (*U*= 79.50, *Z*=-1.31, *p*=.198, *r*=.24), 59% of the participants in the Spillover Effect condition increased in global self-efficacy (between .10 and .40 points out of a possible average of 4 points) compared to only 38% of the Focused Components condition (increased between .10 and .40 points).

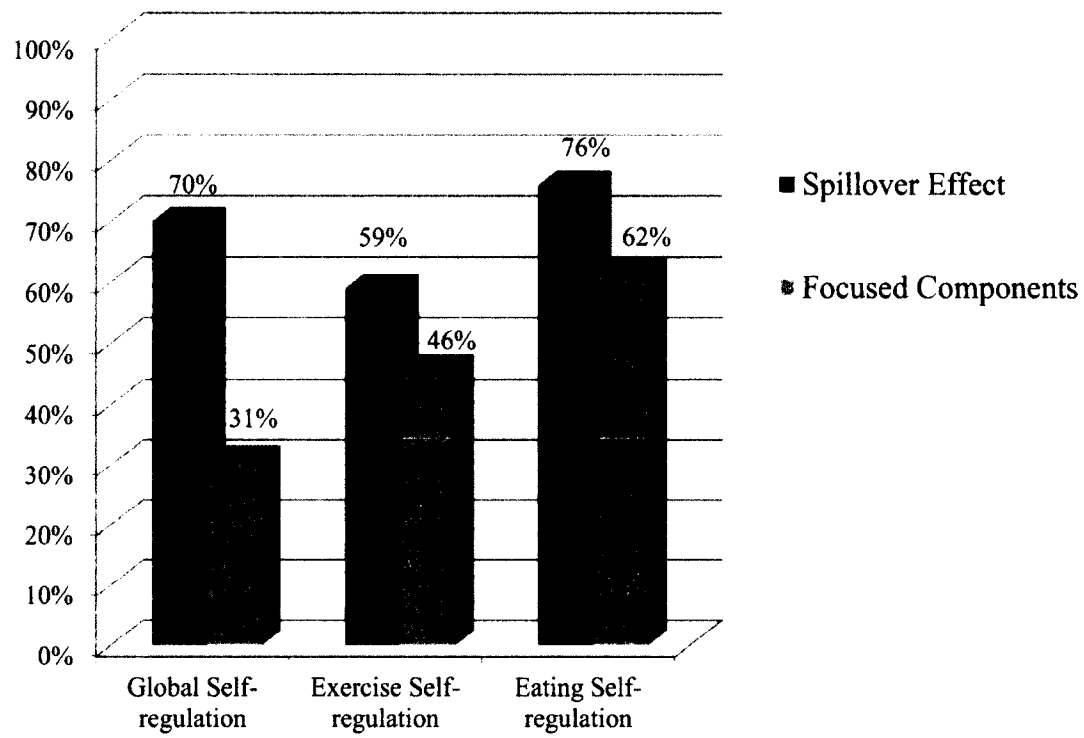

Figure 3. Summary of increases in self-regulation by condition.

Approximately the same percentage of participants in the Spillover Effect and Focused Components conditions reported an unchanged self-efficacy (24% and 23%, respectively); however, only 18% of the Spillover Effect reported a decreased self-efficacy score (between .10 and .50) compared to 38% of the Focused Components sample's decreased scores (between .10 and .80). Although no significant group difference was obtained between changes in self-efficacy across the time interval examined, the effect size and proportion differences are worth noting for practical significance. See Figure 4 for a visual representation of group differences in self-efficacy.

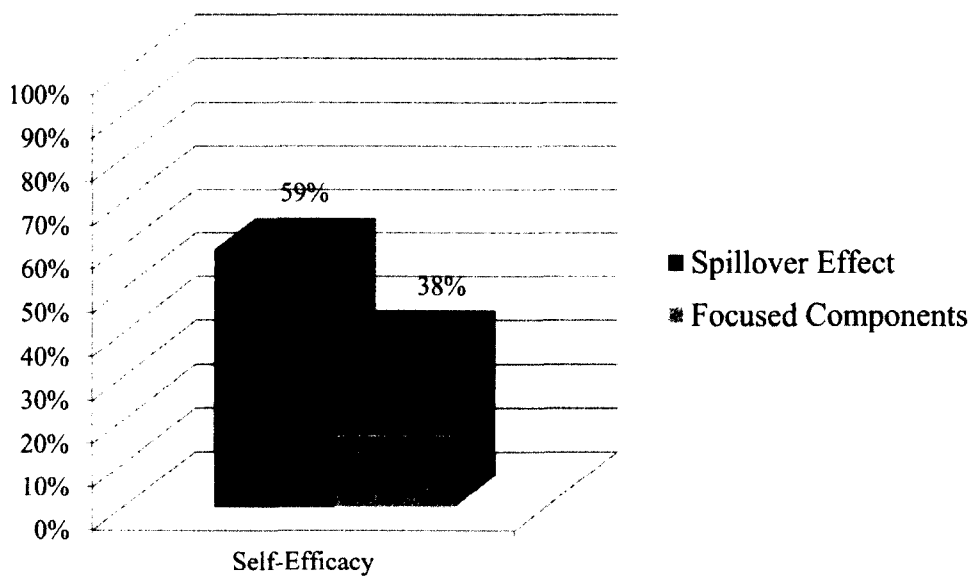

Figure 4. Summary of increases in self-efficacy by condition.

Impulsivity. The final key piece of the Keystone Model was impulsivity as operationally defined by several components (i.e., the lack of perseverance, lack of premeditation, negative urgency, positive urgency, and sensation seeking). No significant difference in lack of perseverance was reported between the Spillover Effect (*Mdn*=-0.10, 25%=-0.10, 75%=0.10) and Focused Components (*Mdn*=0.00, 25%=-0.15, 75%=0.15) conditions, *U*= 111.00, *Z*=0.02, *p*=.999, *r*=.00. Similarly, the Spillover Effect (*Mdn*=0.00, 25%=-0.09, 75%=0.14) and Focused Components (*Mdn*=0.09, 25%=-0.09, 75%=0.23) conditions reported changes in lack of premeditation that were not significantly different, *U*= 130.00, *Z*=0.82, *p*=.432, *r*=.15. However, after closer examination of the data, a greater percentage of the Focused Components sample reported increased lack of perseverance (38% vs 24%) and lack of premeditation (54% vs. 35%) compared to the Spillover Effect sample. The Spillover Effect (*Mdn*=0.00, 25%=-0.38, 75%=0.21) and

Focused Components (*Mdn*=0.00, 25%=-0.42, 75%=0.25) conditions reported changes in negative urgency that were not significantly different, U= 109.50, Z=-0.04, p=.967, r=.01. Approximately 47% of each intervention sample reported increases in negative urgency scores indicating no practical difference in this aspect of impulsivity over the one month period. The Spillover Effect (*Mdn*=0.07, 25%=-0.11, 75%=0.32) and Focused Components (*Mdn*=0.00, 25%=-0.14, 75%=0.07) conditions reported changes in positive urgency that were not significantly different, U= 85.50, Z=-1.05, p=.300, r=.19, yet 59% of the Spillover Effect reported increases in positive urgency compared to only 23% of the Focused Components condition. Additionally, the Spillover Effect (*Mdn*=0.17, 25%=-0.17, 75%=0.33) and Focused Components (*Mdn*=-0.08, 25%=-0.25, 75%=0.00) conditions reported significantly different changes in sensation seeking, U= 60.00, Z=-2.12, p=.035, r=.39, such that 65% of the Spillover Effect condition reported increases in their sensation seeking scores at follow-up compared to only 23% of the Focused Components condition. In fact, the Focused Components increases in scores for positive urgency (between .14 and .50) and sensation seeking (between .08 and .50) had a much lower range than the Spillover Effect sample's reported positive urgency (between .07 and 1.07) and sensation seeking scores (between .08 and .67). See Figure 3 for a summary of impulsivity dimension change by intervention condition.

Taken together, the inferential statistics suggest the Spillover Effect intervention may not have improved self-regulation, self-efficacy, and impulsivity (with the exception of sensation seeking) significantly more than the Focused Components intervention over the one-month study period. Yet effect sizes and patterns of change (i.e., percentage of participants with increased/decreased scores) lend support to the notion that the two

methodological approaches (i.e., sequential vs. simultaneous) may yield beneficial effects. Particularly, the Spillover Effect condition may yield better outcomes albeit not statistically significant in the current sample. See Figure 5 for a visual representation of group differences in impulsivity.

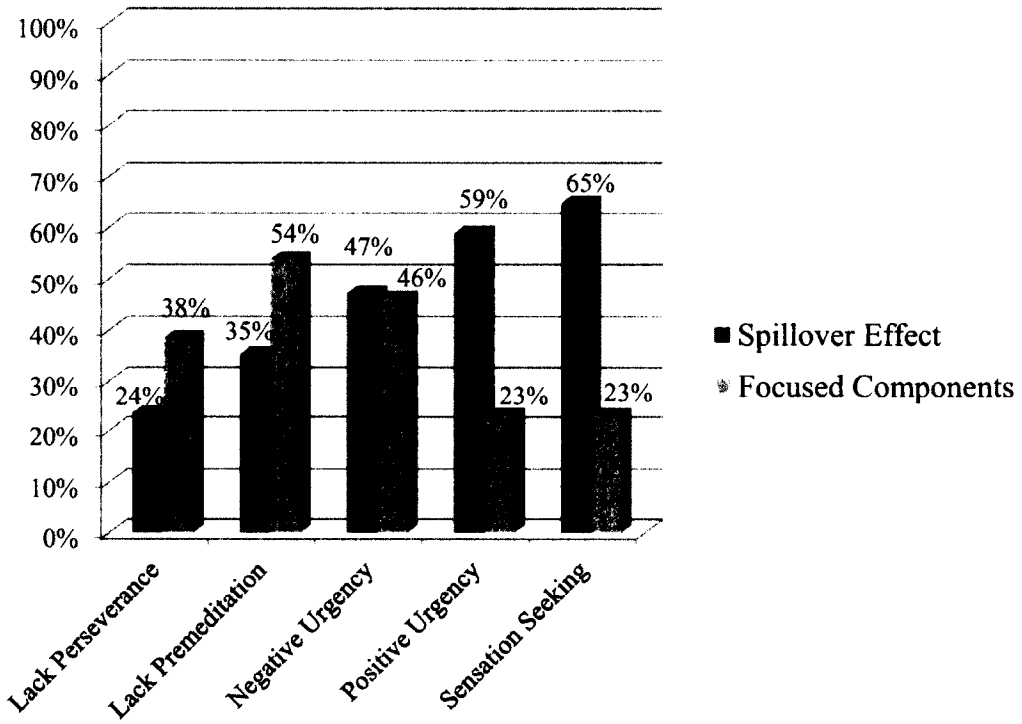

Figure 5. Summary of increases in impulsivity dimensions by condition.

Change in physical activity over time. A series of Mann-Whitney U tests were conducted in order to test the hypothesis that the Spillover Effect condition would report a greater increase in physical activity behaviors from baseline to follow-up than the Focused Components condition. Differences in total weekly minutes and days of aerobic

exercise, as well as weekly minutes of all-type exercise between baseline and follow-up were assessed.

Change in typical weekly minutes of aerobic exercise from baseline to follow-up was not significantly different between the Spillover Effect (*Mdn*=15.00, 25%=-52.00, 75%=57.50) and the Focused Components conditions (*Mdn*=0.00, 25%=-145.00, 75%=45.00), U= 85.00, Z=-0.84, p=.423, r=.16. However, a notable outcome was present such that 47% of the Spillover Effect group reported an increase in the amount of aerobic exercise as compared to only 30% of the Focused Components condition. Additionally, the differences in the number of days for which participants reported engagement in aerobic activity was not significantly different between the Spillover Effect (*Mdn*=0.00, 25%=-2.00, 75%=2.00) and Focused Components (*Mdn*=0.00, 25%=-1.50, 75%=1.00) conditions, U= 101.00, Z=-0.41, p=.711, r=.07. Although the difference was non-significant, 35% of the participants in the Spillover Effect condition increased the frequency of aerobic activity days between an additional one to four days. In contrast, 30% of participants in the Focused Components condition increased the frequency of aerobic exercise days by an additional one to three days. There was no significant difference reported in typical weekly minutes of exercise, inclusive of all types of exercise, from baseline to follow-up between the Spillover Effect (*Mdn*=0.00, 25%=-125.00, 75%=115.00) and Focused Components (*Mdn*=0.00, 25%=-105.00, 75%=135.00) conditions, U= 117.50, Z=-0.29, p=.773, r=.05. The Focused Components sample equally reported an increase (38%) and decrease (38%) in total minutes of weekly exercise. Similarly, the Spillover Effect sample equally reported an increase (47%) and decrease (47%) in total minutes of weekly exercise. The results indicated a trend such

that the Spillover Effect condition appeared to result in an increase in the frequency of aerobic exercise, but no significant difference in cumulative general exercise over time, as compared to the Focused Components condition. See Figure 6 for a visual representation of group differences in physical activity.

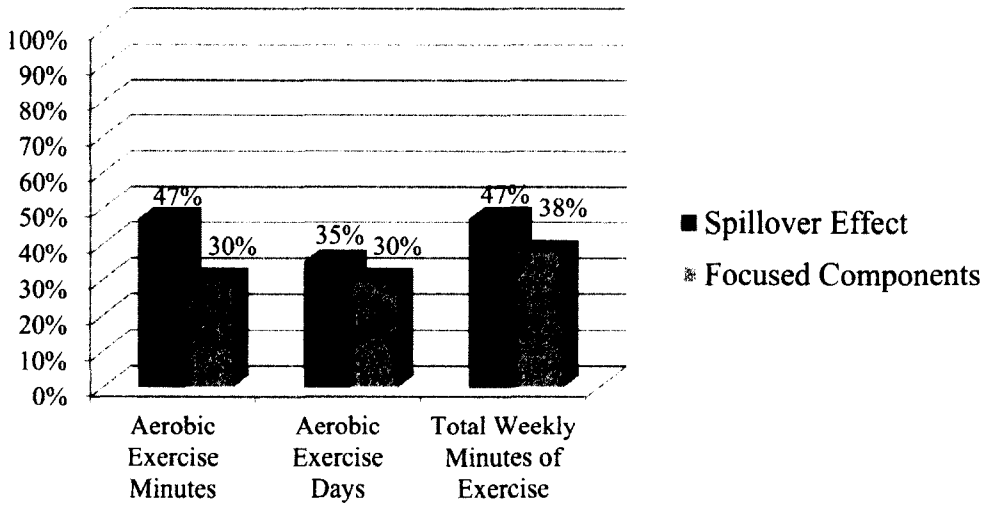

Figure 6. Summary of increases in physical activity by condition.

Change in fruit and vegetable consumption over time. A series of Mann-Whitney U tests were conducted in order to test the hypothesis that the Spillover Effect condition would report better improvement in fruit and vegetable consumption compared to the Focused Components condition. Number of servings and variety of different fruits and vegetables consumed in the last week were assessed. The Spillover Effect (*Mdn*=-2.00, 25%=-9.00, 75%=1.00) and Focused Components (*Mdn*=-2.00, 25%=-9.00, 75%=0.00) conditions reported medians that were not significantly different for total weekly fruit servings, U= 100.00, Z=-0.44, p=.680, r=.08. The variety of different fruits eaten during the week was similar across Spillover Effect (*Mdn*=-2.00, 25%=-7.00,

75%=1.00) and Focused Components (*Mdn*=-2.00, 25%=-5.50, 75%=1.50) conditions, *U*= 113.50, *Z*=0.13, *p*=.902, *r*=.02. Although non-significant, 23% of the participants in the Spillover Effect condition increased both their fruit servings (an additional two to ten servings), and increased their variety of fruits consumed (an additional two to six different fruits). In comparison, only 15% of the participants in the Focused Components condition increased their fruit servings (an additional three servings), and similarly, 23% of the condition increased their variety of fruits consumed (an additional three to seven different fruits).

The Spillover Effect (*Mdn*=-1.00, 25%=-6.50, 75%=4.00) and Focused Components (*Mdn*=0.00, 25%=-4.00, 75%=4.00) conditions did not report significantly different weekly vegetable servings, *U*= 114.00, *Z*=0.15, *p*=.902, *r*=.03. The variety of different vegetables eaten during the week was similar across Spillover Effect (*Mdn*=1.00, 25%=-4.00, 75%=3.00) and Focused Components (*Mdn*=0.00, 25%=-5.00, 75%=4.00) conditions, *U*= 103.50, *Z*=-0.30, *p*=.773, *r*=.05. Although non-significant, 41% of the participants in the Spillover Effect condition increased their reported vegetable servings (an additional two to nine servings), and 53% reported an increase in the variety of vegetables consumed (an additional one to nine different vegetables). In comparison, only 30% of the participants in the Focused Components condition reported an increase in their vegetable servings (an additional four to seven servings); 30% of those in the Focused Components condition increased their variety of vegetables consumed (an additional four to seven different vegetables).

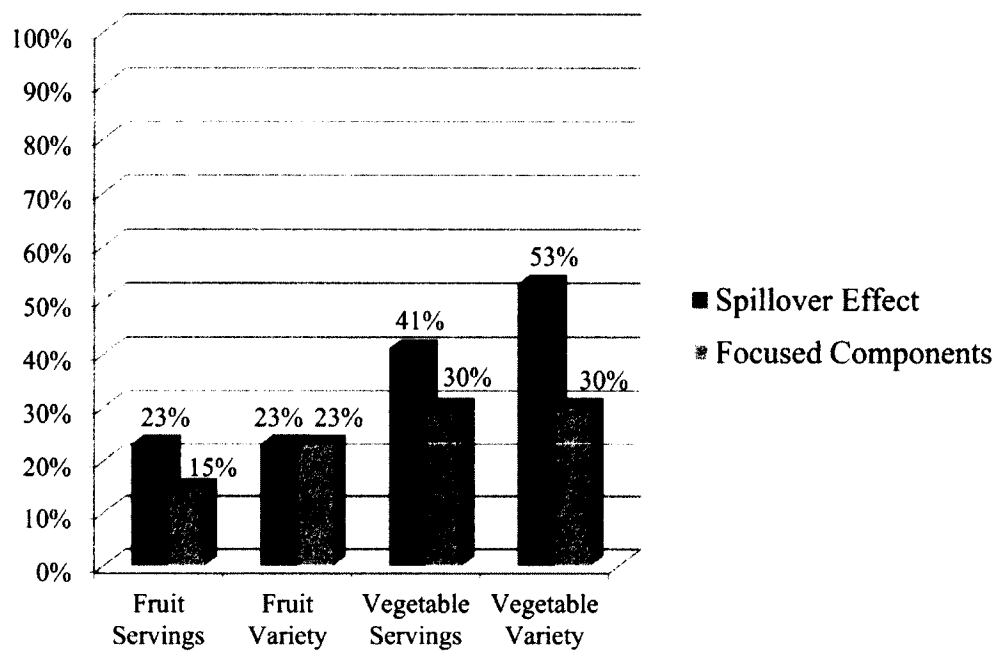

Figure 7. Summary of increases in fruit and vegetable consumption by condition.

Overall, these results indicated that despite no statistically significant differences in fruit and vegetable consumption change over the study period between intervention conditions, the Spillover Effect condition evidenced a greater proportion of participants who increased their fruit and vegetable servings and variety of vegetable consumption. See Figure 7 for a visual representation of group differences in fruit and vegetable consumption.

Change in health-related outcomes over time. The Spillover Effect condition was hypothesized to report more improvement in other health-related outcomes, such as sleep, weight maintenance/loss, electronic media hours (hours spent on media/entertainment), and positive/negative psychological and physical symptoms, compared to the Focused Components condition.

Sleep. At the end of the baseline and follow-up surveys, participants were asked to report the times they typically go to bed and wake up on a weeknight. Additionally, participants were asked to report the hours of sleep they receive on a typical weeknight. Interestingly, although no statistical significant difference in hours of sleep was found for either measure, each measure portrays a different pattern. The Spillover Effect condition reported a median of 7.50 hours of sleep at baseline (M=7.03, SD=1.73, 25%=6.00, 75%=8.00), and a median of eight hours of sleep (M=7.35, SD=1.00, 25%=7.00, 75%=8.00) at follow-up. The Focused Components condition reported a median of seven hours of sleep at baseline (M=6.88, SD=1.39, 25%=6.00, 75%=8.00), and a median of eight hours of sleep at follow-up (M=7.04, SD=1.64, 25%=6.00, 75%=8.00). Analyzing the self-reported measure indicated that the Spillover Effect (Mdn=0.00, 25%=-0.75, 75%=1.00) and the Focused Component conditions (Mdn=0.00, 25%=0.00, 75%=0.50), U= 111.50, Z=0.04, p=.967, r=.01, were similar in terms of reported change in sleep. However, when analyzing the calculated difference in hours of sleep from the self-reported wake and rise times at baseline and follow-up [Spillover Effect (Mdn=0.00, 25%=-0.75, 75%=1.50) and the Focused Component conditions (Mdn=-0.50, 25%=-1.00, 75%=0.50), U= 81.50, Z=-1.23, p=.229, r=.22], the results were inconsistent. Given the calculation of sleep from the reported sleep and rise times, the Spillover Effect condition reported a median of 7.5 hours of sleep at baseline (M=7.47, SD=1.93, 25%=6.50, 75%=8.75), and a median of eight hours of sleep at follow-up (M=7.94, SD=1.25, 25%=7.00, 75%=9.00). From the calculations, the Focused Components condition reported a median of eight hours of sleep at baseline (M=7.88, SD=1.40, 25%=7.00,

75%=9.00), and a median of eight hours of sleep at follow-up (*M*=7.81, *SD*=1.44, 25%=7.25, 75%=8.50).

Specifically, only 8% of the Focused Components sample reported a decrease in hours of weeknight sleep from baseline to follow-up (compared to 31% of that reported an increase); however, when examining the calculated hours of weeknight sleep, 62% the Focused Components sample reported fewer sleep hours from baseline to follow-up (compared to 23% that reported an increase). In contrast, the Spillover Effect sample's results were relatively stable between the self-reported measure (41% increase in sleep hours; 29% decrease in sleep hours) and the calculated variable (35% increase in sleep hours; 29% decrease in sleep hours). See Figure 8 for a visual representation of group differences in sleep.

Weight maintenance/loss. No significant difference in reported weight change (calculated from reported weight in pounds at baseline and follow-up) was evidenced between the Spillover Effect (*Mdn*=0.00, 25%=-1.40, 75%=0.00) and Focused Components (*Mdn*=0.00, 25%=-2.50, 75%=2.00) conditions, *U*= 124.00, *Z*=0.60, *p*=.592, *r*=.11. The Spillover Effect condition reported a median weight of 168 pounds at baseline (*M*=170.31, *SD*=62.93, 25%=112.50, 75%=217.10) and a median weight of 166 pounds at follow-up (*M*=170.36, *SD*=62.31, 25%=112.50, 75%=215.60). The Focused Components condition reported a median weight of 135 pounds at baseline (*M*=143.15, *SD*=26.72, 25%=121.50, 75%=160.00) and a median weight of 140 pounds at follow-up (*M*=142.31, *SD*=23.23, 25%=125.00, 75%=156.50).

Specifically, in the Spillover Effect condition: 53% maintained their weight from baseline, 29% reduced their weight (between .80 to 6.0 pounds), and 18% increased their

weight (between 1 to 8 pounds). In contrast, of those participants in the Focused Components condition: 38% maintained their weight from baseline, 23% reduced their weight (between 5 to 13 pounds), and 38% increased their weight (between 1 to 5 pounds). See Figure 9 for a visual representation of group differences in weight change.

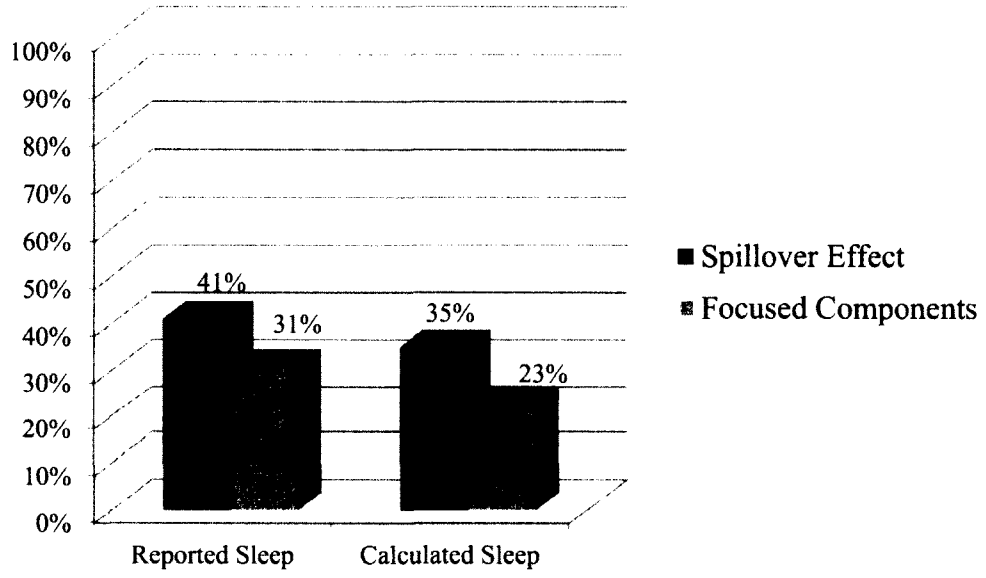

Figure 8. Summary of increases in sleep by condition.

Electronic media hours. At baseline and follow-up, participants were asked to report the number of hours they engaged with various electronic media (e.g., online television, Internet surfing, game consoles, phone/tablet use). No significant change over time was reported between the Spillover Effect (*Mdn*=-5.00, 25%=-12.50, 75%=4.00) and Focused Components (*Mdn*=1.00, 25%=-9.50, 75%=10.00) conditions, *U*= 132.50, *Z*=0.92, *p*=.363, *r*=.17. The Spillover Effect condition reported a median of 20 hours at baseline (*M*=18.18, *SD*=11.97, 25%=8.00, 75%=27.00) and a median of 14 hours at

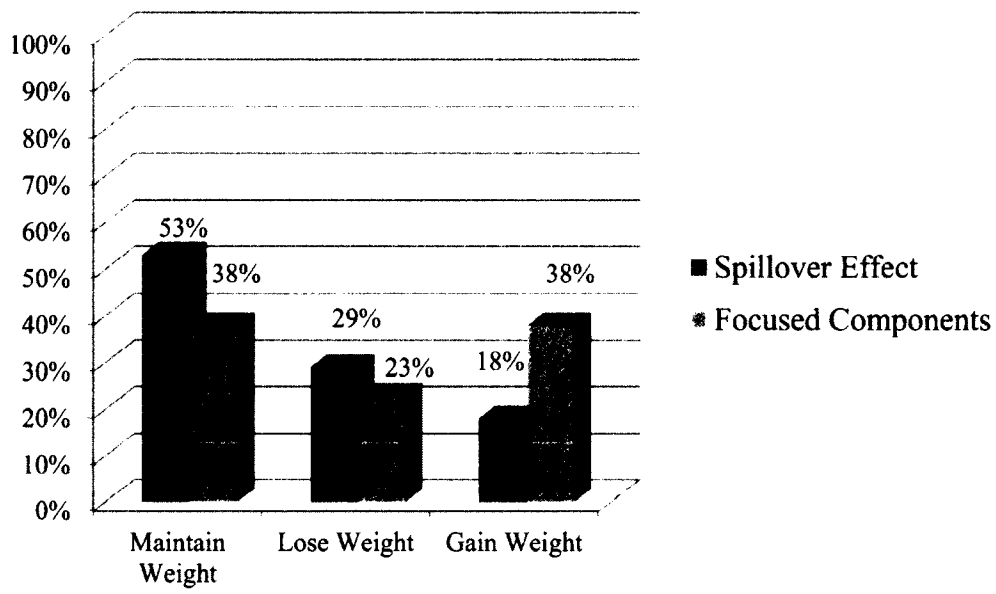

Figure 9. Summary of weight change by condition.

follow-up (*M*=16.18, *SD*=16.05, 25%=5.50, 75%=20.00). The Focused Components condition reported a median of 15 hours at baseline (*M*=21.08, *SD*=22.78, 25%=5.00, 75%=35.00) and a median of 20 hours at follow-up (*M*=19.92, *SD*=16.31, 25%=6.00, 75%=27.50). Despite no significant difference, there was a notable pattern in the Spillover Effect condition, such that: 59% decreased their reported electronic media usage (between 3 to 26 hours), 35% increased their use (between 1 and 63 hours), and 6% remained unchanged. In strong contrast, 62% of Focused Components participants reported an increase in their electronic media usage (between 1 to 18 hours), and only 38% of participants reducing their use (between 1 and 29 hours). See Figure 10 for a visual representation of group differences in electronic media use.

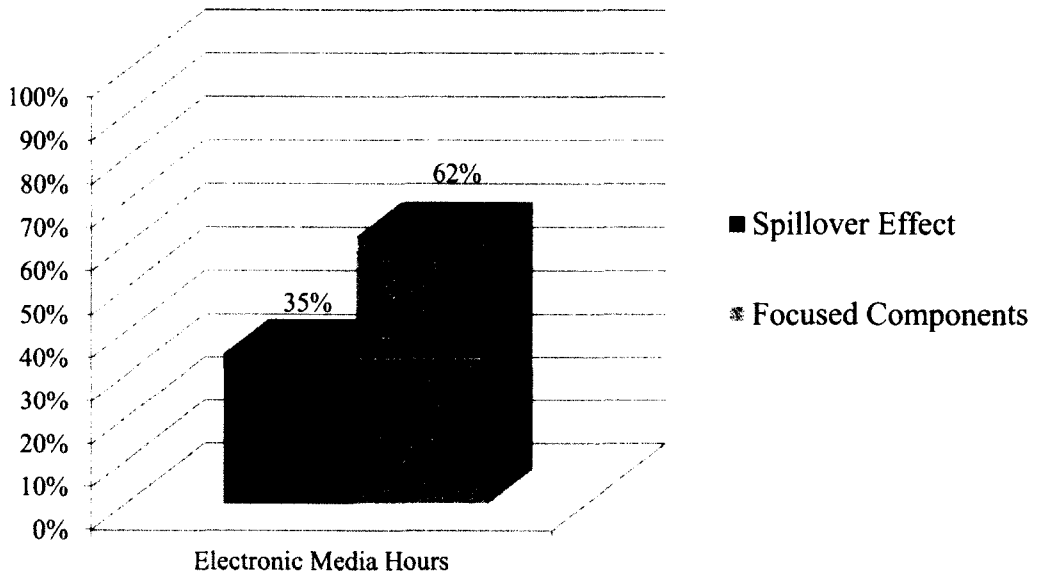

Figure 10. Summary of increases in electronic media hours by condition.

Positive and negative affect. Participants were asked to complete a checklist of the frequency for which they experienced various positive and negative experiences (e.g., cheerful, upset) and behaviors (e.g., active, jittery/shaky). No significant change in positive moods or behaviors over time was reported between the Spillover Effect (*Mdn*=0.21, 25%=0.00, 75%=0.54) and Focused Components (*Mdn*=0.00, 25%=-0.36, 75%=0.71) conditions, U= 92.00, Z=-0.78, p=.457, r=.14. Similarly, no significant change in negative affect over time was reported between the Spillover Effect (*Mdn*=-0.14, 25%=-0.46, 75%=0.29) and Focused Components (*Mdn*=-0.21, 25%=-0.54, 75%=0.18) conditions, U= 96.00, Z=-0.61, p=.563, r=.11. The Spillover Effect condition reported a median of 2.07 positive affect at baseline (*M*=2.12, *SD*=0.73, 25%=1.61, 75%=2.61) and a median of 2.43 positive affect at follow-up (*M*=2.44, *SD*=0.83,

25%=1.93, 75%=2.86). The Focused Components condition reported a median of 2.14 positive affect at baseline (*M*=2.40, *SD*=0.92, 25%=1.86, 75%=3.11) and a median of 2.43 positive affect at follow-up (*M*=2.58, *SD*=1.18, 25%=1.64, 75%=3.79). The Spillover Effect condition reported a median of 0.79 negative affect at baseline (*M*=0.95, *SD*=0.64, 25%=0.54, 75%=1.21) and a median of 0.79 negative affect at follow-up (*M*=0.90, *SD*=0.62, 25%=0.54, 75%=1.21). The Focused Components condition reported a median of 0.93 negative affect at baseline (*M*=0.79, *SD*=0.93, 25%=0.36, 75%=1.21) and a median of 0.50 negative affect at follow-up (*M*=0.58, *SD*=0.44, 25%=0.11, 75%=0.86). Despite no significant differences in positive affect, there was a notable pattern in the Spillover Effect condition, such that 71% of the sample reported an increase in their experience of positive affect (between .14 and 1.57 points out of a maximum of 4 points). In contrast, the Focused Component sample was evenly split between reporting an increase (46%) and a decrease (46%) in the frequency of experiencing positive affect. Although favoring the Focused Components condition, similar proportions of the Spillover Effect (53%) and the Focused Components (62%) samples reported decreases in negative affect. See Figure 11 for a visual representation of group differences in positive and negative affect.

Daily Diary (DD) Sample Hypotheses Testing

To determine whether the conditions reported improvement in outcomes over the study period, the sign test was conducted. Although the sign test does not evaluate magnitude of differences, the test determines whether the median difference indicates significant improvement, decline, or stagnation between the pre and post-intervention

periods (Field, 2009, p. 555). The nonparametric binomial sign test, which assumes a binomial distribution, was assessed as the most

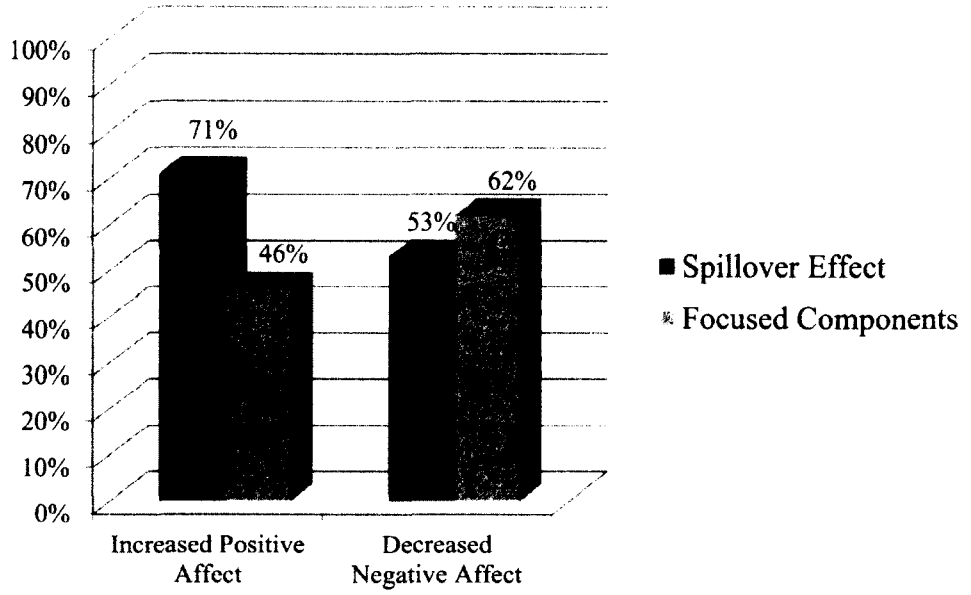

Figure 11. Summary of changes in positive and negative affect by condition.

appropriate analysis to test for significant change between groups with very small samples (n=6 or less; Field, 2009, p. 555). Because the sample size for the daily diary was especially small, assumptions for parametric hypothesis testing were not met. Although repeated measures ANCOVA would have been the preferred analysis, the assumption of sphericity, similar to the homogeneity of variance assumption, was violated and the sample size impaired meeting the normality assumption. In order to create an equal comparison of change, regardless of baseline levels of behaviors, differences between conditions were analyzed with change scores (i.e., follow-up value minus baseline value). Further, given the current small sample size, significance values

from Fisher's exact test were reported. Grissom and Kim (2012) suggest reporting the probability of positive difference scores (number of positive change scores divided by total number of matched pairs) as a measure of effect size for the binomial sign test.

In order to detect significant differences between conditions, the independent samples Kolmogorov-Smirnov test was utilized. This non-parametric test, different from that used to test for normal distribution of data, tests whether two groups are drawn from the same population (Field, 2009, p.548). The Kolmogorov-Smirnov tests the null hypothesis which states that the two samples are drawn from the same population distribution, and examines the absolute maximum difference between the distributions of the two samples (IBM, 2012). In essence, the Kolmogorov-Smirnov test can be more efficiently used in place of the Mann-Whitney test given that it not only examines the difference in the average ranks of the two samples, but also detects differences in the shape of the distributions (Lehman, 2006; StatSoft, 2012). In fact, Lehmann (2006) specifically states that, although the Kolmogorov-Smirnov has less power to detect median differences compared to the Mann-Whitney test, the Kolmogorov-Smirnov test has more power to detect changes in the shape of the distributions. This ability provides a better analytical picture of the effectiveness, rather than relying on the median difference or average rank difference. Furthermore, it is the relatively more powerful method when the condition's sample sizes are less than 30, and also does not require homogenous sample variances (Field, 2009, p. 548). However, when using the Kolmogorov-Smirnov Z-test, it is important to bear in mind the influence of outliers that could result in a large absolute difference between distributions.

Day to day change in model constructs over time. The Spillover Effect condition was hypothesized to report a larger improvement in global self-regulation and self-efficacy compared to the Focused Components and control conditions. To determine whether the Spillover Effect condition reported improvement in self-regulation and self-efficacy between the pre and post-intervention periods, sign tests were conducted. The Spillover Effect condition did not report significant changes in self-regulation between pre and post-intervention time periods, Z=-0.35, p=.727. Within the condition, three participants reported increased change in scores, five reported decreased change in scores, and one participant's scores did not change. Further, the Spillover Effect condition reported no significant change in their self-efficacy from pre to post-intervention, Z=0.00, p=.999. Specifically, self-efficacy reports increased for five participants and decreased for four participants. See Figure 12 for a visual representation of group differences in global self-regulation and self-efficacy. See Tables 5, 6, and 7 for descriptive statistics for changes in study variables by condition (i.e., Spillover Effect, Focused Components, and Control) for the PPD sample.

The Focused Components condition did not report significant changes in self-regulation between pre and post-intervention time periods, Z=0.00, p=.999. Within the condition, three participants reported increased change in scores, and three reported decreased change in scores. On the other hand, although the Focused Components condition reported no significant change in their self-efficacy from pre to post-intervention (Z=1.23, p=.219), five of the six participants reported increases in their self-efficacy score over the study period.

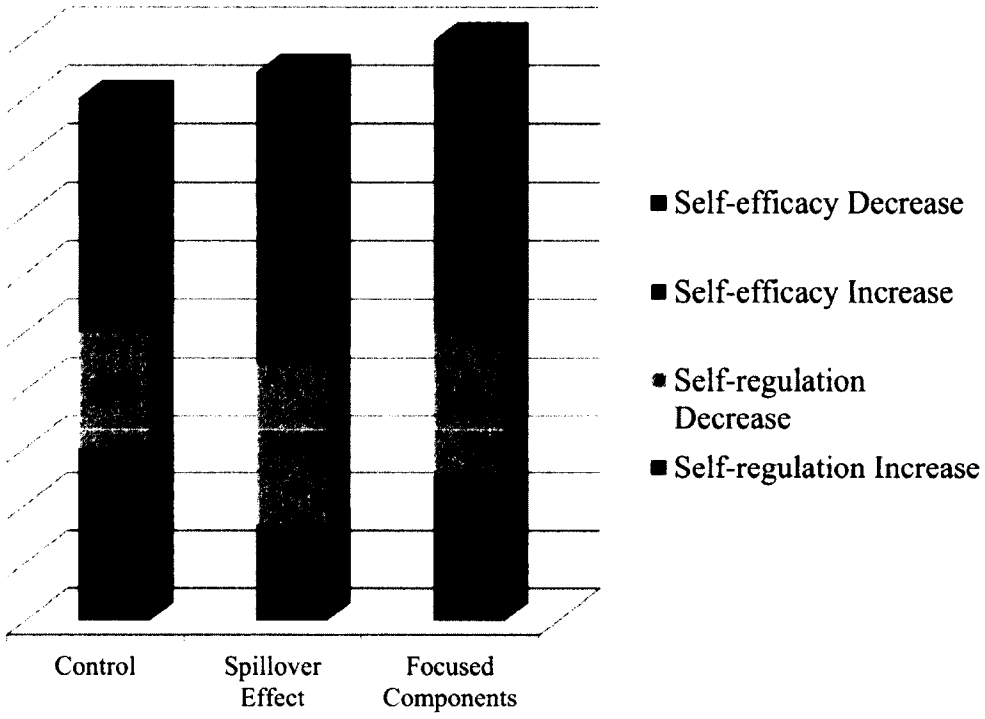

Figure 12. Summary of daily changes in self-regulation and self-efficacy by condition.

The control condition did not report significant changes in self-regulation between pre and post-intervention time periods, Z=0.00, p=.999. In fact, no clear trend was evident; three participants reported increases and two participants reported decreases in global self-regulation. Similarly, the control condition reported no significant change in their self-efficacy from pre to post-intervention (Z=0.00, p=.999); two participants reported increased changes in scores, two participants reported decreased changes in scores, and one participant reported no change in self-efficacy.

Table 5

Daily Diary (DD) Spillover Effect: Descriptive Statistics for Changes in Study Outcomes

	Spillover Effect									
	Baseline					Follow-Up				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Keystone Model Constructs										
Global Self-Regulation	128.03	15.16	124.75	120.19	137.86	124.58	17.83	124.43	109.97	137.47
Self-Efficacy	3.37	0.35	3.49	2.98	3.65	3.24	0.37	3.14	120.19	137.86
Physical Activity										
PAL Weekly Total Physical Activity (mins)	180.46	216.63	93.13	80.18	196.56	132.51	138.15	61.47	27.46	218.63
Weekly Moderate or Vigorous Activity (mins)	81.53	161.40	23.75	17.50	52.19	12.25	13.76	7.06	0.00	23.65
Fruit and Vegetable Consumption										
Fruit Servings	1.31	0.86	1.19	0.61	2.06	1.11	0.71	0.88	0.60	1.71
Fruit Variety	1.19	0.43	1.25	0.93	1.44	0.87	0.37	0.86	0.57	1.06
Vegetable Servings	1.77	1.09	2.00	0.94	2.63	1.18	1.26	0.47	0.23	2.09
Vegetable Variety	2.28	1.91	2.00	1.21	2.88	1.41	0.74	1.77	0.20	1.97

Note. N=9.

Table 6

Daily Diary (DD) Focused Components: Descriptive Statistics for Changes in Study Outcomes

	Focused Components									
	Baseline					Follow-Up				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Keystone Model Constructs										
Global Self-Regulation	115.17	21.67	111.57	97.40	133.24	115.56	21.34	114.87	96.47	132.96
Self-Efficacy	3.32	0.61	3.34	2.80	3.90	3.37	0.62	3.40	2.86	4.00
Physical Activity										
PAL Weekly Total Physical Activity (mins)	67.28	55.02	52.50	26.16	113.33	52.82	59.21	31.10	19.50	76.49
Weekly Moderate or Vigorous Activity (mins)	16.97	17.35	10.36	5.98	29.43	5.41	8.52	0.71	0.00	12.89
Fruit and Vegetable Consumption										
Fruit Servings	0.88	0.93	0.44	0.25	1.79	0.56	0.65	0.41	0.12	0.82
Fruit Variety	0.80	0.69	0.56	0.32	1.36	0.60	0.62	0.42	0.26	0.84
Vegetable Servings	1.39	0.91	1.53	0.41	2.31	1.31	0.62	1.23	0.77	1.88
Vegetable Variety	1.70	1.15	1.46	0.88	2.88	1.57	1.05	1.05	0.86	2.50

Note. N=6.

Table 7

Daily Diary (DD) Control: Descriptive Statistics for Changes in Study Outcomes

	Control									
	Baseline					Follow-Up				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Keystone Model Constructs										
Global Self-Regulation	97.91	16.07	99.00	82.79	112.50	99.29	17.37	99.14	82.74	115.93
Self-Efficacy	2.74	0.31	2.90	2.41	2.99	2.72	0.28	2.69	2.46	3.00
Physical Activity										
PAL Weekly Total Physical Activity (mins)	53.20	24.15	53.57	33.71	72.50	83.19	87.49	53.81	19.57	161.50
Weekly Moderate or Vigorous Activity (mins)	6.71	6.62	4.29	1.07	13.57	0.38	0.85	0.00	0.00	0.95
Fruit and Vegetable Consumption										
Fruit Servings	0.49	0.53	0.29	0.04	1.04	0.43	0.49	0.29	0.14	0.79
Fruit Variety	0.60	0.57	0.57	0.07	1.14	0.53	0.54	0.33	0.15	1.01
Vegetable Servings	1.29	0.85	1.36	0.55	2.00	1.12	0.70	1.04	0.55	1.74
Vegetable Variety	1.86	1.11	1.57	1.00	2.86	1.73	1.45	1.57	0.55	2.98

Note. N=5.

Day to day change in physical activity over time. The Spillover Effect condition was hypothesized to report a greater increase in physical activity behaviors than the Focused Components and control conditions. The Spillover Effect condition reported no significant change in their Physical Activity Log (PAL) total daily minutes of physical activity from pre to post-intervention, Z=-1.33, p=.180. Specifically, two participants increased and seven participants decreased their physical activity. The Spillover Effect condition reported a significant decrease in total minutes engaged in moderate or vigorous physical activity from pre to post-intervention, Z=-2.00, p=.039; eight of the nine participants reported decreased physical activity.

The Focused Components condition reported no significant change in their Physical Activity Log (PAL) total daily minutes of physical activity from pre to post-intervention, Z=-0.69, p=.688. Specifically, two participants increased and four participants decreased their physical activity. Further, the Focused Components condition reported a significant decrease in total minutes engaged in moderate or vigorous physical activity from pre to post-intervention, Z=-2.04, p=.031; all six participants reported decreased physical activity.

The control condition reported no significant change in their Physical Activity Log (PAL) total daily minutes of physical activity from pre to post-intervention, Z=0.89, p=.375. All but one of the five participants increased their physical activity. The control condition reported no significant decrease in total minutes engaged in moderate or vigorous physical activity from pre to post-intervention, Z=-1.50, p=.125; four of the five participants reported decreased physical activity and one reported no change. See Figure 13 for a visual representation of group differences in physical activity.

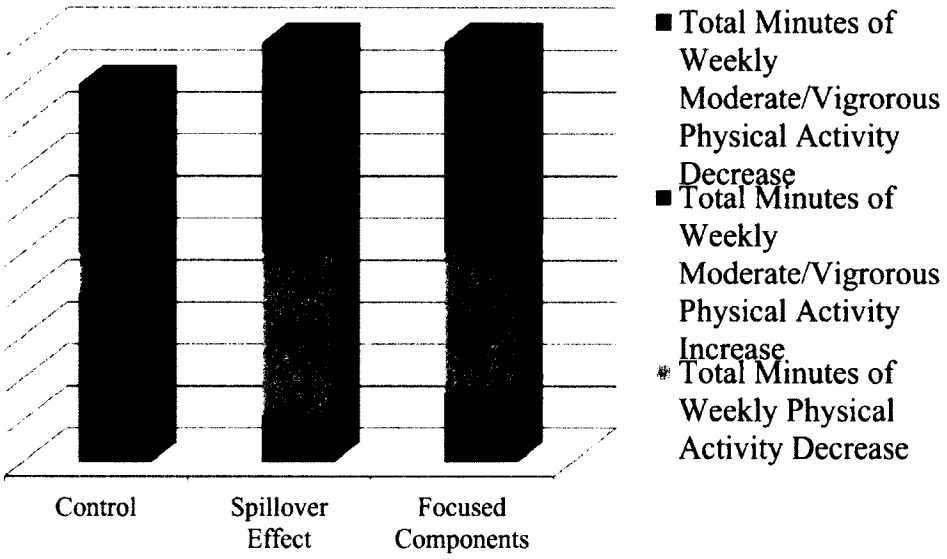

Figure 13. Summary of daily changes in physical activity by condition.

Overall, these results indicate a trend that physical activity decreased over time for all conditions. Specifically, it appears as though both moderate/vigorous exercise and total physical activity decreased. These numbers should be interpreted cautiously as the sample sizes were small and magnitude of change is not taken into account.

Day to day change in fruit and vegetable consumption over time. The Spillover Effect condition was hypothesized to report more improvement in fruit and vegetable consumption than the Focused Components and control conditions. The Spillover Effect condition reported no significant change in their total fruit servings from pre to post-intervention, Z=0.00, p=.999. Specifically, four participants increased, and five participants decreased in their daily servings of fruit. Further, there was no significant difference in number of different fruit consumed, Z=0.00, p=.999, but five participants reported an increase and four reported a decrease in the variety of fruit consumed. Similarly, there was no significant difference in total vegetable servings from

pre to post-intervention, Z=0.00, p=.999. However, four participants reported an increase in vegetable servings, four participants reported a decrease, and one remained constant. Similar to the variety in fruit consumption, the Spillover Effect condition did not report a statistical difference in their variety of vegetable consumption, Z=-1.33, p=.180, with seven participants decreasing and only two participants increasing their variety of vegetables.

The Focused Components condition reported no significant change in their total fruit servings (Z=0.00, p=.999) or variety of fruits consumed (Z=0.00, p=.999) from pre to post-intervention. Among those in the Focused Components condition, three participants increased and three participants decreased their servings and variety of fruits. Additionally, the amount (Z=-0.41, p=.688) and variety (Z=0.00, p=.999) of vegetable consumption reported evidenced no significant change over the study period. Although there was an even split (n=3) between participants increasing or decreasing their vegetable servings consumption, only two participants increased their variety of vegetables compared to four participants decreasing their variety across the time period.

The control condition reported no significant change in their fruit servings (Z=0.00, p=.999) or variety of fruits consumed (Z=0.00, p=.999) over time. Of the five control participants, two participants increased, one participant decreased, and two participants reported no change in their fruit servings over time. One participant increased variety of fruit consumption, but two decreased and two reported no change. No significant difference was evidenced for change in the amount (Z=0.00, p=.999) or variety (Z=-0.50, p=.625) of vegetable consumption across the study period. Two participants increased and three participants decreased their vegetable servings. Similarly,

only one participant reported an increase in vegetable consumption variety, whereas three participants reported decreases in vegetable consumption and one remained unchanged. See Figure 14 for a visual representation of group differences in fruit and vegetable consumption.

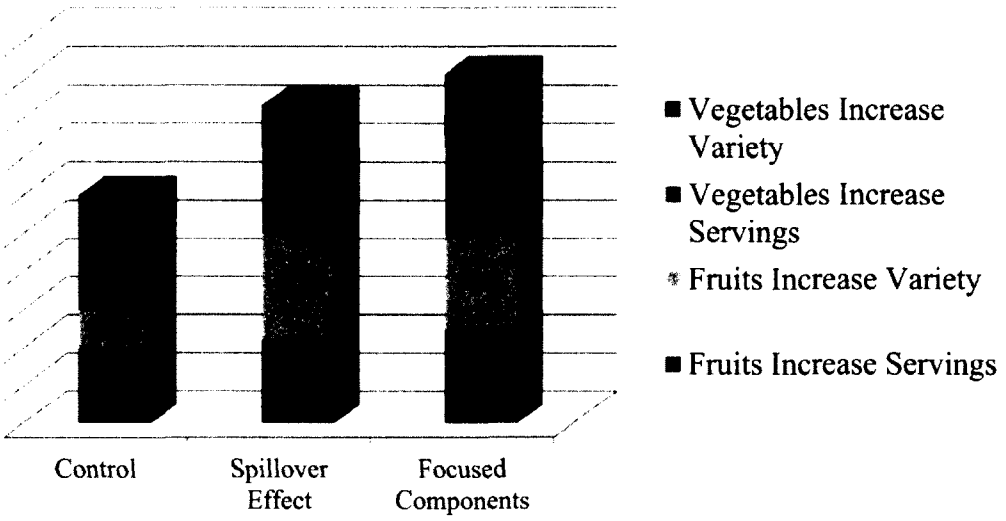

Figure 14. Summary of daily changes in fruit and vegetable consumption by condition.

Overall, there were no significant change between conditions in fruit and vegetable conditions. However, it appears that the intervention conditions reported more participants increasing fruit variety; specifically, the Focused Components condition reported the greatest proportion of participants increasing vegetable variety.

Day to Day Change in Strategy Use Over Time. The Spillover Effect condition was hypothesized to report more strategy use from the intervention training techniques than the Focused Components condition. No significant differences were found in use of

implementation intention (i.e., "If-Then") strategy use for physical activity (Z=0.84, p=.476, *Most Extreme Difference*=0.44), fruit consumption (Z=0.42, p=.994, *Most Extreme Difference*=0.22), vegetable consumption (Z=0.42, p=.994, *Most Extreme Difference*=0.22), or in general daily life (Z=0.42, p=.994, *Most Extreme Difference*=0.22), between the Spillover Effect and focused component conditions. However, the implementation intention differences were in favor of the Spillover Effect condition reporting more use of "If-Then" strategies for these specific health behaviors with the exception of "general" use of the strategy outside of these specific health behaviors. No significant difference was found between the conditions' distributions of implementation intention use for the collective set of health behaviors (Z=0.42, p=.994, *Most Extreme Difference*=0.22), but the means indicated the Spillover Effect reported greater use of this self-regulation strategy. See Table 8 in reference to descriptive statistics of strategy use between the Spillover Effect and Focused Components intervention conditions.

The distribution difference between conditions in the use of the visualization strategy for physical activity was significant (Z=1.48, p=.026, *Most Extreme Difference*=0.78), with the difference in favor of the Spillover Effect condition. No significant differences between the Spillover Effect and focused component conditions' distributions were found in visualization use for fruit consumption (Z=0.32, p=.999, *Most Extreme Difference*=0.17), vegetable consumption (Z=0.95, p=.329, *Most Extreme Difference*=0.50), or in general daily life (Z=0.63, p=.819, *Most Extreme Difference*=0.33). However, examination of the means revealed that the Focused Components reported higher use of the visualization strategy for fruit and vegetable

consumption, and in general daily life outside of these specific health behaviors. No significant difference was found between the conditions' distributions for the use of visualization strategy collectively for the set of health behaviors (Z=0.53, p=.944, *Most Extreme Difference*=0.28), but the means indicated the Focused Components condition reported greater use of this self-regulation strategy.

No significant differences between the Spillover Effect and focused component conditions' distributions were found in mindfulness use for physical activity (Z=0.63, p=.819, *Most Extreme Difference*=0.33), fruit consumption (Z=0.42, p=.994, *Most Extreme Difference*=0.22), vegetable consumption (Z=0.53, p=.994, *Most Extreme Difference*=0.28), or in general daily life (Z=0.63, p=.819, *Most Extreme Difference*=0.33). Examination of the means revealed that the Spillover Effect condition reported higher use of the mindfulness strategy for exercise and fruit consumption, whereas the Focused Components reported higher use of mindfulness for vegetable consumption, and in general daily life outside of these specific health behaviors. No significant difference was found between the conditions' distributions for the use of the mindfulness strategy collectively for the set of health behaviors (Z=0.42, p=.994, *Most Extreme Difference*=0.22), but the means indicated the Focused Components condition reported greater use of this self-regulation strategy.

No significant differences between the Spillover Effect and focused component conditions' distributions were found in use of positive words for physical activity (Z=0.63, p=.819, *Most Extreme Difference*=0.33), fruit consumption (Z=0.84, p=.476, *Most Extreme Difference*=0.44), vegetable consumption (Z=1.05, p=.216, *Most Extreme Difference*=0.56) , or in general daily life (Z=0.84, p=.476, *Most Extreme*

Table 8

Daily Diary (DD): Strategy Use Adherence by Intervention Condition

	Spillover Effect					Focused Components				
	M	*SD*	*Mdn*	25%	75%	*M*	*SD*	*Mdn*	25%	75%
Implementation Intentions										
Physical Activity	0.20	0.16	0.19	0.09	0.28	0.14	0.17	0.10	0.00	0.26
Fruit Consumption	0.07	0.14	0.00	0.00	0.11	0.04	0.05	0.03	0.00	0.09
Vegetable Consumption	0.05	0.08	0.00	0.00	0.09	0.05	0.08	0.00	0.00	0.15
General Life	0.78	0.16	0.81	0.66	0.91	0.79	0.15	0.78	0.67	0.93
Any Targeted Health Behavior[1]	0.32	0.31	0.29	0.09	0.47	0.23	0.17	0.25	0.07	0.38
Visualization										
Physical Activity	0.21	0.12	0.21	0.15	0.24	0.09	0.04	0.09	0.05	0.13
Fruit Consumption	0.05	0.06	0.05	0.00	0.09	0.09	0.15	0.03	0.00	0.17
Vegetable Consumption	0.07	0.10	0.05	0.00	0.12	0.18	0.12	0.15	0.08	0.28
General Life	0.78	0.15	0.76	0.74	0.87	0.83	0.12	0.85	0.70	0.93
Any Targeted Health Behavior[1]	0.34	0.22	0.33	0.16	0.53	0.36	0.29	0.28	0.16	0.57
Mindfulness										
Physical Activity	0.22	0.22	0.14	0.06	0.42	0.15	0.11	0.15	0.07	0.26
Fruit Consumption	0.16	0.19	0.05	0.00	0.39	0.13	0.18	0.03	0.00	0.36
Vegetable Consumption	0.16	0.22	0.05	0.00	0.32	0.18	0.15	0.17	0.04	0.32
General Life	0.78	0.15	0.76	0.74	0.87	0.83	0.12	0.85	0.70	0.93
Any Targeted Health Behavior[1]	0.33	0.29	0.16	0.08	0.66	0.34	0.26	0.29	0.11	0.60
Use of Positive Words										
Physical Activity	0.30	0.18	0.32	0.17	0.45	0.24	0.20	0.19	0.08	0.48
Fruit Consumption	0.18	0.20	0.10	0.00	0.40	0.22	0.21	0.11	0.09	0.40
Vegetable Consumption	0.15	0.22	0.00	0.00	0.28	0.27	0.16	0.30	0.09	0.38
General Life	0.77	0.18	0.76	0.61	0.93	0.62	0.23	0.66	0.42	0.80
Reduce Negative Words										
Physical Activity	0.23	0.23	0.14	0.06	0.40	0.15	0.12	0.10	0.08	0.22
Fruit Consumption	0.10	0.20	0.00	0.00	0.15	0.05	0.06	0.05	0.00	0.11
Vegetable Consumption	0.09	0.20	0.00	0.00	0.11	0.15	0.16	0.10	0.00	0.32
General Life	0.83	0.19	0.88	0.80	0.94	0.84	0.13	0.84	0.73	0.96

Note. [1]Any Targeted Health Behavior included physical activity, fruit consumption, and vegetable consumption. Spillover Effect (*N*=9). Focused Components (N=6).

Difference=0.44).Examination of the means revealed that the Spillover Effect condition reported higher use of the positive words strategy for exercise and in general daily life outside of these specific health behaviors. The Focused Components reported higher use of positive words for fruit and vegetable consumption.

No significant differences were found between the Spillover Effect and Focused Components conditions' distributions for the reduction of negative words related to physical activity (Z=0.63, p=.819, *Most Extreme Difference*=0.33), fruit consumption (Z=0.42, p=.994, *Most Extreme Difference*=0.22), vegetable consumption (Z=0.84, p=.476, *Most Extreme Difference*=0.44), or in general daily life (Z=0.63, p=.819, *Most Extreme Difference*=0.33). The means revealed that the Spillover Effect condition reported higher use of the negative word reduction strategy related to exercise and fruit consumption. In comparison, the Focused Components reported higher use of negative word reduction strategy for vegetable consumption, and in general daily life outside of these specific health behaviors.

Day to day change in health-related outcomes over time. The Spillover Effect condition was hypothesized to report more improvement in health-related outcomes over time, such as sleep, experience of negative thinking, and positive/negative health symptoms, compared to the Focused Components and control conditions.

Sleep. Based on reported sleep and rise times in daily diary survey, the calculated total minutes of sleep reported by the Spillover Effect condition significantly increased between baseline and follow-up points (Z=2.00, p=.039); eight of the nine participants reported increases in sleep across the 30 days. The Focused Components condition did not report a significant change in sleep across the 30 days (Z=-0.41, p=.688); four

participants reported decreases in sleep, and two participants reported increases in sleep. All participants in the control condition reported decreases in their sleep over thirty days (Z=-1.79, p=.062). See Figure 15 for a visual representation of group differences in sleep. The Spillover Effect condition reported a median of 8.04 hours of sleep before the intervention (M=7.74, SD=0.84, 25%=7.19, 75%=8.43), and a median of 8.48 of sleep after the intervention (M=8.35, SD=0.84, 25%=7.64, 75%=9.18). The Focused Components condition reported a median of 8.39 hours of sleep prior to the intervention (M=8.50, SD=1.15, 25%=7.74, 75%=9.16), and a median of 8.52 hours of sleep after the intervention (M=8.77, SD=1.02, 25%=7.81, 75%=9.84). The control condition reported a median of 8.21 hours of sleep during the first week (M=8.09, SD=0.58, 25%=7.55, 75%=8.56), and a median of 7.61 hours of sleep after the first week (M=7.61, SD=0.66, 25%=7.08, 75%=8.13).

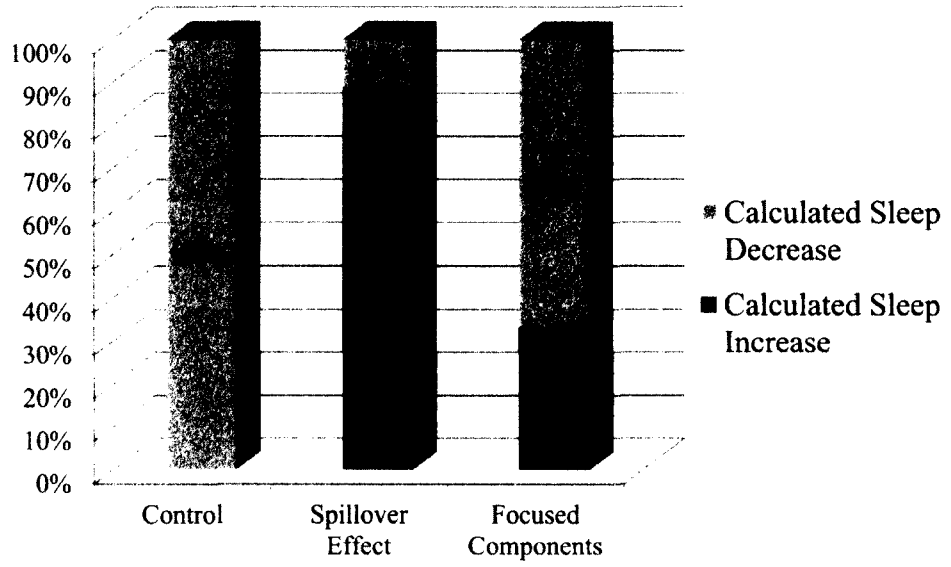

Figure 15. Summary of daily changes in calculated sleep by condition.

Positive and negative affect. The Spillover Effect condition was hypothesized to report more improvement in positive and negative affect than the Focused Components and control conditions. The Spillover Effect condition reported no significant change in positive affect, Z=0.00, p=.999. Specifically, five participants reported an increase in positive affect, and four participants reported a decrease in positive affect. On the contrary, the Spillover Effect reported a significant decrease in negative affect (Z=-2.00, p=.039) such that eight of the nine participants reported reduced negative affect, and only one participant reported an increase in negative affect.

The Focused Components condition reported no significant change in positive affect (Z=0.00, p=.999); two participants reported an increase in positive affect, three participants reported a decrease in positive affect, and one participant reported no change. Similar to the Spillover effect, participants in the Focused Components reported a significant decrease in negative affect (Z=-2.04, p=.031) such that all six participants reported reduced negative affect.

Although the control condition participants reported no significant change in positive affect (Z=-0.89, p=.375), unlike the intervention conditions, the majority of the participants (n=4) reported a decrease in positive affect compared to only one participant who reported an increase in positive affect. Moreover, the control condition participants reported no significant change in negative affect (Z=0.00, p=.999); two participants reported an increase in negative affect, and three participants reported decreases in negative affect. See Figure 16 for a visual representation of group differences in positive and negative affect.

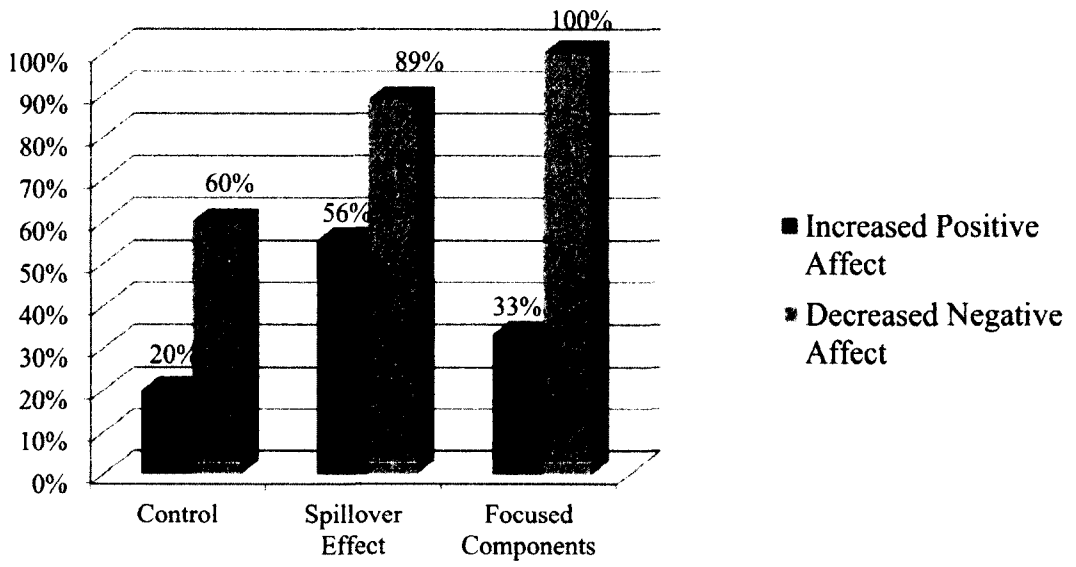

Figure 16. Summary of daily changes in positive and negative affect by condition.

Despite no significant differences in positive affect, there was a notable pattern in which more participants in the Spillover Effect (56%) and Focused Components (33%) conditions reported an increase in positive affect than the control condition (20%). Similarly, participants in the Spillover Effect (89%) and Focused Components (100%) conditions reported significant decreases in negative affect compared to no significant change for participants in the control condition (60%).

Day to day changes between intervention and control conditions. To test whether differences were reported between participants in the Spillover Effect and Focused Components conditions compared to participants in the control condition, a series of independent samples Kolmogorov-Smirnov tests were conducted. The Spillover Effect and Focused Components conditions (n= 15, Mdn=-0.29, M=-1.92, SD=5.74, 25%= -3.75, 75%=0.76) did not report significantly different changes compared to the control participants (n=5, Mdn=0.14, M=1.38, SD=6.91, 25%= -4.70, 75%=8.07) in

regard to self-regulation, Z=0.78, p=.586, *Most Extreme Difference*=0.40. Similarly, for self-efficacy, participants in the Spillover Effect and Focused Components conditions (n=15, *Mdn*=0.01, M=-0.05, SD=0.30, 25%= -0.24, 75%=0.09) did not report significantly different changes compared to the control participants (n=5, *Mdn*=0.00, M=-0.02, SD=0.20, 25%= -0.17, 75%=0.12), Z=0.52, p=.952, *Most Extreme Difference*=0.27.

For total daily minutes of physical activity reported in the Physical Activity Log (PAL), participants in the Spillover Effect and Focused Components conditions (n= 15, *Mdn*=-11.39, M=-34.55, SD=91.19, 25%= -70.95, 75%=10.22) did not report significantly different changes over time compared to the control participants (n=5, *Mdn*=7.86, M=29.99, SD=77.19, 25%= -17.95, 75%=89.00), Z=1.03, p=.236, *Most Extreme Difference*=0.53. Similarly, participants in the Spillover Effect and Focused Components conditions (n= 15, *Mdn*=-19.91, M=-46.19, SD=118.65, 25%= -25.71, 75%=-7.94) did not report significantly different changes over time in total minutes engaged in moderate or vigorous physical activity compared to the control participants (n=5, *Mdn*=-4.29, M=-6.33, SD=6.33, 25%= -12.62, 75%=-1.07), Z=1.03, p=.236, *Most Extreme Difference*=0.53.

For fruit serving consumption, participants in the Spillover Effect and Focused Components conditions (n= 15, *Mdn*=-0.05, M=-0.07, SD=0.54, 25%= -0.44, 75%=0.33) did not report significantly different changes over time compared to the control participants (n=5, *Mdn*=0.00, M=-0.05, SD=0.30, 25%=-0.28, 75%=0.15), Z=0.65, p=.799, *Most Extreme Difference*=0.33. Similarly, participants in the Spillover Effect and Focused Components conditions (n= 15, *Mdn*=0.05, M=-0.06, SD=0.46, 25%= -0.48,

75%=0.17) did not report significantly different changes over time in fruit variety compared to the control participants (*n*=5, *Mdn*=0.00, *M*=-0.07, *SD*=0.37, 25%= -0.40, 75%=0.23), *Z*=0.65, *p*=.799, *Most Extreme Difference*=0.33. For vegetable serving consumption, participants in the Spillover Effect and Focused Components conditions (*n*= 15, *Mdn*=0.00, *M*=-0.13, *SD*=0.50, 25%= -0.65, 75%=0.10) did not report significantly different changes over time compared to the control participants (*n*=5, *Mdn*=-0.12, *M*=-0.17, *SD*=0.43, 25%= -0.58, 75%=0.21), *Z*=0.39, *p*=.998, *Most Extreme Difference*=0.20. Similarly, participants in the Spillover Effect and Focused Components conditions (*n*= 15, *Mdn*=-0.36, *M*=-0.33, *SD*=0.50, 25%= -0.74, 75%=0.05) did not report significantly different changes over time in vegetable variety compared to the control participants (*n*=5, *Mdn*=-0.07, *M*=-0.13, *SD*=0.49, 25%= -0.56, 75%=0.26), *Z*=0.65, *p*=.799, *Most Extreme Difference*=0.33.

For reported sleep, participants in the Spillover Effect and Focused Components conditions (*n*= 15, *Mdn*=0.29, *M*=0.47, *SD*=0.90, 25%= -0.23, 75%=0.84) did not report significantly different changes over time compared to the control participants (*n*=5, *Mdn*=-0.53, *M*=-0.48, *SD*=0.26, 25%=-0.72, 75%=-0.21), *Z*=1.42, *p*=.035, *Most Extreme Difference*=0.73. In contrast, participants in the Spillover Effect and Focused Components conditions (*n*= 15, *Mdn*=0.00, *M*=0.07, *SD*=0.25, 25%= -0.05, 75%=0.24) reported significantly different changes over time in positive affect compared to the control participants (*n*=5, *Mdn*=-0.22, *M*=-0.20, *SD*=0.29, 25%= -0.43, 75%=0.04), *Z*=1.42, *p*=.035, *Most Extreme Difference*=0.73. Lastly, participants in the Spillover Effect and Focused Components conditions (*n*= 15, *Mdn*=-0.04, *M*=-0.12, *SD*=0.19, 25%= -0.12, 75%=-0.03) did not report significantly different changes over time in

negative affect compared to the control participants (n=5, *Mdn*=-0.03, *M*=-0.17, *SD*=0.41, 25%=-0.58, 75%=0.17), Z=0.78, p=.586, *Most Extreme Difference*=0.40.

Overall, the Kolmogorov-Smirnov tests indicated no significant differences between the intervention and control groups. However, looking at trends in the data, the control group participants were more likely to increase their total daily physical activity, but not moderate or vigorous physical activity, compared to the intervention conditions. Participants in the intervention conditions were more likely to report better sleep and improvement in positive affect compared to the control condition.

CHAPTER IV

DISCUSSION

The U.S. continues to struggle with the prevention of lifestyle-related diseases and deaths caused by health behaviors that are amenable to change, such as poor diet, sedentary lifestyle, and alcohol use (CDC, 2012a; Mokdad et al., 2004; Pronk et al., 2004). The current study aimed to simultaneously address these lifestyle behaviors in a young adult, university student population. The specific goals of the current research were to examine the efficacy of the Spillover Effect as an approach to promote multiple health behavior change compared to the traditional Focused Components approach which has dominated the multiple health behavior change literature (Hyman et al., 2007; Prochaska et al., 2008c; Rosenberg et al., 2007). Additionally, an important aim of the study was to further develop the literature concerning the optimal theoretical framework for which multiple health behavior change is to be understood. To meet this aim, the Keystone Model was developed to address a limited number of key constructs (i.e., self-regulation supplemented with reduced impulsivity and bolstered with self-efficacy) for successful behavior change. From the theoretical Keystone Model to the Spillover Effect approach itself, the consistent theme in the current research was parsimony in multiple health behavior change in order to encourage participants' successful behavior change and potentially demonstrate that less is more when it comes to intervention programming.

Overview of Findings and Trends in the Data

Trends in descriptive statistics are discussed given the caveat that the generalizability and stability of the results are limited due to the sample size. It is difficult to determine whether the non-significant differences simply reflect the underpowered

nature of the analyses. Given the restricted power in the current study, failing to find significant differences between conditions on study outcomes does not demonstrate that the interventions are equivalent in their effectiveness. However, even given small sample sizes, the overarching trends indicated the Spillover Effect tended to demonstrate similar or more positive performance in the various health-related behaviors and outcomes compared to the Focused Components condition. Although the sample is not sufficient to make strong claims, examining the descriptive statistics of the different conditions in both the pre-post design PDD and the daily diary (DD) samples demonstrates the intervention may have had a beneficial effect on the targeted health behaviors (e.g., exercise) as well as secondary health-related behaviors like sleep and electronic media use.

In general, the majority of the hypotheses stating that the Spillover Effect approach would outperform the Focused Components approach were not statistically supported. However, more subjects in the Spillover Effect condition, reported improvements from baseline to follow-up in many of the study outcomes as compared to the Focused Component condition. For instance, the Spillover Effect condition reported more improvement in global self-regulation, exercise self-regulation, eating self-regulation, and self-efficacy compared to the Focused Components condition. Changes in impulsivity between the conditions in the PPD analyses demonstrated greater improvement in lack of perseverance and lack of premeditation for the Spillover Effect compared to the Focused Component condition. In contrast, the Spillover Effect condition reported a greater increase in positive urgency and sensation seeking compared to the Focused Component condition in the PPD sample. Moreover, the Spillover Effect

condition reported more improvement in aerobic exercise, fruit servings, vegetable servings, and variety of vegetables consumed compared to the Focused Components condition. A larger percentage of the Spillover Effect condition reported weight loss or weight maintenance compared to the Focused Components condition. Moreover, a greater decrease in sleep was reported in the Focused Components condition compared to the Spillover Effect condition. The Spillover Effect condition even reported a greater decrease in hours of electronic media use compared to the Focused Components condition. An unexpected finding was the increase in positive urgency and sensation seeking over time for the Spillover Effect condition. In previous research, positive urgency has been associated with higher engagement in behaviors like illegal drug use and risky sexual behavior (Zapolski, Cyders, & Smith, 2009), and compulsive buying (Rose & Segrist, 2014). Additionally, sensation seeking has been found to be negatively related to both aerobic exercise class engagement (Babbitt, Rowland, & Franken, 1990a), and preoccupations about body weight (Babbitt, Rowland, & Franken, 1990b).

Analysis of the daily diaries revealed that a greater portion of the Focused Component condition improved self-efficacy, vegetable variety, and vegetable servings compared to the other conditions. The daily diaries also revealed a greater proportion of Spillover Effect participants reported increases in fruit variety, sleep, and positive affect. Although in general, group differences between the Spillover Effect and Focused Components conditions revealed no statistically significance, trends provide some support for the Spillover Effect method meeting or exceeding the benefit provided by the Focused Components approach.

Relation to Existing Literature

One of the primary aims of the current research study was to meaningfully increase exercise duration and frequency in young adults. However, the techniques that have demonstrated large success with other college student populations (Stadler et al., 2009), such as the self-regulation techniques used in the current study, did not demonstrate the same effect sizes. Specifically, Stadler et al. (2009) found that an intervention that combined mental contrasting and implementation intentions resulted in weekly exercise increases twice that of the control group. One reason why this may not have been replicated in the current study could be due to the fact that the current study's control group in the daily diary study received, in effect, a self-monitoring intervention as they were required to report daily on their health-related behaviors. This self-monitoring effect may explain why participants receiving the intervention did not report a significantly large difference in weekly exercise compared to the control group.

In contrast, several findings were consistent with previous research. In the present study, no noticeable changes in self-efficacy occurred over the study period in any of the conditions for either the PDD or DD samples. The lack of significant change in self-efficacy is similar to Guillaumie et al. (2012) who also found no significant change in self-efficacy for an intervention condition utilizing implementation intentions and self-efficacy intervention from pre to post intervention periods. The lack of statistically significant or meaningful change in self-efficacy in either of the current study's intervention conditions may indicate one of several possible causes; first, the self-efficacy strategies or training were not effective. Second, given that this is a young adult population, they may have experienced the optimism bias effect. Consequently, at the

onset of the study they reported a high self-efficacy, that is, they believed that they had better control and ability to make the desired health behavior changes. However, after participating in the study, they were more aware of their ability to change their behaviors, that is, their self-efficacy was more accurate. This explanation was partially evident in the case of sleep, in which some young adults believed they were getting more sleep that they actually did. Lastly, the non-significant finding could be due to the measurement of self-efficacy. The current study only assessed global self-efficacy, but just as with self-regulation, it may be important to assess self-efficacy specific to the target behaviors to determine potential changes (e.g., exercise self-efficacy).

In regard to the completion rate of the study, Schulz (2012) reported that the non-completion rate was higher in the simultaneous condition that in the sequential condition. In other words, the condition in which participants received more intervention materials for multiple health behaviors experienced a higher non-completion rate as compared to a condition that received one health behavior intervention at a time. Similarly, this may have occurred for the current sample. In the current study, the non-completion rate was higher among the Focused Components (n=12) as compared to the Spillover Effect conditions (n=8) condition. Further, the average number of days completed in the daily diary sample was higher for the Spillover Effect sample (M=19, SD=4.27, Mdn=19) than the Focused Components sample (M=16.83, SD=5.85, Mdn=19.5). Additionally, the control condition completed an average number of days less than both interventions conditions (M=10.4, SD=6.43, Mdn=10).

Limitations

Although the current study provides the groundwork for advancing research on identifying important ways in which the Spillover Effect and focused component approaches to multiple behavior change, there were several factors that limited the reach of the current study's potential findings. The most critical, and far-reaching, factor in the current research was attrition and the resulting limited sample size. Several factors may have attributed to the attrition from initial pre-screen survey completion including: 1) the autonomous motivation to stay engaged in a study with two "one-hour" surveys to complete; 2) the 30 day window and multiple time points (prescreen, baseline, follow-up, daily) may have contributed to lost interest and/or decreased motivation; 3) time commitment conflicts with other priorities particularly for those respondents in which the follow-up survey took place during the middle or end of an academic semester; and 4) the online nature of the study may not have been engaging or lack of a personal connection (e.g., one-to-one correspondence with the participants, ongoing training, or a personal coach) may have hindered commitment. In fact, a study of young adults completing a 10-week weight loss program, with a self-regulation framework, that consisted of weekly in-person meetings reported 93% and 88% retention rates for ten and twenty week follow-up assessments; the majority of these participants (88%) were women which may have influenced study retention. On the contrary, these same participants provided feedback indicating support for a hybrid program reducing in-person requirements and increasing online format availability; additionally, participants had expressed desire for a shorter time-frame of intervention (LaRose, Gorin, & Wing, 2009). Regardless of the specific

period of time, adding an intervention booster may lead to improved intervention potency (Chapman & Armitage, 2010), better recall of strategies, and reduced attrition.

The small number of participants in the pre-post design and daily diary method samples caused violations of parametric assumptions for hypothesis testing, and limited the ability to analyze the research questions with more powerful and parsimonious analyses. Bootstrapping (Efron, 1979) is a statistical procedure that randomly resamples values from an original set of data in order to create new samples of data, typically a few thousand, which taken together can be used to estimate the sampling distribution (Varian, 2005). Despite the many benefits of bootstrapping, its application to this data was not feasible given such few cases in the primary samples (PPD and DD samples). Given these limitations, non-parametric analyses were selected, especially in consideration of the small sample. Notably, participants' self-selection into the study may have yielded a biased sample that is unrepresentative of the typical college student population. Additionally, given that participants self-selected into the behavior change research, many did not consume alcohol which limited the application of the model and approach comparisons in this targeted behavior. Given the exploratory nature of the analyses and the emphasis on effect size interpretation, rather than significance, alpha corrections were not applied.

The majority of interested participants at baseline were women. Women may have been more ready for change compared to their male counterparts given gender differences in health attitudes and behaviors noted in previous research. For instance, women between the ages of 19 and 25 are more likely than men to have a regular health care provider, and to have visited the doctor in the past twelve months (Kirzinger, Cohen, &

Gindi, 2012). In comparison to women, a meta-analysis of 150 studies (collective sample of 100,000 participants; Byrnes, Miller, & Schafer, 1999) found that men were more likely to engage in a variety of risky behaviors (e.g., drinking, sexual activities, driving). Moreover, one study found that 46% of men were significantly more likely to agree with the statement, "I don't worry about food, I just eat what I like," compared to only 27% of women (Beardsworth, Brynan, Keil, Good, Haslam, & Lancashire, 2002, p. 478). A study of college students, between the ages of 18 and 30, found the negative correlation between intrinsic exercise motivation (e.g., exercise for fun) and exercise amotivation (e.g., exercise has no value); p. 234) was twice as large for women compared to men (Daley & Duda, 2006); this reflects that women's feelings of challenge or enjoyment from exercise has a stronger inverse relation to exercise amotivation compared to men.

The tendency for women to take part in the study may reflect that women are more health conscious of their weight than men (Aruguete, Yates, & Edman, 2006; Girz et al., 2013). In recent longitudinal research following college students across four years of undergraduate education, female college students reported a greater level of preoccupation with eating behaviors and weight compared to men (Girz et al., 2013), which is not surprising given the social norms and pressure for women to meet cultural norms of beauty (e.g., Strahan, Wilson, Cressman, & Buote, 2006). Furthermore, eating attitudes of college men who gained weight did not differ initially, or in the fourth year, from other college men who did not gain weight (Girz et al., 2013); this gender difference in making healthy eating choices may highlight critical cognitive differences in how men and women react to the priority of thinness in American culture ("culture of slimness"; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). For instance, Aruguete et al.

(2006) found that female college students tend to internalize body dissatisfaction through food restriction as compared to men who tend to externalize by expressing their dislike of overweight/obese people.

Future Directions

Based on previous literature and current findings, research stemming from this study should examine the effect of using different behaviors as the primary behaviors targeted for the spillover effect. Exercise was chosen in this study for its far-reaching psychological and physical benefits (CDC, 2011b). Additionally, the efficacy of the intervention across the age span may demonstrate that middle age and older adults benefit more from the interventions as they may have more life experience of health issues that prompt an increased saliency for them to take health behavior changes more seriously. Fear appeal (Lennon & Rentfro, 2010) and appeal to appearance and physical body changes (LaRose, Leahey, Hill, & Wing, 2013) may promote behavior change willingness in youth and young adults. Conversely, for children and adolescents, learning self-regulation skills specific to the targeted health behaviors may be a fruitful application of the intervention. Specifically, when considering coping mechanisms, children and adolescents tend to use problem-focused earlier, as early as preschool years, compared to emotion-focused approach given their developmental stage (Compas, Worsham, & Ey, 1992); learning practical self-regulation behaviors and strategies would be conducive to a problem-focused coping approach extended to obesity and health-related behaviors.

In selecting participants for intervention, willingness to change may be considered either a leading (e.g., participants are already willing to change) or lagging (e.g.,

participants do not start intervention with willingness to change) factor. Ideally, for optimal behavior change results, people should express a willingness to change. In the current study, all participants in the current study indicated that they were "willing" or "very willing" to change their health behaviors. Subsequent research should also attempt to include the Transtheoretical Model's readiness to change stages as inclusionary criteria or as a control factor as willingness may not translate into "preparation" or "action" stage. Furthermore, when examining willingness as a factor of behavior change, interventionists could recruit participants that report strong willingness to change from gyms and fitness centers to examine goals related to intensity and endurance of physical activity instead of only frequency of exercise.

On the other hand, research should intervene on populations that may not initially identify as willing to change given that there may be external motivational factors involved to encourage change. For example, companies with an aim of improving employee health and reducing employees' medical costs could benefit from the current intervention given that employees have a willingness to change and/or whether employers offer incentives such as reduced insurance premiums for participating in behavior change interventions. In the application of a multiple health behavior change intervention, willingness is an important factor; however, it is possible to provide an intervention to people that do not yet identify as willing to change in the hope that their interest in sparked by the potential intrinsic health benefits, extrinsic rewards, or ease of strategy use.

Additionally, the current application of the intervention made the, perhaps incorrect, assumption that young adults were knowledgeable about dietary guidelines,

and instead focused on translating goals of healthy eating into action for healthy eating. However, research has shown that dietary guidelines may not be universal knowledge among college students (Holden, Pugh, Norrell, & Keshock, 2014), and in fact, the more knowledgeable college students were about dietary guidelines, the more likely they were to meet various guidelines (e.g., fruit, dairy, whole grains; Kolodinsky, Harvey-Berino, Berlin, Johnson, & Reynolds, 2007).

Testing of the full Keystone model using path analysis was not possible given the limited sample size in the current study. Future research should examine the simultaneous relationships among model constructs to ensure that the addition of impulsivity, presented as a barrier to self-regulation augmentation, meaningfully increases the model's predictive power in explaining multiple behavior change beyond Annesi's model (2011a) consisting of self-regulation and self-efficacy alone. Further, the spillover effect should be further investigated to determine the cause behind the effect; perhaps it is specific improvement in exercise self-regulation, not global self-regulation, that predicts the indirect effect on other behaviors like fruit and vegetable consumption.

The current sample consisted of all female students who were interested in making some changes in their health behaviors as long as they met the study inclusion criteria such as reported fruit and vegetable consumption less than the recommended national guidelines. The inclusion criteria for physical activity used in the current study was based on ASCM's guideline (60 to 90 minutes of moderate-intensity aerobic activity on most days [300-630 minutes/weekly]), which is at least double the nationally recommended guideline of 150 minutes by multiple governmental agencies (CDC, 2011b; US Department of Health and Human Services [USDHHS], 2008). Future

research should bear in mind the transition to 150 minutes/week from sedentary behavior or irregular exercise engagement was only intended for the initial step in reducing the prevalence of sedentary behavior. The guideline of 150 minutes of weekly exercise should increase once a sedentary or inactive person has reached that minimum, and/or if their goal is to also reduce or maintain weight (Donnelly et al., 2009). Ideally, interventions such as the Keystone model intervention can target people who already meet the 150 minutes of physical activity through other life domains (e.g., yard work, walking), and encourage more strenuous guidelines such as 60 to 90 minutes of physical activity, specifically aerobic activity, most days of the week. Lastly, the problematic alcohol use criterion initially used in the study was dropped due to lack of participants meeting the criterion. Future research interested in examining the spillover effect for multiple health behaviors including alcohol use should specifically recruit students who report drinking as compared to recruiting students interested in global health behavior change. Given that most students interested in eating healthier or exercising in the currently study reported a lack of alcohol misuse, these students may be representative of a different population than students who misuse alcohol.

Given the reliance on young adults' self-motivation to initiate the process of an online health intervention or training, additional research should center around motivational and personality factors that increase young adults' interest and persistence in an online training and multiple health behavior change program. Previous research indicates that, compared to middle aged adults (36-50 years of age), young adults' likelihood to engage in exercise was influenced by social motivation and desire to improve appearance, but not by a medical event or for health reasons (LaRose et al.,

2013). Furthermore, LaRose et al. (2013) found that young adults prefer self-led weight loss plans compared to commercial weight loss programs. Factors like these can be taken into account to advertise and solicit interest in young adults. For example, the current study's intervention can be promoted to young adults in terms of an online mobile application to learn techniques for weight loss, which maintains the autonomy desired by young adults. Moreover, to address social motivation factors, the intervention could include social network links (e.g., Facebook, Twitter), and discussion boards to share progress and receive support.

CHAPTER V

CONCLUSION

The spillover effect may not have yielded statistically significant improvements compared to the Focused Components condition. However, examination of the descriptive statistics indicated that the Spillover Effect condition does perform equal to or better than the simultaneous direct intervention approach (e.g., Focused Components). The exploratory results in the current pilot study lend support for a fully-powered study to test the benefit of the Keystone model as well as to compare the benefit of the spillover effect approach to the simultaneous approach (i.e., indirect versus direct intervention) for multiple health behavior change intervention.

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APPENDIX A

RAPID EATING ASSESSMENT FOR PARTICIPANTS-SHORTENED VERSION (REAP-S)

1. Skip breakfast?
2. Eat 4 or more meals from sit-down or take out restaurants?
3. Eat less than 2 servings of whole grain products or high fibeter starches a day? Servings = 1 slice of 100% whole grain bread; 1 cup whole grain cereal like Shredded Wheat, Wheaties, Grape Nuts, high fiber cereals, oatmeal, 3-4 whole grain crackers, ½ cup brown rice or whole wheat pasta, boiled or baked potatoes, yucca, yams or plantains?
4. Eat less than 2 servings of fruit a day? Serving = ½ cup or 1 medium fruit or ¾ cup 100% fruit juice
5. Eat less than 2 servings of vegetables a day? Serving = ½ cup vegetables, or 1 cup leafy raw vegetables.
6. Eat or drink less than 2 servings of milk, yogurt, or cheese a day? Serving = 1 cup milk or yogurt; 1 ½ - 2 ounces cheese.
7. Eat more than 8 ounces (see sizes below) of meat, chicken, turkey, or fish per day? Note: 3 ounces of meat or chicken is the size of a deck of cards or ONE of the following: 1 regular hamburger, 1 chicken breast or leg (thigh and drumstick), or 1 pork chop.
8. Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?

9. Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, fried mozzarella sticks, or fried yucca?
10. Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low-fat chips or low-fat cracker, air-popped popcorn?
11. Add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?
12. Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day?
13. Drink 16 ounces or more of non-diet soda, fruit drink/punch or Kool-Aid a day? Note: 1 can of soda = 12 ounces.
14. You or a member of your family usually shops and cooks rather than eating sit-down or take-out restaurant food? **(Yes No)**
15. Usually feel well enough to shop or cook? **(Yes No)**
16. How willing are you to make changes in your eating habits in order to be healthier?

1 (*very willing*) 2 3 (*Unsure*) 4 5 (*Not at all willing*)

APPENDIX B

GLOBAL SELF-REGULATION

Short Self-Regulation Questionnaire (SSRQ; Carey, Neal, & Collins, 2004)
Participants use the following response scale:
( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree

I usually keep track of my progress toward my goals.
I have trouble making up my mind about things.
I get easily distracted from my plans.
I don't notice the effects of my actions until it's too late.
I am able to accomplish goals I set for myself.
I put off making decisions.
It's hard for me to notice when I've "had enough" (alcohol, food, sweets).
If I wanted to change, I am confident that I could do it.
When it comes to deciding about a change, I feel overwhelmed by the choices.
I have trouble following through with things once I've made up my mind to do something.
I don't seem to learn from my mistakes.
I can stick to a plan that's working well.
I usually only have to make a mistake one time in order to learn from it.
I have personal standards, and try to live up to them.
As soon as I see a problem or challenge, I start looking for possible solutions.
I have a hard time setting goals for myself.
I have a lot of willpower.
When I'm trying to change something, I pay a lot of attention to how I'm doing.
I have trouble making plans to help me reach my goals.
I am able to resist temptation.
I set goals for myself and keep track of my progress.
Most of the time I don't pay attention to what I'm doing.
I tend to keep doing the same thing, even when it doesn't work.
I can usually find several different possibilities when I want to change something.
Once I have a goal, I can usually plan how to reach it.
If I make a resolution to change something, I pay a lot of attention to how I'm doing.
Often I don't notice what I'm doing until someone calls it to my attention.
I usually think before I act.
I learn from my mistakes.
I know how I want to be.
I give up quickly.

APPENDIX C

PHYSICAL ACTIVITY SELF-REGULATION

Physical Activity Self-Regulation (modified; Annesi, 2011)
Participants use the following response scale:
(1) Never or Rarely
(2) Infrequently
(3) Sometimes
(4) Frequently
(5) Almost Always

I make formal agreements with myself regarding my physical activity.
I set aside a specific time to be active.
I say positive things to myself about physical activity.
I set physical activity goals (e.g., exercise at least two times a week, improve endurance, build muscle strength, etc).
I choose physical activities that are more enjoyable to me.
I keep a record or diary of my physical activity (e.g., keeping count of calories burned or types of activity engaged in, using mobile app to track, etc).
I ask friends to join me in physical activity (e.g., going to the gym, playing sports or pick-up games, walking, jogging).
I encourage friends to be active instead of sedentary (e.g., encourage them to do something physical rather than sitting most the time at the television, computer, or cellphone).
I help others be physically active.
I try to recruit others to support my physical activity goals.
I reward myself for being physically active (e.g., engaging in physical activity multiple times might be rewarded with shopping or watching a game/concert).
I praise myself for doing physical activity.
When I get off-track with my physical activity plans, I work to quickly get back to my routine.
If I slip-up on my physical activity goals, I try to get back on track toward being active.
I purposely address my barriers to engaging in physical activity.
I choose convenient physical activities.
I think about the benefits of being physically active (e.g., weight maintenance/loss, muscle gain, reducing cholesterol, blood sugar, or blood pressure, stress reduction, etc).

APPENDIX D

EATING SELF-REGULATION

Eating Self-Regulation Strategies (modified; Annesi, 2011)
Participants use the following response scale:
(1) Never or Rarely
(2) Infrequently
(3) Sometimes
(4) Frequently
(5) Almost Always

I make formal agreements with myself regarding my eating.
I schedule times to eat.
I say positive things to myself about eating well.
I set eating goals (e.g., eating fruits/vegetables, cutting back on fast food, etc).
I choose healthy foods that are enjoyable to me.
I keep a record or diary of my eating (e.g., keeping count of calories or types of food, using a mobile app to track, etc).
I ask friends to eat healthier choices when we eat together (e.g., choose a healthier meal or snack instead of fast food, etc.).
I attempt to get friends to eat healthier food.
I help others engage in healthier eating.
I try to recruit others to support my eating plans.
I reward myself for eating healthier foods.
I praise myself for making healthy eating choices.
When I get off-track with my eating plans, I work to quickly get back to my routine.
If I slip-up on my healthy eating goals, I try to get back on track toward healthy eating
I purposely address my barriers to eating appropriately.
I choose convenient, healthy food choices (e.g., pre-cut or frozen vegetables, easy to cook meals, baked potato instead of French fries)
I think about the benefits of eating a healthy diet (e.g., weight maintenance/loss, muscle gain, reducing cholesterol, blood sugar, or blood pressure, etc.)

APPENDIX E

IMPULSIVITY

UPPS Impulsive Behavior Scale Impulsive Behavior Scale and Positive Urgency Measure (Whiteside & Lynam, 2001)
Participants will respond using the following scale:
( ) Strongly Disagree
( ) Disagree
( ) Agree
( ) Strongly Agree

Please indicate how you agree with the following statements...
I have a reserved and cautious attitude toward life.
I have trouble controlling my impulses.
I generally seek new and exciting experiences and sensations.
I generally like to see things through to the end.
When I am very happy, I can't seem to stop myself from doing things that can have bad consequences.
My thinking is usually careful and purposeful.
I have trouble resisting my cravings (for food, cigarettes, etc.).
I'll try anything once.
I tend to give up easily.
When I am in a great mood, I tend to get into situations that could cause me problems.
I am not one of those people who blurt out things without thinking.
I often get involved in things I later wish I could get out of.
I like sports and games in which you have to choose your next move very quickly.
Unfinished tasks really bother me.
When I am very happy, I tend to do things that may cause problems in my life.
I like to stop and think things over before I do them.
When I feel bad, I will often do things I later regret in order to make myself feel better now.
I would enjoy water skiing.
Once I get going on something I hate to stop.
I tend to lose control when I am in great mood.
I don't like to start a project until I know exactly how to proceed.
Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.
I quite enjoy taking risks.
I concentrate easily.
When I am really ecstatic, I tend to get out of control.
I would enjoy parachute jumping.
I finish what I start.
I tend to value and follow a rational, "sensible" approach to things.
When I am upset I often act without thinking.
Others would say I make bad choices when I am extremely happy about something.

I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.
I am able to pace myself so as to get things done on time.
I usually make up my mind through careful reasoning.
When I feel rejected, I will often say things that I later regret.
Others are shocked or worried about the things I do when I am feeling very excited.
I would like to learn to fly an airplane.
I am a person who always gets the job done.
I am a cautious person.
It is hard for me to resist acting on my feelings.
When I get really happy about something, I tend to do things that can have bad consequences.
I sometimes like doing things that are a bit frightening.
I almost always finish projects that I start.
Before I get into a new situation I like to find out what to expect from it.
I often make matters worse because I act without thinking when I am upset.
When overjoyed, I feel like I can't stop myself from going overboard.
I would enjoy the sensation of skiing very fast down a high mountain slope.
Sometimes there are so many little things to be done that I just ignore them all.
I usually think carefully before doing anything.
Before making up my mind, I consider all the advantages and disadvantages.
When I am really excited, I tend to not think of the consequences of my actions.
In the heat of an argument, I will often say things that I later regret.
I would like to go scuba diving.
I tend to act without thinking when I am really excited.
I always keep my feelings under control.
When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.
I would enjoy fast driving.
When I am very happy, I feel like it is ok to give in to cravings or overindulge.
Sometimes I do impulsive things that I later regret.
I am surprised at the things I do while in a great mood.

APPENDIX F

GLOBAL SELF-EFFICACY

Self-Efficacy (General; Schwarzer & Jerusalem, 1995)
(1) Not at all True
(2) Hardly True
(3) Moderately True
(4) Exactly True

I can always manage to solve difficult problems if I try hard enough.
If someone opposes me, I can find the means and ways to get what I want.
It is easy for me to stick to my aims and accomplish my goals.
I am confident that I could deal efficiently with unexpected events.
Thanks to my resourcefulness, I know how to handle unforeseen situations.
I can solve most problems if I invest the necessary effort.
I can remain calm when facing difficulties because I can rely on my coping abilities.
When I am confronted with a problem, I can usually find several solutions.
If I am in trouble, I can usually think of a solution.
I can usually handle whatever comes my way.

APPENDIX G

DAILY PHYSICAL ACTIVITY LOG (POINT-BASED PAL)

Activity	Duration	Points
Lifestyle Physical Activity		
Transportation Light (walk, light bike to class/store/to eat)		
Transportation Moderate (speed walk, bike, rollerblade)		
Occupation Moderate (server)		
Occupation Intense (Construction worker, mover)		
Maintain home (cook, clean, garden)		
Take active options (stairs, park far away)		
Leisure Physical Activity		
Play Moderate (baseball/softball, volleyball, golf, hunt, moderate tennis)		
Play Intense (basketball, ultimate Frisbee, intense tennis, football)		
Outdoors Moderate (walk, hike, leisure bike, kayak, canoe)		
Outdoors Intense (rock climb, mountain bike, kayak)		
Exercise Physical Activity		
Exercise Light (slow jog, speed walk, bike, most cardio machines)		
Exercise Moderate (run, intense bike, traditional weight lift, jog stadiums)		
Exercise Intense (spring, intense weight lift, intense stadiums)		

1 – Lifestyle Physical Activity	Points/30 min
a transportation light (walk, light bike to class, store, out to eat)	3
b. transportation moderate (speed walk, bike, roller-blade to class, store)	6
c. occupation moderate (server)	3
d. occupation intense (construction worker, mover)	10
e. maintain home (cook, clean, garden)	3
f. take active options (stairs, park far away)	6

2 – Leisure Physical Activity	Points/30 min
a. play moderate (baseball, softball, volleyball, golf, hunt, moderate tennis)	6
b. play intense (basket ball, ultimate Frisbee, intense tennis, football)	10
c. outdoors moderate (walk, hike, leisure bike, kayak, canoe)	6
d. outdoors intense (rock climb, mountain bike, kayak)	10

3 – Exercise Physical Activity	Points/30 min
a. exercise light (slow jog, speed walk, bike, most cardio machines)	6
b. exercise moderate (run, intense bike, traditional weight lift, jog stadiums)	8
c. exercise intense (sprint, intense weight lift, intense stadiums)	12

APPENDIX H

PHYSICAL ACTIVITY CHART

Over the past week, how many different times did you engage in moderate to vigorous physical activity? In the second row, please indicate the total minutes of physical activity you engaged in each day.

[redacted]	Morning							
	Afterno on							
	Evening							
[redacted]	Morning							
	Afterno on							
	Evening							

In a typical week, how many days do you spend at least 30 minutes at a time in moderate or vigorous physical activity? _____days *(to determine eligibility)*

How many days in a typical week do you engage in aerobic physical activity (e.g., running, jogging, elliptical, walking)?" _____days

What is the typical duration you engage in aerobic physical activity per physical activity session? _____minutes

How many days per week do you engage in resistance or weight training? _____days

What is the typical duration you engage in resistance or weight training? _____minutes

APPENDIX I

FRUIT AND VEGETABLE CONSUMPTION CHARTS

Over the past week, how many different types of fruit have you eaten? Also, in the second row, please indicate how many total servings you consumed for all fruit combined for that day.

[illegible]	Morning							
[illegible]	Afternoon							
[illegible]	Evening							
[illegible]	Morning							
[illegible]	Afternoon							
[illegible]	Evening							

Over the past week, how many different types of vegetables have you eaten? Also, in the second row, please indicate how many total servings you consumed for all vegetables combined for that day.

[illegible]	Morning							
[illegible]	Afternoon							
[illegible]	Evening							
Number of Total Servings	Morning							
	Afternoon							
	Evening							

APPENDIX J

INTENTION FOR BEHAVIOR CHANGE

'Very Willing (5)' 'Willing (4)' 'Unsure (3) 'Not Willing (2)' 'Not at all willing (1)'

1 How willing are you to make changes in your life in order to be healthier?

2 How willing are you to make changes in your eating habits, specifically increasing fruit consumption, in order to be healthier?

3 How willing are you to make changes in your eating habits, specifically increasing vegetable consumption, in order to be healthier?

4 How willing are you to make changes in your lifestyle behaviors, specifically increasing physical activity, in order to be healthier?

5 How willing are you to make changes in your alcohol consumption in order to be healthier?

APPENDIX K

POSITIVE AND NEGATIVE AFFECT

How much of the time, in the past two weeks, did you feel/experience…

0 (None of the Time) 1 (A little of the time) 2 (Some of the Time) 3 (Most of the Time) 4 (All of the Time)

- "in good spirits?"
- "cheerful?"
- "extremely happy?"
- "calm and peaceful?"
- "satisfied?"
- "full of life?"
- "close to others?"
- "like you belong?"
- "enthusiastic?"
- "attentive?"
- "proud?"
- "active?"
- "confident?"
- "energetic?"
- "restless or fidgety?"
- "nervous?"
- "worthless?"
- "so sad nothing cheered you up?"
- "everything was an effort?"
- "hopeless?"
- "lonely?"
- "afraid?"
- "jittery or shaky?"
- "irritable?"
- "ashamed?"
- "upset?"
- "angry?"
- "frustrated?"

APPENDIX L

DEMOGRAPHIC INFORMATION

1 How old are you? _____(years)

2 Are you male or female?

a. Male

b. Female

3 Your Race/Ethnicity (check one):

___ Native American Indian or Alaskan Native
___ Asian
___ Black or African American, non-Hispanic
___ Hispanic/Latino/Latina
___ Native Hawaiian or Other Pacific Islander
___ White, non-Hispanic
___ Other (please specify): _____

4 What is your current year in college?

a. First-semester Freshman

b. Second-semester Freshman

c. First-semester Sophomore

d. Second-semester Sophomore

e. First-semester Junior

f. Second-semester Junior

g. First-semester Senior

h. Second-semester Senior

i. Post-baccalaureate Student taking additional courses

j. Graduate Student

k. Other (please specify): _____

5 Where do you live during the school year?

a. On-campus dormitory

b. Other university housing

c. Off-campus residence

d. Family's residence

6 Who do you currently live with?

a. Alone

b. Roommate(s)

c. Spouse or Partner

d. Family member(s)

7 Did you ever suspect that your mother had a drinking problem? YES NO

8 Did you ever suspect that your father had a drinking problem? YES NO

9 What is the highest level of education your mother completed? (check one)

___ some high school

___ high school

___ some college

___ completed college (e.g., B.S., B.A.)

___ some courses toward a masters degree

___ completed masters degree (e.g., M.S., M.A., M.S.W.)

___ completed doctorate (Ph.D., M.D., J.D.,etc.)

10 What does your mother do for a living?
_____(please be specific)

11 What is the highest level of education your father completed? (check one)

___ some high school

___ high school

___ some college

___ completed college (e.g., B.S., B.A.)

___ some courses toward a masters degree

___ completed masters degree (e.g., M.S., M.A., M.S.W.)

___ completed Ph.D., M.D., etc.

12 What does your father do for a living? _____ (please be

specific)

13 GPA: Is this your first semester in college?

a. If yes, please indicate your overall high school GPA (in numeric form)?

_____

b. If you are NOT a first semester freshman, what was your overall GPA at the end of last semester?_____

14 How would you classify your current financial situation?

__ Barely enough to get by
__ Enough to get by, but no more
__ Solidly middle class
__ Plenty of extra
__ Plenty of luxuries
__ Don't know
__ Prefer not to say

15 What is your height? _____ft _____inches

16 What is your current weight? _____ lbs

17 In a typical week, how many hours do you spend watching television, using the computer/surfing the Internet, using your phone/tablet, playing with game consoles (Playstation, XBOX, etc.)?

_____hours

If anything in this survey has made you feel upset, please call the Counseling Center at ODU or visit their website. Phone: (757) 683-4401 or Website:http://studentaffairs.odu.edu/counseling/Appointment/index.shtml

If you have any questions about this study, please do not hesitate to contact the research team Gabrielle D'Lima, Graduate Student Researcher: gdlima@odu.edu; Dr. Michelle L. Kelley, PI: mkelley@odu.edu

VITA

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Education

M. S. in Applied Experimental Psychology (2009-2011)
Advisor: Michelle L. Kelley
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Professional Development

Biostatistician (Fall 2012-Fall 2014), Sentara Healthcare, Norfolk, VA
Health Psychology Instructor (Fall 2012- Fall 2014), ODU, Norfolk, VA
Research Methods Instructor (Spring 2014), ODU, Norfolk, VA

Select Publications

D'Lima, G. M., Pearson, M. R., & Kelley, M. L. (2012). Protective behavioral strategies as a mediator and moderator of the relationship between self-regulation and alcohol-related consequences in first-year college students. *Psychology of Addictive Behaviors, 26,* 330-337.

D'Lima, G. M., Winsler, A., & Kitsantas, A. (2014). Gender and ethnic differences in first-year college students' goal orientation, academic self-efficacy, extrinsic motivation and intrinsic motivation. *Journal of Educational Research, 107,* 341-356.

Kelley, M. L., D'Lima, G. M., Henson, J. M., & Cotton, C. (2014). Substance-abusing mothers' and fathers' willingness to allow their children to receive mental health treatment. *Journal of Substance Abuse Treatment, 47,* 106-111.

Select Awards & Scholarships

Sentara Healthcare Key Contributor Award ($2500); Fall 2014
Nomination for Outstanding Classroom Instructor (Health Psychology); Spring 2014
APF/COGDOP Graduate Research Scholarship ($1000); Fall 2013
Nomination for Graduate Service Award; Spring 2013
APA Travel Award funded by NIAAA and NIDA ($750); Summer 2011-2012
Nomination for Outstanding Lab Instructor (Quantitative Methods); Spring 2010
Dean's Challenge Scholarship, George Mason University ($2000); Fall 2008
Early Identification Program (Tuition); Summer 2005-Spring 2009