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Understanding Mechanisms of Mindfulness using a Mediation Model

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UNIVERSITY OF CALIFORNIA
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Mindfulness Predicting Physical and Psychological Health in Emerging Adulthood:
Understanding Mechanisms of Mindfulness Using a Mediation Model

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor of Philosophy

in

Psychology

by

Christie Lynn Lundwall

December 2011

Dissertation Committee:
Dr. Ruth Chao, Chairperson
Dr. M. Robin DiMatteo
Dr. Tuppett Yates

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2011

The Dissertation of Christie Lynn Lundwall is approved:

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ABSTRACT OF THE DISSERTATION

Mindfulness Predicting Physical and Psychological Health in Emerging Adulthood:
Understanding Mechanisms of Mindfulness using a Mediation Model

by

Christie Lynn Lundwall

Doctor of Philosophy, Graduate Program in Psychology
University of California, Riverside, December 2011
Dr. Ruth K. Chao, Chairperson

This study tested a theory derived multiple step structural equation model of four potential mediators of the relation from mindfulness to emotional distress, physical health, and well-being during emerging adulthood in 440 college students. Specifically, two models (a basic mediation model and the hypothesized theory based model) were tested and compared to determine whether and in what ways goal-directed self-regulation, cognitive emotion regulation, stress reduction, and sleep quality mediated the relation of mindfulness to health and well-being variables. Separate models were run for the three outcome variables, and in each case the hypothesized theoretical mediation model was a better fit of the data than the basic mediation models was.

As hypothesized by the model, the two types of self-regulation, goal-directed and cognitive emotional, fully mediated the relation from mindfulness to stress-reduction, as the direct relation became non-significant once these variables were included in the model. Next, stress reduction was found to either fully or

partially mediate the relations from both types of self-regulation to sleep quality, emotional distress, physical health, and well-being. Stress reduction then had a strong direct relation to all three latent health outcomes. While the patterns of results for the hypothesized models were somewhat similar across the three outcomes, there were also some interesting differences in the degree to which each mediator was influential. For example, while cognitive emotion regulation had substantial indirect relations through stress reduction to all outcomes, it was only directly related to emotional distress. In contrast, goal-directed self-regulation had smaller indirect relation to the outcomes, and was directly related to physical health and well-being, but not emotional distress. Moreover, sleep quality had small significant direct relations to emotional and physical health, but not well-being. Altogether, these data supported a meaningful role of mindfulness in emotional distress, physical health, and well-being during emerging adulthood, while illuminating several mechanisms by which it likely influenced these outcomes.

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INTRODUCTION

There have been many studies that have demonstrated the efficacy of mindfulness as a practice and approach to living that improves mental and physical health (Evans, 2010a; Hofmann, Sawyer, Witt, & Oh, 2010). The health benefits have been seen whether an individual is naturally higher in dispositional or trait mindfulness, or if the mindfulness is increased through formal training and practice. Emerging adulthood is a critical period when young people are given greater responsibility and are establishing their own thinking, coping strategies, health behaviors, and life goals and plans, and so their levels of mindfulness during this time may be particularly important to setting the trajectory for their lifelong physical and psychological health and happiness. However, most of the mindfulness research has been done with middle aged and older participants, who are seeking treatment for some type of health problem or disease. Furthermore, mechanisms of the benefits mindfulness are still not well understood. While a number of theories have been proposed to explain the mechanisms by which mindfulness imparts these health benefits, the data to support these theories is sparse (Schreiber, 2008). Because there is great potential to improve health and wellness in society through mindfulness, increasing energy and attention has been given to teaching mindful practices and approaches in many settings including medical centers, schools, churches, the workplace, and even the military. Nevertheless, time, energy, and funding are frequently limited resources, so it is important to understand the complexities of how mindfulness works in order to guide good decisions around the settings and populations mindfulness training programs will be most effective and worthwhile for, and which aspects of the

training are the most critical. The primary purpose of this dissertation is to add to the literature by proposing and investigating a theoretical model that will help to explain how mindfulness may work to reduce emotional distress and improve physical health and well-being during the critical developmental period of emerging adulthood.

Humans have a universal longing to be healthy, happy, and fulfilled. Our bodies and minds have a remarkable innate potential for health and happiness, yet are often plagued by stress, disease, pain, and suffering. Some of this stress and poor health may be beyond our control, but much of it is self-created by human thinking and emotions, or as Mark Twain has said "I've lived through some terrible things in my life, a few of which actually happened." Each time we imagine a worst case scenario (which likely never occurs), dwell on a past injustice, or relive a mistake or embarrassment in our minds, we create our own stress and painful emotions through thinking. Furthermore, human stress and poor physical and psychological health are often caused by acting in ways that provide short term benefits but are counterproductive to long-term well-being and goal attainment, such as behaving impulsively and/or procrastinating. Mindfulness practices and meditation are one strategy for improving health and well-being and reducing stress that have an ancient history going back over 2,500 years but have gained popularity in Western culture much more recently (Siegel, 2007). This dissertation will examine cognitive emotion regulation strategies and goal-directed self-regulation as potential mechanisms by which mindfulness reduces stress and exerts its health benefits.

In order to assess the current knowledge base in the field of mindfulness research, an initial literature review examining the evidence of direct relations between

mindfulness and physical and psychological health (e.g. emotional distress and well-being) will be provided. This review will show that there has been tremendous growth in data demonstrating the relation of mindfulness to emotional distress (e.g. depression and anxiety) and more modest evidence of its relation to happiness and well-being. Some prior work has focused on the role of mindfulness in lowering blood pressure or reducing markers of disease, yet there has been very limited work looking at the role of mindfulness in general physical health (e.g. physical health, body weight, vitality, and physical activity levels). By examining the direct relationship of mindfulness to these three areas of health, this study will seek to replicate previously found direct relations between mindfulness and psychological health, and to add to the literature by examining the direct relation of mindfulness to general physical health outcomes that are risk factors for the later development of chronic diseases. Next, the importance of mindfulness during the unique developmental period of emerging adulthood will be explored. The assessment of the literature will then expand to include commonly cited theories on the mechanisms of mindfulness, and the proposed mediators for the current study, which are goal-directed self-regulation, cognitive-emotional self-regulation, stress reduction, and sleep quality. Relatively little work has been devoted to understanding these mechanisms, so there will be discussion of why these variables are predicted to account for the benefits of mindfulness on health, and what is presently known and yet to be discovered about their relation to mindfulness and to the health and wellness outcomes. Finally, the proposed theoretical mediation model and specific hypotheses will be introduced.

Overall, the proposed study seeks to: (1) investigate the role of mindfulness in the physical health, emotional distress, and well-being of college students during early adulthood and (2) expand upon the existing theoretical models of mindfulness by examining the extent to which the proposed mediators including goal-directed self-regulation, cognitive-emotion regulation, stress reduction, and sleep quality explain the relation between mindfulness and the physical and psychological health outcomes. Structural equation modeling will be used to establish the fit of the data to the theoretical model. In line with Baron and Kenny's (1986) steps for establishing mediation, this study proposes that the initial strong relation between mindfulness and physical health, emotional distress, and well-being will be greatly reduced or eliminated when goal-directed self-regulation, cognitive-emotional regulation, stress reduction, and sleep are added to the model as the relation will be largely mediated, or explained by these factors. Figure 1 depicts the proposed theoretical model that will guide the hypotheses of this dissertation. As shown in Figure 1, the proposed theoretical model includes two steps of mediation. In the first step, the direct relation between mindfulness and stress reduction is mediated by goal-directed self-regulation and cognitive-emotional self-regulation. In the second step, the direct relations between goal-directed self-regulation and cognitive-emotional self-regulation and the health outcomes are mediated by stress reduction and sleep quality.

Mindfulness

In its simplest form, mindfulness is present moment awareness. Jon Kabat-Zinn (2003, p. 145) defines mindfulness as “awareness that emerges through paying attention

on purpose, in the present-moment, and non-judgmentally to the unfolding of experience moment by moment." Kabat-Zinn further elaborates that "Mindfulness includes an affectionate, compassionate quality within the attending, a sense of openhearted, friendly presence and interest" and is typically practiced within an ethical framework of non-harm that often leads to insights about life and how the untrained mind can lead to unnecessary suffering. In the present study, mindfulness is viewed in line with Kabat-Zinn's definition, as a way of being that incorporates 1) awareness, 2) attention, 3) present moment orientation, 4) non-judgment, 5) purposefulness, and 6) acceptance. The scope of practicing mindfulness encompasses all areas of life, and ranges from formal progressive and advanced practices such as yoga and meditation to merely noticing the breath, thoughts, emotions, body sensations, sights, scents, and sounds while completing simple daily tasks such as walking, taking a shower, listening, eating and drinking. In line with the perspective of Brown & Ryan (2004), for the purpose of this dissertation, mindfulness is viewed as being both traitlike and statelike in that it is an inherent, natural capacity of the human organism, with natural individual differences in its manifestation. Yet its features can be enhanced by training and practices such as meditation, yoga, and psychotherapy, among others. Ruth Baer's Five Facet Mindfulness Questionnaire (2006), will be used to measure mindfulness in this study because it aligns with the aforementioned definition of mindfulness, has been shown to capture the key dispositional traitlike and statelike features of mindfulness, and to be influenced by practices such as meditation. This measure was developed by doing a factor analysis of five of the most commonly accepted mindfulness questionnaires, and encompasses the

factors observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience.

Despite its longstanding history, less than ten years ago, there was a paucity of scientific evidence to prove whether and/or how Mindfulness Practices such as Mindfulness Based Stress Reduction (MBSR) work to improve health and well-being. Scott Bishop (2002) asked “What do we really know about Mindfulness-Based Stress Reduction?” and concluded that while learning mindfulness may offer therapeutic promise, the scientific proof of its efficacy was scarce and methodologically flawed. Further, he posited that there was no evidence to explain the mechanism of action for mindfulness. Based on her meta-analysis of the literature, Ruth Baer (2008) similarly called for research on the underlying mechanisms of mindfulness and larger better-designed efficacy studies while at the same time concluding that mindfulness was “probably efficacious.”

Since then, there has been dramatic growth in scientific research in the field of mindfulness that has largely demonstrated the health benefits of both trait mindfulness and mindfulness training and practices such as Mindfulness-Based Stress Reduction (MBSR) or Mindfulness-Based Cognitive Therapy (MBCT). The current literature which now includes a number of meta-analyses, supports numerous benefits of mindfulness on many aspects of psychological and physical health and well-being (Evans, 2010b; Hofmann et al., 2010; Kabat-Zinn et al., 1998; Merkes, 2010; Rosenzweig et al., 2007; Shennan, Payne, & Fenlon, 2010; C. Wang et al., 2010; Way, Creswell, Eisenberger, & Lieberman, 2010). Research on mindfulness training and mindful meditation practices

has demonstrated its value for many specific physical and mental health conditions such as cardiovascular disease (Ditto, Eclache, & Goldman, 2006), high blood pressure and markers of inflammation (Carlson, Speca, Faris, & Patel, 2007), irritable bowel syndrome (Layous, Chancellor, Lyubomirsky, Wang, & Doraiswamy, 2011; Villotte & Knusel, 2011), chronic pain (Gardner-Nix, Backman, Barbati, & Grummitt, 2008; Kabat-Zinn, Lipworth, & Burney, 1985), generalized anxiety and panic disorders (Kabat-Zinn et al., 1992; Kim et al., 2009), and depression (Barnhofer et al., 2009; Bondolfi et al., 2010).

Additionally, a small but promising study of 48 HIV-1 infected adults at UCLA found that 8 weeks of MBSR training completely stopped the decline in CD4+ T lymphocytes that was experienced by the single day stress education class control group (Creswell, Myers, Cole, & Irwin, 2009). If replicated, this has positive implications for the impact of Mindfulness interventions on immune system functioning. Davidson and colleagues (2003) designed an interesting study testing the effects of mindful meditation on the brain and the immune system, finding increases in left-sided anterior activation, a pattern previously associated with positive affect, and a corresponding increase in antibody response to vaccination in the meditators compared with the nonmeditators. Another recent study went so far as to compare a brief mindfulness intervention to a sham meditation intervention and usual treatment control group, finding that the mindfulness intervention improved blood pressure, heart rate, and mood variables compared to either the sham or control groups (Zeidan, Johnson, Gordon, & Goolkasian, 2010). These interventions have been primarily based on mindfulness training, such as MBSR and MBCT, or have incorporated mindfulness as a key component of treatment,

such as Acceptance and Commitment Therapy (Jelic et al., 2010), and Mindfulness-Based Dialectical Behavior Therapy (MBDBT).

Measures of dispositional or trait mindfulness have also been shown to be related to meditation experience, to be higher in meditators versus similarly matched non-meditators, and to increase with mindfulness training (R. A. Baer, 2006; R. A. Baer et al., 2008; Eisenberg, 2000). Many studies have used measures of dispositional or trait mindfulness to examine the ways that this approach to thinking and living may impact psychological and physical health in individuals who are naturally more mindful. For example, Baer (2006) examined five different measures of mindfulness and found that they all had substantial positive relations to emotional intelligence and self-compassion, and negative relations to measures of psychological symptoms, neuroticism, thought suppression, difficulties in emotion regulation, alexithymia (the inability to express feelings with words), dissociation, experiential avoidance, and absent-mindedness. In another study, Way et al. (2010) found that dispositional mindfulness was negatively correlated with right amygdala reactivity whereas depressive symptomology was positively correlated with reactivity in this part of the brain when resting or when viewing negative emotional faces, relative to shape matching. Therefore, whether by training, or nature, mindfulness has been shown to be related to positive health outcomes.

Mindfulness in Emerging Adulthood

A limitation of many mindfulness studies is their focus is often on adults who have already been coping with stress in unhealthy ways for many years and may have

already developed psychopathology or disease. However, stress is present throughout life, and learning healthy strategies for reducing and managing stress may be particularly important during early adulthood, when youth are beginning to take on new life responsibilities, identify what is important to them, make their own life decisions, and set and work towards their own goals. Furthermore, experimental studies have found that older adults are better at regulating their emotions than young adults (Kessler & Staudinger, 2009). Higher education can be a stressful experience for young college students as they struggle with numerous personal, developmental, social and academic challenges as well as many changes and transitions of college life (Deckro et al., 2002).

Developmental research has highlighted key themes of this period, labeled Emerging Adulthood (between the ages of 18 to 29), that suggest it is an appropriate developmental stage to address physical and psychological health. Arnett (2000) describes five features that characterize this developmental period: 1) identity exploration to address questions of love, work, ideology, and world views, 2) instability with high rates of residential changes, 3) a self-focused age where commitments to others are low and focus on oneself is high, 4) feeling in-between since most individuals have claimed they do not consider themselves an adolescent nor an adult, and 5) an age of possibility that embraces optimism and hope for the future and the idea of self-transformation. In brief, this time period allows for the process of learning to stand one's own independent from one's family, to formulate life goals, self-regulate one's efforts toward adult sufficiency, and increasing self-governance. College can be a difficult transition because students must manage their stress independently and in many more domains in their life

than they had previously. They must manage and regulate their academic performance, financial responsibilities, romantic relationships, social pressures, and health decisions around sex, drugs, and alcohol. Although non-college youth may be experiencing a similar transition of self-exploration and stressful challenges, the sheer number of youth attending college suggests it is a viable location for preliminary studies for this age group.

While some of the correlates of mindfulness have been studied in college samples including many young adults, older college students have typically been included in these studies, and investigations of the mechanisms of mindfulness and its potential for impacting mental and physical health during this developmental period are needed. For example, Baer (2006) used undergraduate psychology students aged 18 to 57 to examine the psychometric properties, factor structure, and relations between four commonly used mindfulness questionnaires, and their relations to other constructs. She found that most facets of mindfulness positively related to constructs such as openness, emotional intelligence and self-compassion and negatively related to difficulties with emotion regulation, psychological symptoms, neuroticism, and thought suppression. Another study that measured mindfulness in college students using the Mindful Attention Awareness Scale (MAAS), found that students who scored higher on mindfulness were more likely to take their time eating and to engage in healthy behaviors such as eating fruits and vegetables compared to students with low mindfulness scores (Grinnell, Greene, Melanson, & Lofgren, 2009). Another study of medical students found that a 10-week MBSR intervention reduced total mood disturbance (TMD) scores including the

Tension-Anxiety, Confusion-Bewilderment, Fatigue-Inertia, and Vigor-Activity subscales compared to controls (Rosenzweig, Reibel, Greeson, Brainard, & Hojat, 2003). However, these studies also included older college students who are past this developmental stage, and the mechanisms of mindfulness were not elucidated. Therefore, this study will specifically study the mechanisms of mindfulness in college students age 18 to 29 during the developmental period of emerging adulthood.

Mindfulness and Study Outcomes

Mindfulness and Emotional Distress

The relation between mindfulness and emotional distress including anxiety and depression has been widely studied and largely supported in the literature. Many studies have found relations between both dispositional mindfulness and mindfulness interventions to lower depression and anxiety symptoms. A recently published large Swedish study of over 1,000 participants found that dispositional mindfulness was negatively related to anxiety and depression (Branstrom, Duncan, & Moskowitz, 2010). Despite this, there has been some debate around this strength of this evidence due to issues with study design quality and questions around the mechanisms of the relation. For example, one meta-analysis published in 2007 which analyzed just 15 studies of the effects of Mindfulness interventions (including MBSR and MBCT) concluded that the relation between practicing mindfulness and changes in depression and anxiety measure scores was equivocal (Toneatto & Nguyen, 2007). The authors stated that this conclusion was based primarily on study design issues (e.g. most studies used a wait list or usual

therapy control group instead of an active control group), which prevented them from drawing strong conclusions versus lack of efficacy. A more recent meta-analysis of 39 Mindfulness Based Therapy (MBT) interventions (MBSR and MBCT) including 1,140 patients published by Hoffman and colleagues, calculated and reported clinically meaningful effect sizes for improving anxiety (Hedges' $g = 0.63$) and depressive symptoms (Hedges' $g = 0.59$) from pre to post-treatment for the overall sample (Hofmann et al., 2010). The effect size was even more robust for patients who had been officially diagnosed with anxiety disorders (Hedges' $g = 0.97$) and mood disorders (Hedges' $g = 0.95$). While this meta-analysis included a broad mix of study designs, the Jadad scale (measure to independently assess the methodological quality of a clinical trial from zero to five) was used to assess the degree that included publications were adequately randomized, double blinded, and reported participant drop-out rates. The authors also did a separate analysis for the 16 studies that included a control group and found that for the 11 controlled studies employing a waitlist or treatment as usual comparison condition resulted in a mean Hedges' g effect size of 0.41 for depression and 0.33 for anxiety while the 5 controlled studies with an active treatment comparator (such as relaxation training) provided a mean Hedges' g effect size of 0.50 for depression, and 0.81 for anxiety. Interestingly, while Hoffman and colleagues noted that they were initially quite skeptical about the efficacy of MBT, they in fact found robust effect sizes which they concluded were not accounted for by publication bias, and were substantially greater than what could be expected from a psychological placebo. For the purposes of this study, it is expected that this established relation between mindfulness and

depression and anxiety will be replicated in the present sample of young adult college students. However, the present study seeks to expand upon this prior research by seeking to explore the underlying mechanisms by which mindfulness reduces depression and anxiety.

Mindfulness and Well-Being

While more attention has been paid to the effects of mindfulness on reducing depression and anxiety, it is equally interesting to examine whether and how mindfulness contributes to positive psychological health such as happiness and well-being. A study of oncology patients found moderate increases in life satisfaction and joy in life after completing a MBSR intervention (Kieviet-Stijnen, Visser, Garssen, & Hudig, 2008). When using the MAAS to measure mindfulness, researchers found that mindfulness was associated with higher pleasant affect, positive affectivity, vitality, life satisfaction, self-esteem, optimism, and self-actualization (Kirk Warren Brown & Richard M. Ryan, 2003). The relation between mindfulness and well-being is further supported by a study of preadolescent youth demonstrating a significant increase in optimism, and a nearly (but not quite) significant increase in positive affect in the mindfulness intervention group versus the control group (Schonert-Reichl & Lawlor, 2010). Baer et al. (2008) investigated the mediating role of the FFMQ mindfulness facets in the relation between meditation experience (months of regular practice) and well-being. The FFMQ subscales Observe, Describe, Nonreact, and Nonjudge were all positively correlated with meditation experience, even when controlling for demographic variables, and these same four facets completely mediated the relation between longer meditation experience and

increased well-being. In another study by Carmody and Baer (2008) they examined the relation between length of time spent in formal mindfulness practice during an MBSR intervention, the FFMQ, and well-being, and found that mindfulness practice affects well-being directly, and that the relation was partially mediated by corresponding increases in mindfulness measured by the FFMQ. Similarly, a study of cancer patients found that the improvements in positive affect and quality of life resulting from mindfulness based stress reduction training were partially mediated by increased levels of mindfulness as measured with the FFMQ (Branstrom, Kvillemo, Brandberg, & Moskowitz, 2010).

While these prior studies have shown that there is a relation between MBSR training and meditation experience and well-being, and that this relation is substantially mediated by corresponding increases in mindfulness, this primarily demonstrates that the mindfulness measures are doing a good job of measuring mindfulness and that mindfulness does in fact predict well-being. These studies do not explain what it is about the increase in mindfulness that contributes to the increase in well-being. Therefore, this study seeks to further the research by examining relations among the study variables that may lead to insights about the specific mechanisms by which mindfulness relates to psychological well-being (including measures of happiness, life satisfaction, and positive affect) in young adults.

Mindfulness and Physical Health

During emerging adulthood, students are experiencing a greater degree of independence in terms of making their own health-related decisions. This study will

examine the role of mindfulness with specific health-related outcomes including obesity, physical activity, vitality, and general health. While the literature largely supports the role of mindfulness in reducing diseases, it is sparse when it comes to the role of mindfulness in proactively maintaining health such as having healthy dietary habits, physical activity and energy levels, and body weight.

When it comes to the role of mindfulness in initiating or maintaining healthy levels of physical activity, there has not been much research in this area. One study by Ulmer and associates (2010) found that YMCA exercisers who reported successfully maintaining weekly exercise had higher scores on measures of mindfulness and acceptance, and lower scores on measures of thought suppression than those who reported more frequently missing exercise. However, these findings were correlational, so there was no way to establish the direction of the results. Clearly further research is warranted.

There are a small number of studies looking at the impact of specific mindfulness techniques on eating, weight loss and obesity reduction. As mentioned previously, a correlational study by Grinnell and colleagues (2009) found that students who scored higher on mindfulness as measured by the MAAS were more likely to take their time eating and to engage in healthy behaviors such as eating fruits and vegetables compared to students with low mindfulness scores. Kristal, Littman, Benitez, and White (2005) found that regular yoga practice has benefits for maintaining healthy weight for both average and obese individuals, with a 3.1 lb lower weight gain among normal weight (BMI < 25) and an 18.5 lb lower weight gain among overweight participants. However,

there are a number of potential reasons for this, so it is not possible to determine whether or not increases in mindfulness that may be learned with yoga practice were the cause of the weight loss. Recent research looking at a 4 session Action Commitment Therapy mindfulness intervention with 62 adults (mean age = 41) and a mean BMI of 31.57 found increases in physical activity and greater weight loss in the intervention group versus control group (Tapper et al., 2009). A small pilot study of the Mindful Eating and Living (MEAL) program that didn't include a control group found that the Mindfulness based curriculum led to modest weight loss, reductions in binge eating, reductions in C-reactive protein (a marker of inflammation), and psychological health improvements in 10 obese participants (Dalen et al., 2010). In addition, a recent dissertation study by Spadaro (2008) found that adding mindfulness meditation (MM) to a 24-week standard weight loss (SWL) intervention for overweight adults led to a significant improvement in eating behaviors. Further, although weight loss trajectories were similar through week 12, there was a trend for continued weight loss between weeks 12 and 24 for the MM + SWL group versus a regain in weight and higher drop-out rate for the SWL group at week 24. Finally, in a study of food craving, Alberts and colleagues (2010) found that adding a mindfulness component that taught acceptance of cravings to usual weight loss education actually led to decreased preoccupation with and cravings for food in overweight participants over time.

Thus, in these small intervention studies, there appears to be initial evidence of a relation between mindfulness and healthy eating and weight loss in participants who are currently trying to lose weight. However, studies have not examined the relation of

dispositional mindfulness to maintaining healthy weight in a general population of young college students. Further, no studies were found studying the role of mindfulness in more general perceptions of physical health and vitality, and only one correlational study found a relation between mindfulness and likelihood of maintaining a physical exercise routine. Moreover, none of these studies have addressed the mechanisms by which mindfulness relates to these aspects of physical health. This research will seek to determine whether or not dispositional mindfulness relates to measures of physical health in a young college aged population, and to gain insights into mechanisms of action.

Mindfulness and Study Mediators

Underlying Mechanisms of Mindfulness

The aforementioned research has discussed theories and assumptions as to the process by which mindfulness impacts health and well-being, without actually studying these processes. Now that we understand that mindfulness is effective, the next step is to empirically study how it works. This step, uncovering the processes by which mindfulness creates change, is critical to refining the efficiency and appropriate utilization of mindfulness training (Lynch, Chapman, Rosenthal, Kuo, & Linehan, 2006). Practical implications of understanding the mechanism of a training or treatment programs can include more appropriately targeted interventions with improved results, and a reduction in wasteful resource investment. According to Baron and Kenny (1986), the generative mechanisms of change, or the variables that account for the relation between an independent and dependent or outcome variable of interest, are called mediators. Drawing from the relevant literature on the direct relations between

mindfulness, the proposed mediators, and outcomes, a theoretical framework will be proposed to explain the way that mindfulness works to improve physical and psychological health (e.g. less emotional distress and greater well-being).

Many authors have suggested that self-regulation of attention, emotions, and/or behaviors are mechanisms of change. However, the assumptions are frequently being made without any testing of the underlying theoretical model or mechanism. For example, Shapiro and colleagues (2006) hypothesize that changes in attention, intention, and attitude are three axioms that occur together during mindfulness, which thereby leads to a significant shift in perspective, termed *reperceiving*. They suggest that *reperceiving* is a meta-mechanism, which overarches additional direct mechanisms that lead to change and positive health outcomes including self-regulation, values clarification, cognitive, emotional, and behavioral flexibility, and exposure. They suggest that further research needs to be done to test this theory.

Several researchers have suggested that cognitive processes such as decreasing rumination through metacognitive awareness (Teasdale et al., 2002), decentering (Fresco, Segal, Buis, & Kennedy, 2007), attention regulation (Carmody, Baer, E, & Olendzki, 2009), or positive reappraisal (Garland, Gaylord, & Park, 2009) are mechanisms of mindfulness. There have been a few studies linking mindfulness to improvements in attention (Jha, Krompinger, & Baime, 2007; Semple, 2010; Tang et al., 2007). While improvements in attention are likely important in improving self-regulation of emotions and behaviors, this study theory proposes that the specific health and happiness benefits are from improvements in the capacity to cognitively regulate emotions and goal-directed

behavior, not attention in and of itself. There is also some support in the literature for the role of mindfulness in increasing emotion regulation (Arch & Craske, 2006; Goldin & Gross, 2010). As implicated in the naming of Mindfulness Based Stress Reduction, most have assumed that reducing stress plays a key role in improving health. Several studies have largely supported this assumption although the results of studies of cortisol and cytokines as markers of stress reduction have been somewhat inconsistent (Brisbon & Lowery, 2009; Carlson & Garland, 2005; Carlson et al., 2007; Carlson, Speca, Patel, & Goodey, 2003; Matousek, Dobkin, & Pruessner, 2010; Witek-Janusek et al., 2008). Another proposed mechanism for health benefits of mindfulness interventions is via the improvements in sleep quality that many participants report, as sleep quality has increasingly been shown to be important to physical and psychological health (Britton et al., 2010; Carlson & Garland, 2005). There has also been a recent emergence of neuroscience data looking at changes in the brains of participants in mindfulness interventions, or comparing long-term meditators to non-meditators (Fletcher, Schoendorff, & Hayes, 2010). Thus, the literature has proposed a number of theories pointing to many possible mediators.

The degree to which these potential mechanisms are instrumental in explaining the relation between mindfulness and physical health, emotional distress, and well-being has not yet been elucidated. Researchers are calling for a more thorough investigation, as there is limited research to explain the underlying mechanism(s) by which mindfulness imparts its benefits (R. Baer, 2010). For example, while mindfulness has been shown to be directly related to improvements in physical and psychological health, and to directly

relate to some of the mediators, it is unknown whether and to what degree each of these proposed mediators is what contributes to the better health or reduced distress.

Furthermore, there are likely multiple important effectors by which mindfulness helps people, making measuring and understanding the process more complex. Given the paucity of research on the mechanisms of mindfulness, the purpose of this study is to examine the relative contribution of four hypothesized mediators including goal-directed behavioral self-regulation, cognitive-emotion regulation, stress reduction, and sleep quality to mediate the relation between dispositional mindfulness and psychological and physical health and well-being.

Mindfulness and Self-regulation

Numerous researchers have proposed self-regulation as a mechanism of mindfulness (K. W. Brown & R. M. Ryan, 2003; Lutz, Slagter, Dunne, & Davidson, 2008; Smalley, 2008). Self-regulation can be defined as any effort by a human being to alter its own responses including actions, thoughts, feelings, desires, and performances, in a way that overrides the natural or accustomed response and substitutes another response (or lack of response) in its place (Baumeister, Heatherton, & Tice, 1994). Self-regulation ability has been linked to qualities such as self-efficacy (Bandura, 1989), delay of gratification (Sethi, Mischel, Aber, Shoda, & Rodriguez, 2000; Wilson, Lengua, Tininenko, Taylor, & Trancik, 2009), persistence (Baumeister, Bratslavsky, Muraven, & Tice, 1998), social competence (Eisenberg et al., 2001), coping and resiliency (Eisenberg et al., 1997), and empathy and prosocial behavior (Eisenberg et al., 1996). Moreover, mental health and behavioral problems such as mood and anxiety disorders (Carver,

Johnson, & Joormann, 2008), obsessive-compulsive disorder (Gillan et al., 2011), eating disorders (Whiteside et al., 2007), shyness (Eisenberg, Fabes, & Murphy, 1995), substance abuse (Baumeister et al., 1994), attention deficit disorder (Ronnemaa et al., 1997; Zylowska et al., 2008), disruptive behavior disorders, and aggression (Olson, Lopez-Duran, Lunkenheimer, Chang, & Sameroff, 2011) all have associations to self-regulation failure. While few studies have examined the theory that self-regulation is a key mechanism for the relation between mindfulness and physical and psychological health, as noted above, studies have shown that 1) self-regulation plays a role in mood and anxiety disorders, self-efficacy, coping, resiliency, and other attributes that are likely linked to health and well-being and 2) meditation does impact aspects of self-regulation of emotions and behaviors (Jha et al., 2007; Tang et al., 2007). This dissertation will examine the degree to which two types of self-regulation (e.g. cognitive-emotional and goal-directed behavioral) mediate the relation between mindfulness and stress, and the other measured physical and behavioral health outcomes.

Mindfulness and Cognitive Emotion Regulation

According to Garnefski and Kraaij (2007, p. 141), "cognitive emotion regulation refers to the conscious, cognitive way of handling the intake of emotionally arousing information and can be considered part of the broader concept of emotion regulation defined as all the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features." Essentially, because thoughts are inextricably tied to emotions, a cognitive emotion regulation strategy involves thinking in a way that will modify the emotional response. In

fact, a person's reality and/or emotions are not always based on what is actually happening; rather it is often created by perspectives inside of the mind. Three cognitive emotion regulation strategies that have been found to be related to the greatest degree of internalizing problems are self-blame, rumination, and catastrophizing (Garnefski & Kraaij, 2007). Thoughts often have great power to elicit positive and negative emotions, depending on the nature of the thought, and the thinker's relationship to the thought. One of the lessons of practicing present moment awareness is to notice with an attitude of open curiosity that thinking is a natural function of the mind, that these thoughts are transient and often repetitive, and to objectively recognize that not all of these thoughts are true or helpful. Developing awareness of the relation between thinking and emotions, and the capacity to notice and decide whether or not to believe or buy into the natural flow of thoughts, may foster greater control over inner emotional states in more mindful individuals, and make them less likely to ruminate or catastrophize.

A number of studies have looked at mindfulness and its relation to emotions and emotion regulation. The evidence supporting the theory that mindfulness enhances resiliency and health by improving aspects of emotion regulation is mounting. Baer found that five different self-reported mindfulness measures were all negatively correlated with difficulties in emotion regulation (R. A. Baer, 2006). A key study by Davidson and colleagues found that participants who had MBSR training showed significant increases in left-sided activation in the anterior cortical area which is correlated with greater positive emotional expression and positive affect compared to the activation levels in these same regions of the control participants (Davidson et al., 2003). The authors

propose that the brain changes resulting from the MBSR training are likely related to improvements in emotion regulation. In another study, Creswell and colleagues found that dispositional mindfulness was associated with greater widespread prefrontal cortex activation and attenuated amygdala responses during an affect labeling activity, which also suggests greater emotion regulation of states such as anxiety and negative affect (Way et al., 2010). Jimenez and colleagues (Jimenez, Niles, & Park, 2010) investigated the role of affect regulation as measured by positive emotions, mood regulation expectancies (i.e., perceived ability to repair own mood), and self-acceptance in mediating the relation between trait mindfulness and depression. Using structural equation modeling, the researchers found that the effect of mindfulness as measured by the Freiburg Mindfulness Inventory on depressive symptoms was mediated by its positive relation to positive emotions, mood regulation expectancies, and self-acceptance, which then predicted lower levels of depression. In sum, the data supports a link between mindfulness and emotion regulation, and one study suggests that this is a likely mechanism of its psychological health benefits. Further research needs to be done in order to confirm these findings. In addition, there is still a need to understand how mindfulness and emotion regulation relate to physical health outcomes.

The research specific to mindfulness and cognitive emotion regulation is limited; however, there have been studies that have examined the relation between mindfulness and thinking and rumination (which is one maladaptive cognitive emotion regulation strategy). Teasdale, Segal and colleagues (Teasdale et al., 2002) emphasize the importance of disengaging attentional focus from ruminative thoughts and increasing

metacognitive awareness in their description of the mindfulness-based cognitive therapy (MBCT). Based on their research, they propose that mindfulness may reduce depression by changing the individual's relationship to their negative thoughts. The results from one study comparing mindful meditation to relaxation training indicate that both mindfulness and relaxation are effective in reducing negative psychological states and enhancing positive states of mind for students experiencing significant distress, but that mindful meditation was unique in reducing rumination and distraction compared with relaxation (Jain et al., 2007). Feldman, Hayes, Kumar, Greeson, & Laurenceau (2007) found that scores on the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) were associated with clarity of feelings, mood repair, attention to feelings, and distraction. Since the association of the CAMS-R was stronger with clarity of feelings than with distraction the authors hypothesize that learning mindfulness both helps to diminish rumination and also helps people become more comfortable sitting with unpleasant emotions. Additionally, Deyo and colleagues (Deyo, Wilson, Ong, & Koopman, 2009) found that MBSR training reduced both rumination and symptoms of depression. However perhaps due to a small sample size, they were not able to prove that the decreased rumination was due to increases in mindfulness, and they didn't test whether or not rumination mediated the negative relation of mindfulness to depression.

Research has also shown that higher levels of dispositional mindfulness in a typical population, and a mindfulness intervention in a psychological treatment seeking sample, reduced the frequency of depressive, worrisome, and social fear negative thoughts and also perceptions of the ability to let go of negative thoughts (Frewen, Evans,

Maraj, Dozois, & Partridge, 2008). Another interesting study compared the effects of a mindfulness intervention to relaxation training and utilization of set worrying periods on the emotion regulation of chronic worriers (Delgado et al., 2010). The researchers found that the mindfulness intervention group reported better emotional meta-cognition and had improvements in somatic and autonomic regulation during cardiac defense (e.g. fight or flight) evocation compared to the active control group. They conclude that this is evidence that mindfulness works to reduce chronic worry by promoting emotional and physiological regulatory mechanisms.

Collectively, these findings suggest that cognitive emotion regulation is a strong candidate as an important mechanism underlying the link between mindfulness and emotional distress. However, this has yet to be proven. Moreover, no studies were found looking at the direct relation between cognitive emotional regulation and physical health outcomes. The current proposal differs from previous research in that it is the first to study three key cognitive emotion regulation strategies including catastrophizing, rumination, and self-blame as potential mediators of the relation between mindfulness and multiple outcomes including stress, physical health, emotional distress and well-being in a young adult population. As mentioned earlier, these cognitive emotion regulation strategies are strongly related to psychological health, and have been chosen because mindfulness is predicted to reduce engaging in and buying into this type of thinking.

Mindfulness and Goal-Directed Behavioral Self-Regulation

Proposing that a greater capacity for self-regulated behavior and therefore goal attainment is a mechanism of the benefits of mindfulness may to some appear to be a paradox. The practice of mindfulness is often done sitting and focusing on the breath, in what appears to be non-doing, and with a mindset of non-judgment, non-striving, non-attachment, and curiosity about and acceptance of what is. In fact, comedians have made jokes such as "I realized I'm not lazy, I'm just Buddhist," or about "the monk who refuses to help because he's "too busy doing nothing." Based on this line of thinking, it could be predicted that being mindful would lead to less goal-directed behavior.

So why does the hypothesis of this study predict the opposite? According to Brown & Ryan (Kirk Warren Brown & Richard M. Ryan, 2003, p. 823), "mindfulness may be important in disengaging individuals from automatic thoughts, habits, and unhealthy behavior patterns and thus could play a key role in fostering informed and self-endorsed behavioral regulation, which has long been associated with well-being enhancement." This research hypothesis is based on the fact that persistence in working towards meaningful goals has been strongly related to happiness and psychological well-being (Eisenberg et al., 1995), and because goal-directed behavior often stopped by strong uncomfortable emotions such as fear. As a result, many people fail to set and/or work towards goals as a result of procrastination due to their judgments about the unpleasantness of the efforts required, attachments to and fears and anxieties around the outcomes of these efforts, and/or following their impulses to do something that is more immediately rewarding or will reduce their discomfort.

Behavioral self-regulation involves controlling one's own activity and reactivity to environmental stimuli (Dawes, Clark, Moss, Kirisci, & Tarter, 1999). Carver and Scheier (1998) have provided a comprehensive feedback loop model describing how goal-directed behavioral self-regulation works. They explain that all behavior is goal-directed, and that these goals are ordered hierarchically. Goals can include virtually any human aim such as to obtain food, to reduce the discomfort caused by a strong physiological emotional response, to meet caregiver, societal, or self-standards, or to achieve a personal objective such as making a new friend or getting accepted to college. The reason people regulate their behaviors is because they receive feedback indicating that their current behavior is not, or that their most natural response will not effectively move them towards their goal(s). According to the model, one's priorities and investment in the goal is directly related to the intensity of positive or negative affect one will experience when receiving feedback indicating that one is either succeeding or failing to reach that goal. The person must then cognitively evaluate whether to disengage from the goal, continue with their current strategy, or to change their approach based on this information and their emotional response.

The practice of mindfulness is done in order to develop a greater capacity for living in the present and reducing suffering in everyday life. Mindful people do not stop setting, working towards, and achieving goals. Yet they may be more likely to focus their awareness on their meaningful priorities and notice and catch themselves when they begin to do something counter to their most important goals due to improved awareness and attention, and/or experience less suffering and recover more quickly when goals are

thwarted due to less judgment and greater acceptance. In fact, higher levels of self-reported mindfulness are associated with self-reports of greater engagement in valued behaviors and interests (K. W. Brown & R. M. Ryan, 2003). In addition, numerous authors, and Buddhist teachings have proposed that mindfulness leads to insight (Carver et al., 2008; Shapiro et al., 2006). With greater mindfulness, these insights are likely to develop both around what is truly important to the individual, and around the impermanence of mental and emotional states, thus reducing their hold on him or her. One study by Lykins and Baer (2009) demonstrated that both meditation experience and higher self-reported levels of mindfulness predicted better behavioral self-regulation regardless of emotional state as measured by the Difficulties in Emotion Regulation Scale. Greater mindfulness may make judgments of and attachments to outcomes of goal-directed efforts less likely, thereby reducing the likelihood of resistance to or fear of taking action. In mindfulness practice, meditators learn to notice thoughts and emotions that are uncomfortable or painful with curiosity, non-judgment, and acceptance. As a result, they typically learn how relate differently to "negative" thoughts and emotions, and that they can accept these transient states and still move towards their goals instead of trying to resist or avoid them at all costs.

Although several authors have proposed behavioral self-regulation as a potential mechanism of mindfulness, the research to support this theory is actually quite sparse. A limited number of studies have supported a direct relation between mindfulness and behavioral self-regulation, and no studies in any population have demonstrated that goal-directed self-regulation is a mechanism of mindfulness. The current study proposes that

with this greater understanding of one's values and priorities, and reduced fear of action (due to insights around the impermanence of and disidentification from fearful or uncomfortable thoughts and emotions), self-regulated and goal-directed actions will become easier to accomplish. In line with Bandura's Self-Efficacy Theory (Bandura, Caprara, Barbaranelli, Gerbino, & Pastorelli, 2003), it is proposed that as mindful individuals develop greater capacity for the self-regulation of their thoughts, emotions, and behaviors through personal experience (and/or learning from mentors and peers in the MBSR group), this will give them greater influence over their inner and outer environment, which will improve their feelings of self-efficacy. Moreover, with less attachment to goal outcomes, more mindful individuals may be better able to move on and re-engage with new goals when success at a particular goal becomes impossible or unlikely. Over time, this may enable more mindful individuals to live lives that are more aligned with their personal priorities and goals even in the face of the obstacles and challenges that all humans face. Thus, this study will test the hypothesis that higher levels of mindfulness will predict more self-regulated goal-directed activity, which will mediate the benefits of mindfulness on stress reduction, physical health, emotional distress, and well-being.

Mindfulness and Stress Reduction

Stress reduction is the most commonly proposed mediator of mindfulness, especially in the MBSR program. Stress is difficult for scientists to define as it is a subjective experience with an array of potential physical, emotional, inflammatory, and hormonal responses. It has been defined as a state of disturbed homeostasis inducing

somatic and mental adaptive reactions, defined as the "stress response," aiming to reconstitute the initial homeostasis or a new level of homeostasis after successful adaptation (Bartolomucci & Leopardi, 2009). In his book on Social Intelligence, Daniel Goleman (2006, p. 268) discusses the role of stress, and states that it “handicaps our abilities for learning, for holding information in working memory, for reacting flexibly and creatively, for focusing attention at will, and for planning and organizing effectively.” Furthermore, both life event and specific, enduring work-related psychosocial stress have been shown to contribute to the onset of depression (Kendler, Karkowski, & Prescott, 1999; Tennant, 2001). In terms of the body's capacity for fighting disease, a meta-analysis of over 300 empirical studies showed that acute stress was associated with adaptive upregulation of natural immunity, whereas chronic stress was associated with maladaptive suppression of cellular and humoral immunity (Segerstrom & Miller, 2004). Thus stress, and especially chronic stress, is a likely culprit for damaging effects on physical and emotional distress.

Shapiro and colleagues (Shapiro, Oman, Thoresen, Plante, & Flinders, 2008) found that two different types of mindfulness interventions (MBSR and E. Easwaran's (1978/1991) Eight Point Program) both reduced stress similarly, and that the relation of the intervention to stress was mediated by increases in mindfulness as measured by the MAAS. Shapiro's group also researched the impact of MBSR on stress in master's degree students studying to become therapists, and found that compared to the control group, students who participated in the 8-week MBSR intervention had reductions in their perceived stress scales scores, which were predicted by greater changes in their

mindfulness scores as measured by the MAAS (Shapiro, Brown, & Biegel, 2007).

Another study specifically looked at the relation between trait mindfulness and relationship stress response in couples who were asked to discuss a conflict, finding that participants with higher trait mindfulness had less emotional stress as measured by anxiety and anger/hostility after the conflict discussion (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007). Moreover, undergraduate students given 5 days of 20-minute integrative meditation training had significantly decreased stress-related cortisol compared to a relaxation control group (Tang et al., 2007). Thus, there is evidence to support the direct relation between mindfulness and stress reduction. However, this study is proposing that the relation between mindfulness and stress reduction is mediated by the relations between mindfulness and goal-directed behavioral regulation and cognitive emotion regulation. No studies have looked at this. In addition, it is proposed that stress reduction will be a key mediator of the relation of cognitive-emotional and behavioral self-regulation to the study outcomes.

Mindfulness and Sleep Quality

College is a busy time, and sleep deprivation is common during this developmental period. Sleep is another mechanism by which mindfulness may impart benefits to physical and psychological health. Although many questions still exist around the exact purpose of sleep, it is a necessary recurring state in all mammals that has been found to have a powerful influence on many aspects of health. Adequate amounts and/or quality of sleep have been linked to longevity and either too much or too little have been associated with early mortality (Grouzet et al., 2005). These differences in longevity may

be due in part to other related health issues in that not getting enough sleep has been related to obesity, diabetes, hypertension and other cardiovascular diseases (Shankar, Syamala, & Kalidindi, 2010; Sheldon, Ryan, Deci, & Kasser, 2004). Sleep deprivation studies have also demonstrated the role of sleep in immune function including wound healing and white blood cell counts (Houser-Marko & Sheldon, 2008; Sheldon & Cooper, 2008).

Furthermore, sleep has been implicated in numerous studies of memory and emotions including emotional regulation and emotional memory processing (Walker, 2010). Research by Yoo, Gujar, et al. (2007) found that in healthy adults one night of sleep deprivation resulted in 60% greater magnitude of amygdala reactivity to negative picture stimuli, and a significant loss of functional connectivity between the amygdala and the medial prefrontal cortex (a region known to have inhibitory projections to the amygdala). In fact, major depression has consistently been linked to sleep abnormalities, and insomnia is a key risk factor to the development of initial and recurrent episodes of depression (Perlis et al., 2006). Similarly, treating insomnia with behavioral therapy in addition to pharmacotherapy was found to reduce both insomnia and residual depression (Watanabe et al., 2011).

Stress and worry are often cited as reasons for having difficulty with sleeping, and improvements in sleep quality are widely reported by practitioners of mindfulness. Research is beginning to confirm these reports. Carlson & Garland (2005) examined the efficacy of a MBSR intervention in cancer patients, and found that sleep disturbances were reduced, and sleep quantity and quality improved, while fatigue and mood

disturbances were decreased. Additionally, a mindful meditation and CBT intervention demonstrated benefits of this combined treatment on sleep and insomnia symptoms were generally maintained during time point across the 12-month follow-up period, and that measures of mindfulness skills were negatively associated with perceived daytime sleepiness across each time point (Ong, Shapiro, & Manber, 2009). Another mindfulness intervention with adolescents treated for substance abuse found that greater frequency of mindful meditation was associated with improvements in sleep quality and duration (Britton et al., 2010). A limitation of the aforementioned studies was lack of a control group. A small but interesting study by Cynthia Gross and colleagues (2006) compared the efficacy of a MBSR intervention to pharmacotherapy with eszopiclone and found that the MBSR group had reductions in insomnia and increases in sleep quantity and quality similar to the pharmacotherapy group at 8 weeks and 5 months, but with greater treatment satisfaction. As a result of these findings, this study will be the first to examine sleep quality as a potential mediator of the relation between mindfulness and physical health, emotional distress, and well-being. This research hypothesis involves two steps of mediation, wherein higher reported levels of mindfulness in college students will relate to better cognitive-emotion regulation strategies and stress reduction, which will relate to improved sleep quality, and together these will relate to better health and well-being outcomes (see Figure 1).

Purpose and Hypotheses of Present Study

This study will augment past research by building upon currently existing data on

the relations between mindfulness and physical and psychological health, studying these relations during emerging adulthood, and testing theories around the underlying mechanisms of mindfulness. Despite the dramatic increase in publications on the efficacy of mindfulness in the past few years, the processes that explain its health benefits are not well researched or understood. To my knowledge based on a review of the literature, there have not been any studies that have examined goal-directed self-regulation and cognitive emotion regulation as mediators of the relation between mindfulness and stress reduction, emotional distress, physical health, and well-being. Further, this is the first study to examine stress reduction and sleep quality as mediators of the relation between goal-directed self-regulation and cognitive-emotion regulation and health and well-being outcomes. Moreover, this study is unique in that no studies have proposed models with multiple steps of mediation. The initial goal of the present study is to examine the direct relations between mindfulness and emotional distress, physical health, and well-being in a sample of college students during the developmental period of emerging adulthood. The second goal, and primary purpose of the study will be to further the research in this field by examining whether and in what ways these relations are mediated by cognitive-emotional and goal-directed behavioral self-regulation, stress, and sleep in a multiple mediator model in order to better understand the mechanisms of mindfulness.

Direct Effect Hypotheses

Hypothesis 1a Direct Relation of Mindfulness and Outcomes: The mindfulness literature has generally supported its relation to better health and well-being. Thus for this

study, self-reported mindfulness is predicted to have a strong direct relation to measures of physical health (e.g. Body Mass Index (BMI), general health, physical activity, and vitality), emotional distress (e.g. anxiety, depression, and Positive and Negative Affect Schedule (PANAS)) and well-being (e.g. happiness, life satisfaction, and PANAS positive) in college students during the developmental period of emerging adulthood. Specifically, higher levels of mindfulness will relate to better physical health including a healthy BMI, higher levels of physical activity, self-reported general health, and greater energy and vitality. Further, increased mindfulness will relate to less emotional distress including lower PANAS Negative, anxiety and depression. Finally, more mindfulness will have a strong direct relation to improved well-being as measured by happiness, life satisfaction, and PANAS Positive. Theoretically, gender, ethnic group, and age (given that they are all young adults) differences are not anticipated to impact the way that mindfulness relates to the mediators and outcomes in the models. However, these factors may have direct relations to the health and well-being outcomes, therefore these will be entered into the models as covariates in order to explain as much variability as possible.

Hypothesis 1b Direct Relation of Mindfulness to Mediators: Previous literature has shown that mindfulness predicts better emotion regulation, and less rumination. Additionally, as noted earlier people who score higher on self-reported mindfulness, and those who are experienced meditators, both have greater behavioral self-regulation (Lykins & Baer, 2009). Therefore, it is hypothesized that higher college student reported mindfulness will be associated with corresponding increases in goal-directed self-regulation and cognitive emotion regulation capabilities. In addition, increased

mindfulness is expected to be related to lower levels of stress and improved sleep quality. These relations are anticipated to be similar across the emerging adult age group, gender, and ethnic groups.

Hypothesis 1c Direct Relation of Mediators to Outcomes: Each of the mediators was selected because of its relation to positive health outcomes in the literature. Goal-directed self-regulation is hypothesized to relate to less stress, increased sleep quality, lower emotional distress, better physical health, and greater well-being in the young adult sample. Similarly, greater cognitive-emotion regulation is anticipated to also be associated with lower stress, improved sleep quality, lower emotional distress, better physical health, and greater well-being in the students. In line with the literature, stress reduction is expected to relate to less emotional distress and improved sleep quality, physical health and well-being. Finally, better sleep quality is predicted to relate to reduced emotional distress and improvements in physical health and well-being. While the pattern of relations is anticipated to be similar across the age, gender, and ethnic groups, these characteristics will be added to the models as covariates to determine whether they directly relate to the outcome variables.

Mediation Hypotheses

Hypothesis 2a Goal-Directed Self-regulation as a Mediator: The primary goal of this study is to elucidate the underlying mechanisms by which mindfulness impacts health. It is proposed that once goal-directed self-regulation is entered into the model as a mediator between mindfulness and stress reduction, it will partially eliminate the direct relation between mindfulness and stress reduction. Furthermore, goal-directed self-

regulation is also expected to partially mediate, or explain the relations between mindfulness and physical health, mindfulness and emotional distress, and mindfulness and well-being.

Hypothesis 2b Cognitive-emotional Regulation as a Mediator: It is hypothesized that cognitive-emotion regulation will be a strong mediator of the relation between mindfulness and stress. Once cognitive emotion regulation, which comprises measures of rumination, catastrophizing, and self-blame, is entered into the model as a mediator between mindfulness and stress reduction, it will considerably reduce the direct relation between mindfulness and stress reduction. Additionally, cognitive emotion regulation is also predicted to largely mediate the relations between mindfulness and the study outcomes. Thus, once cognitive-emotion regulation is added to the structural equation model, the direct relation between mindfulness and the study outcomes including physical health, emotional distress, and well-being, are expected to be greatly diminished or eliminated. This would support the hypothesis that cognitive emotion regulation is an important mechanism of mindfulness.

Hypothesis 2c Stress Reduction as a Mediator: Previous research has demonstrated that there is a relation between emotion regulation capability and the experience of psychological stress and post-traumatic stress symptoms (Tull, Barrett, McMillan, & Roemer, 2007; M. J. Wang & Saudino, 2011), and more specifically that cognitive emotion regulation strategies including rumination and self-blame are predictive of greater stress (Martin & Dahlen, 2005). Further, setting avoidance versus approach goals has also been shown to predict greater stress and reduced well-being

longitudinally (Elliot, Thrash, & Murayama, 2011). Moreover, stress has been linked to various aspects of physical and mental health. Based on this literature, this study hypothesizes that stress reduction will be a key mediator of the relation between goal-directed self-regulation and the study health and well-being outcomes. Stress reduction is also predicted to mediate the relation between goal-directed self-regulation and sleep quality. Once stress reduction is added to the model, the direct relation between goal-directed self-regulation to sleep quality and the study outcomes is expected to be reduced. Similarly, when stress reduction is entered into the model as a mediator it will greatly reduce the direct relation of cognitive-emotion regulation to physical health, emotional distress, and well-being.

Hypothesis 2d Sleep Quality as a Mediator: Previous research has demonstrated a relation between higher mindfulness and improved sleep quality and quantity (Carlson & Garland, 2005). As outlined previously, stress and negative emotions may contribute to difficulty falling and staying asleep, and sleep has been linked to aspects of physical and mental health. Thus, it is hypothesized that sleep quality will be a modest mediator of the relation from cognitive emotion regulation to physical health, emotional distress, and well-being. In addition, sleep quality is also predicted to mediate the relation from stress reduction to these study outcomes. Overall, adding sleep to the structural equation model is anticipated to reduce the direct effects of cognitive-emotion regulation and stress reduction on the proposed outcomes, demonstrating that improving sleep quality is one of the downstream mechanisms of mindfulness.

Hypothesized Model Fit Hypotheses

Hypothesis 3a Hypothesized Mediation Model Fit for Mindfulness and Emotional

Distress:

While two models of the mediation of the relation between mindfulness and emotional distress are being investigated, it is predicted that there will be differences in the degree to which the data fit the models. Specifically, the fit of the data to the two proposed models will be compared. It is predicted that the SEM fit indices will support a better fit of the hypothesized mediation model of mindfulness and emotional distress compared to the general comparison mediation model of mindfulness and emotional distress.

Hypothesis 3b Hypothesized Mediation Model Fit for Mindfulness and Physical

Health:

Comparisons will be made between two possible mediation models depicting the relation between mindfulness, mediators, and physical health. The study hypothesis is that the data fit indices will support the acceptance of the hypothesized mediation model of mindfulness and physical health, which is based on theory, compared to the basic mediation model of mindfulness and physical health.

Hypothesis 3c Hypothesized Mediation Model Fit for Mindfulness and Well-

Being:

When comparing the two models of the mediation of the relation between mindfulness and well-being, it is predicted that there will be differences in the degree to which the data fit the models. More precisely, this study hypothesizes that the SEM fit indices will support a better fit of the hypothesized mediation model of mindfulness and

well-being and a relatively worse fit of the general comparison mediation model of mindfulness and well-being.

In sum, the primary goal of this study is to elucidate the underlying mechanisms by which dispositional mindfulness impacts health and well-being during emerging adulthood. This cross-sectional data set does have some limitations in that it will not be able address questions of causality. However, it will allow testing of the fit between the data and the proposed theoretical model, which can provide insights about the relations among the variables and the role of the proposed mediators. The study research hypothesis is that the mindfulness will relate to reduced emotional distress and improved physical health and well-being through its relation to the students' capacity for goal-directed self-regulation, and cognitive-emotion regulation, thereby reducing stress, improving sleep quality and improving health and happiness. Therefore, if direct relations between self-reported dispositional mindfulness to physical and psychological health are found, then the proposed theoretical mediation model will be tested to find the best fit for the relations between mindfulness, cognitive emotional regulation, behavioral self-regulation, sleep quality, stress reduction, emotional distress, physical health, and well-being.

METHOD

Participants

The study consisted of 554 undergraduate students (72% female) from University of California, Riverside. Consistent with the developmental period of emerging

adulthood, the majority (98%) of participants were between the ages of 18 and 24 years. The remaining participants reported their age between 25 and 28 years. The sample was ethnically diverse; over one-third (34%) were Asian, 30% were Latinos, 16% were Caucasian, 8% were African American, 3% were Middle Eastern, and 9% reported a multi-ethnic identity or other. Active consent forms were collected from all students who participated.

Procedures

Data were collected during the spring quarter of 2009 from two psychology courses, Introductory Psychology and Health Psychology. A brief announcement about mindfulness and the study was provided to students before class lecture at the beginning of the quarter. Students interested in participating in the study completed the questionnaires via surveymonkey.com within two weeks from the announcement. Participants submitted a signed hard copy of the consent form at the time of the announcement and/or provided electronic consent at the beginning of the online survey. Participants received either research credit or extra credit depending on the course they were enrolled in for completing the surveys. Surveys took approximately 1 hour to complete.

Constructs Assessed and Measures

This study examined one predictor (dispositional mindfulness), four mediators (goal-directed behavioral self-regulation, cognitive emotion regulation, stress reduction, and sleep), and three latent outcomes (emotional distress, physical health, and well-

being). Measures assessed were used to construct the model's four manifest variables of mindfulness, stress, sleep, and behavioral self-regulation and four latent variables of cognitive emotion regulation, emotional distress, physical health, and well-being. Three subscales (self-blame, rumination, and catastrophizing) of the Cognitive Emotion Regulation Questionnaire (CERQ-short; Garnefskia & Kraaij, 2006) were used to create the latent variable of cognitive emotion regulation. While Garnefskia and Kraaij originally created the questionnaire to include nine distinct cognitive coping strategies, only three subscales (self-blame, catastrophizing, and rumination) are used. These subscales were selected because their constructs were predicted to be related to mindfulness and to have strong relations to mental health outcomes. These three subscales also held together and separated from the others when factor analysis was run on the entire measure, so it was concluded that it was appropriate to combine them as a latent variable. Three manifest variables were used to create each of the latent outcomes (emotional distress, physical health, and well-being).

Predictor

Mindfulness. Mindfulness was assessed using the Five Facet Mindfulness Questionnaire (FFMQ) (R. A. Baer et al., 2006). This 39-item scale consisted of five factors that represent the elements of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. Participants rated each statement on how well it represented their experiences using a 5-point scale with choices including 1 = never/very rarely true, 2 = rarely true, 3 =

sometimes true, 4 = often true, and 5 = very often/always true. Sample items are, "When I'm walking, I deliberately notice the sensations of my body moving" and "I tell myself I shouldn't be feeling the way I'm feeling." All five facet subscales demonstrated adequate to good internal consistency ranging from .75 to .91.

Mediators

Stress. The Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983) was used to evaluate participants' stress level. This 10-item self-reported instrument asked participants about their feelings and thoughts during the last month using a 5-point scale from never, to sometimes, to very often. It is a measure of the degree to which situations in one's life are appraised as stressful. Sample items include, "How often have you felt confident about your ability to handle your personal problems" and "In the last month, how often have you felt nervous and stressed." The PSS demonstrated adequate reliability, $\alpha = .86$.

Sleep quality. Sleep quality was assessed by two questions. Participants were asked to rate their quality of sleep and the extent to which they had difficulty falling asleep or issues with waking up while sleeping. The first item was "To what extent do you have difficulties with falling asleep, waking up during the night, and waking up too early?" Responses were rated on a 5-point scale from not at all, to moderately, to very much. The second item was "In general, how would you rate the quality of your sleep?" Responses were rated on a 5-point scale including very poor, poor, fair, good, and very good.

Goal-directed Behavioral self-regulation. The Self-Regulation Questionnaire (SRQ) (J. M. Brown, Miller, & Lawendowski, 1999) was used to assess participants' self-regulatory functioning. The original 63-item instrument evaluated the self-regulatory processes or the general principles of behavioral self-control (Cronbach's $\alpha = .91$). For the purposes of this study, four items about participants' capacity to work towards goals were used (Cronbach's $\alpha = .69$). The measure was limited to the goal-oriented self-regulation questions due to the author's theories around the importance of goal-directed behavior in living a healthy and satisfying life. Example items include "I am able to accomplish goals I set for myself" and "I usually keep track of my progress toward my goals." Participants responded on a 5-point scale ranging from strongly disagree to uncertain or unsure to strongly agree.

Cognitive Emotion Regulation.

As discussed above, the short version of the self-reported Cognitive Emotion Regulation Questionnaire (CERQ-short) (Garnefski & Kraaij, 2006) was used to measure participants' cognitive coping strategies. Participants indicated their general thought process after having experienced a negative or unpleasant event. The CERQ-short consisted of 2 items for each of its nine distinct subscales: self-blame, acceptance, rumination, positive refocusing, refocus on planning, positive reappraisal, putting in perspective, catastrophizing, and other blame. This study only included a latent variable comprised of self-blame, rumination, and catastrophizing subscales based on the author's theories that these particular cognitive emotion regulation strategies would be negatively

related to mindfulness. Furthermore, these three subscales all loaded strongly onto one factor when factor analysis was run for the 9 subscales, so they fit together. Participants responded on a 5-point scale including never, almost never, sometimes, almost always, and always.

Self-blame. Self-blame was assessed by whether participants reported being preoccupied with thoughts about personal mistakes and their sense of guilt. The two items were “I feel that I am the one who is responsible for what has happened” and “I think that basically the cause must lie within myself” (Cronbach’s $\alpha = .68$).

Rumination. Rumination was assessed by whether participants reported being preoccupied with feelings and thoughts related to their negative experience. The items were “I am preoccupied with what I think and feel about what I experienced” and “I often think about how I feel about what I have experienced” (Cronbach’s $\alpha = .73$).

Catastrophizing. Catastrophizing was examined by whether participants reported recurring thoughts about how their experience was far worse than others’. Items included “I continually think how horrible the situation has been” and “I keep thinking about how terrible it is what I have experienced” (Cronbach’s $\alpha = .81$).

Outcomes

Emotional Distress

Depressive symptoms. The Center for Epidemiological Studies-Depression Scale (CES-D) (Radloff, 1977) was used to assess depressive symptoms. This 20-item Likert-

type scale asked participants to report their emotional state and feelings over the past week using a 4-point scale with choices including never or rarely, sometimes, a lot of the time, and most or all of the time. Sample items included, “you were bothered by things that usually don’t bother you” and “you felt depressed.” Items were coded assigning higher scores to greater levels of depression (Cronbach’s $\alpha = .85-.90$).

Anxiety. The Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988) was employed to assess the physical effects of anxiety. The original scale consisted of 20 items. For this particular study, only items that would more likely be experienced by emerging adults with anxiety were included, reducing the scale to 7 items (e.g., unable to relax, fear of the worst happening, nervous, fear of dying, scared, indigestion or stomach discomfort, and fear of losing control). Items dropped included items such as feelings of choking, difficulty breathing, wobbliness in legs, numbness, and feeling hot, etc. that may have been indicative of other physical problems. Participants were asked how much each symptom was experienced during the past week using a 4-point scale of not at all, mildly, moderately, or severely (reliability measure, $\alpha = .80$).

Negative affect. Negative affect was assessed using the Positive and Negative Affect Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). The negative affect subscale consisted of 10 words that described different negative feelings and emotions. (e.g., irritable, upset, and ashamed). Participants were asked to indicate the extent they generally felt this feeling or emotion using a 5-point scale ranging from very slightly/not at all, to somewhat, to extremely. Alpha coefficient was reliable at .85.

Physical Health

General health. This one-item measure was self-reported, asking participants, “Compared to others of your same age and sex, how is your health?” Participants reported their subjective level of health on a 5-point scale (1 = very poor; 2 = poor, 3 = fair, 4 = good, and 5 = very good).

Activity level. Activity level was assessed by one item, asking participants how often during a usual week were they physically active for at least a 20 minute period.

Subjective Vitality. The one-item measure asked participants, “How would you describe your energy and vitality at this period of life?” Participants reported their level of vitality using a 4-point scale ranging from lack of energy to vigorous.

Body Mass Index (BMI). Obesity was measured via body mass index. BMI was calculated using self-reported height and weight data and can serve as a way of measuring adiposity (BMI formula = $(\text{weight in pounds}/(\text{height in inches})^2) \times 703$).

Subjective Well-being

Happiness. Happiness was assessed by one item, which asked participants how happy they were in comparison to their peers. Responses were reported on a 5-point scale from “a lot more happy” to “the same” to “a lot less happy.”

Life satisfaction. Life satisfaction was measured by one item, asking participants “In general, how satisfied are you with your life?” Participants responded using a 5-point scale from very dissatisfied to neutral to very satisfied.

Positive affect. Positive affect was assessed using the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988). The positive affect subscale consisted of 10 words that described different positive feelings and emotions. (e.g., interested, strong, inspired). Participants were asked to indicate the extent they generally felt this feeling or emotion using a 5-point scale ranging from not at all, to somewhat, to extremely. The alpha coefficient was reliable at .85.

Covariates

Participant age, gender, and ethnic background were measured in order to take into account variability accounted for by these factors. Overall, it was predicted that mindfulness would have similar mechanisms of affecting the study outcomes across these covariates.

Analytic Procedures

The focus of the analyses was to 1) examine the direct relation between mindfulness and the three latent health outcomes (emotional distress, well-being, and physical health) after controlling for gender, age, and ethnicity (Direct Relation Model), and 2) investigate whether and in what manner the relations between mindfulness and the outcomes were mediated by cognitive emotion regulation, goal-directed self-regulation, stress reduction, and sleep quality while controlling for gender, age, and ethnicity. This was done by comparing two possible mediation models. The first mediation model was a basic comparison model wherein all of the mediators of the relation from mindfulness to the latent endogenous variables were entered in a single step (See Figure 1.2). The next

mediation model was the hypothesized model for this dissertation, which conveyed the complex relations and mediation among variables that were based on theory, and involved multiple steps of mediation to get from mindfulness to the latent emotional distress, physical health, and well-being variables (see Figure 1.1). First, SPSS version 16.0 (SPSS, 2007) was used to examine the demographic data and to test whether or not the data was normally distributed. Next, it was important to show that the variables of interest were related to each other. Therefore, Pearson correlations were used to determine whether measures of the predictors, mediators, and outcomes were significantly associated. Next, Baron & Kenny's (1986) four conditions for mediation were examined. Namely, when X represented the predictor variable (e.g. mindfulness), Y represented the endogenous variables (e.g. physical health; emotional distress; well-being), and M represented the exogenous variables (e.g. goal-directed self-regulation; cognitive-emotion regulation; stress reduction; sleep quality):

1. The total direct relation between X and Y was significant.
2. The direct relation of X to M was significant.
3. The direct relation of M to Y controlling for X was significant.
4. The direct relation between X and Y controlling for M became nonsignificant for full mediation or smaller than the total relation between X and Y for partial mediation.

However, due to the complex nature of the theoretical model which involved multiple steps of mediation, structural equation path modeling was used to test for these conditions of mediation. It was predicted that relations and mechanisms of mindfulness would be similar across gender, age, and ethnic groups, however, covariates were controlled for to account for their potential influence on the endogenous variables. For example, if gender had an important relation to physical health or emotional distress that accounted for important variability independent of the effects of mindfulness, this was taken into account.

Structural equation modeling (SEM) analyses was performed using *Mplus* Version 6.11 (Muthén & Muthén, 1998). SEM was used to estimate the strength and direction of observed relations and to analyze how well the proposed theoretical model for this study fit the data that was collected. The strengths of SEM were that it extended the capability to look at complex relationships by encompassing both latent variable measurement models and a structural model which was able to incorporate multiple paths between exogenous and endogenous variables at the same time (Schreiber, 2008). This has enabled researchers to test theoretical propositions regarding how constructs are linked, and the directionality of these relations. The SEM method of data analysis was flexible and enabled the investigator to test each of the proposed aims of this dissertation research by drawing the hypothesized models in structural equation form and comparing the collected data to these models.

Missing Data. Because this data was collected at a single time point and took one hour, missing data were expected to be minimal for most variables. When there were missing data, parameter estimates and model tests were pursued in the context of Maximum Likelihood (ML) methods as implemented in MPLUS. Missing data bias was assessed by computing a dummy variable reflecting the presence or absence of missing data for each variable in the model and then this dummy variable was correlated with other key variables in the model as well as an array of demographic variables.

Statistical Power and Sample Size Consideration. Structural equation modeling required large sample sizes, especially because there were many free parameters to estimate (Schreiber, 2008). Schreiber (2008) has recommended 20 cases for each estimated parameter, but acknowledged that depending on the challenges of data collection, 10 – 15 cases has sometimes been accepted as reasonable. When all of the measures for the latent variables, endogenous, exogenous and control variables were taken into account, each of the models had up to 19 parameters. As a result, the goal was to collect data from at least 380 participants. Fortunately, due to the offer of research credit or extra class credit to large introductory and health psychology classes, the sample size goal was exceeded, which allowed for sufficient power to run the complex proposed structural equation models.

These analyses were testing hypotheses of the relations between mindfulness, proposed mediators, and outcomes depicted in Figure 1.1 and 1.2. These hypotheses were based on theory, but were exploratory, so separate models were run for each outcome

(emotional distress, well-being, and physical health) in order to allow flexibility in determining whether the pattern of effects was similar or differed for each outcome. For example, this allowed the researcher to test whether goal-directed self-regulation more strongly related to physical health outcomes perhaps because physical health benefitted from goal-directed actions, whereas cognitive emotion regulation more strongly related to emotional distress outcomes such as anxiety and depression. Moreover, it was anticipated that the covariates might have been more important with some outcomes versus others. In addition, each hypothesized model was compared with another plausible competing model (e.g. comparisons were made to a simplified model as shown in Figure 1.2 where mindfulness directly predicted all four study mediators, which then directly predicted the study outcomes) in order to ensure that the best fitting theoretical model was selected. Maximum likelihood was employed to estimate all models, and standardized results were reported. Residual variances were not allowed to correlate for the latent variables. The model fit was evaluated by several goodness-of-fit indices. These included the chi-square to degrees of freedom ratio (χ^2/df), the comparative fit index (CFI), the *Akaike information criterion (AIC)*, the Bayesian information criterion (BIC), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). These fit indices were used to compare the fit of the proposed models. The hypothesized model of relations among mindfulness, mediators, and outcomes is shown below in Figure 1. For hypothesis 1, it was predicted that mindfulness would be directly related to each of the measured outcomes (e.g. emotional distress, well-being, and physical health), even when controlling for covariates. However, for hypothesis 2, it was

predicted that when the mediators (behavioral self-regulation-goals, cognitive emotion regulation, stress reduction, and sleep quality) were entered into the model, the relation between mindfulness and the outcomes would be largely reduced, as these mediators would primarily account for the relations. More specifically, it was predicted that the relation between mindfulness and stress reduction and the study outcomes would be mediated by goal-directed and cognitive-emotional self-regulation, and that stress reduction and sleep quality would then directly impact emotional distress, physical health, and well-being. Additionally, stress reduction was also hypothesized to improve sleep quality, which might contribute to additional benefits for physical and psychological health.

RESULTS

Descriptive Statistics

Table 1 provides a summary of the participants' demographic characteristics. The mean age of the study participants was 20 years ($SD = 2.6$), with an age range from 18 – 28 years, in line with the goal to study mindfulness during emerging adulthood. Six participants who took the survey were dropped from the analyses because they were over age 28. The sample was comprised of students from diverse ethnic backgrounds, with 34% being Asian, 30% Latino, 16% Caucasian, 8% African American, 3% Middle Eastern, and 9% being of multi-ethnic identity or other. The majority of study participants were female (72%), with a minority being male (28%). The means and standard deviations for all continuous study variables are provided in Table 2.

In addition, due to attrition at the end of the survey, and the resulting missing variable scores, the total sample size for each of the SEM model analyses was $N = 440$. Since the mindfulness scale was more than half way through the survey, and was the key variable of interest most likely to have missing data, as planned the missing data analyses were run to determine whether or not having missing data on mindfulness was correlated with any of the other study variables. Missing data on mindfulness was not significantly correlated with any variable. The only variable that approached a significant correlation with being missing on mindfulness was general health, $p = .181$, $r = .057$. The demographic variable that came closest was being African American relative to Caucasian, $r = .044$, $p = .301$, and this was not even close to statistical significance. Considering the sample size and number of variables being analyzed, it was unlikely that none of the variables would be significant if there was a pattern to the missing data. Thus, it was concluded that the data were missing completely at random and that this was unlikely to impact the study results.

The criteria for multivariate normality and linearity of the data were evaluated through SPSS 16.0 (SPSS Inc., 2007). Shapiro-Wilk tests were run for all study variables. The goal for this test of normality was for the scores to be near 1. For the study variables, all Shapiro-Wilk scores were $\geq .80$, and most were between .9 and .98 (which is good). However, all were statistically significant, which could be an indication that the data was not normally distributed. The large sample size for this study had an influence on the likelihood of significance for this test, so visual inspection of the data was also important. Visual inspection by looking at the stem and leaf plots and Q-Q plots, revealed sufficient

normality with the exception of physical activity levels. According to Schreiber (2008), the rule of thumb is that if an individual variable had a value of skew greater than one, it is advisable to transform the data. Schreiber further suggested that for SEM ML estimation with robust standard errors (which was used in the present study) could be used with skewness below two and kurtosis below seven. All of the study variables had skew ≤ 1 and Kurtosis < 7 , with the exception of physical activity, which as a result was transformed to its square root. Once transformed, this reduced the physical activity skew to .42, and kurtosis to 1.08. Therefore, it was concluded that the data had sufficient multivariate normality and linearity to satisfy the requirements of the SEM data analyses.

Pearson Correlations

Bivariate correlations were conducted using SPSS to determine the direct relations between mindfulness, mediator variables, and outcome variables (see Table 3). The pre-specified p-value for meeting statistical significance was $p < .05$. Mindfulness was significantly correlated to all study mediators, including self-regulation goals, cognitive emotion regulation, stress reduction, and sleep quality with $p < .01$. The strength of these relations were substantial for self-regulation goals, $r = .48$, $p < .001$, cognitive emotion regulation, $r = .30$, $p < .001$ and stress reduction, $r = .46$, $p < .001$. The relations between mindfulness and sleep quality was relatively modest but still statistically significant, $r = .14$, $p < .01$. Mindfulness was also significantly correlated to all but one of the study outcome measures with $p < .05$. Mindfulness was strongly negatively correlated to all three measures of emotional distress, including depression, $r = -.48$, $p < .001$, anxiety, $r = -.27$, $p < .001$, and PANAS negative, $r = -.50$, $p < .001$.

Mindfulness was moderately positively correlated with three out of four measures of physical health, including general health, $r = .25$, $p < .001$, level of physical activity, $r = .12$, $p < .05$, and energy and vitality, $r = .22$, $p < .001$. The single outcome that was not correlated with mindfulness at all was BMI, $r = -.05$, $p > .05$. Finally, mindfulness was also highly positively correlated with all the measures of well-being, including happiness, $r = .36$, $p < .001$, life satisfaction, $r = .42$, $p < .001$, and PANAS positive, $r = .53$, $p < .001$. In sum, dispositional mindfulness was found to have statistically significant correlation coefficients in the hypothesized direction with all of the measured variables with the exception of BMI.

Similarly, cognitive-emotional and goal-directed self-regulation variables were directly correlated with most of the study health and well-being variables. However, there were some interesting differences. Self-regulation goals correlated with the three measures of emotional distress, including depression, $r = -.38$, $p < .001$, anxiety, $r = -.19$, $p < .001$, and PANAS negative, $r = -.30$, $p < .001$. Self-regulation goals also modestly positively correlated with all four measures of physical health, including general health, $r = .24$, $p < .001$, BMI, $r = .11$, $p < .05$, level of physical activity, $r = .182$, $p < .05$, and energy and vitality, $r = .13$, $p < .05$. Additionally, goal-directed self-regulation was positively correlated with all well-being measures, including happiness, $r = .34$, $p < .001$, life satisfaction, $r = .39$, $p < .001$, and PANAS positive, $r = .52$, $p < .001$. The next mediator, cognitive emotion regulation had the highest bivariate correlations with the three measures of emotional distress, depression, $r = -.37$, $p < .001$, anxiety, $r = -.30$, $p < .001$, and PANAS negative, $r = -.39$, $p < .001$. Cognitive emotion regulation only

modestly correlated with one measures of physical health, which was general health, $r = .11$, $p < .05$. It's relation to the remaining physical health variables were small and nonsignificant. In contrast, cognitive emotion regulation was positively correlated with all well-being measures, including happiness, $r = .18$, $p < .001$, life satisfaction, $r = .27$, $p < .001$, and PANAS positive, $r = .18$, $p < .001$. In addition, it is important to note that self-regulation goals positively correlated with stress reduction, $r = .33$, $p < .001$, as did cognitive emotion regulation, $r = .34$, $p < .001$. Self-regulation goals also modestly correlated with sleep quality, $r = .20$, $p < .001$, as did cognitive emotion regulation, $r = .14$, $p < .001$.

The next hypothesized mediator, stress reduction, had the strongest bivariate correlations with the three measures of emotional distress, including depression, $r = -.76$, $p < .001$, anxiety, $r = -.63$, $p < .001$, and PANAS negative, $r = -.63$, $p < .001$. Stress reduction also positively correlated with general physical health, $r = .27$, $p < .001$, and energy and vitality, $r = .33$, $p < .05$, but surprisingly not with BMI or physical activity. Moreover, stress reduction had positive bivariate correlations with all well-being measures, including happiness, $r = .48$, $p < .001$, life satisfaction, $r = .55$, $p < .001$, and PANAS positive, $r = .33$, $p < .001$.

Bivariate correlations were also examined for sleep quality and health and well-being variables. Better sleep quality was negatively correlated with emotional distress including depression, $r = -.34$, $p < .001$, anxiety, $r = -.20$, $p < .001$, and PANAS negative, $r = -.22$, $p < .001$. Further, sleep quality was modestly correlated with general physical

health, $r = .14$, $p = .001$, and energy and vitality, $r = .14$, $p = .01$, but contrary to predictions, not with BMI or physical activity. Finally, sleep quality had modest positive bivariate correlations with all three well-being measures, including happiness, $r = .20$, $p < .001$, life satisfaction, $r = .21$, $p < .001$, and PANAS positive, $r = .20$, $p < .001$. Overall, most of the expected direct correlations among variables were found, with the exception of some inconsistency with the physical health outcomes, and particularly BMI, which correlated only very modestly with self-regulation goals and with general physical health. While some of the variables and in particular stress reduction and depression were strongly correlated, the bivariate correlations were all well below .90, so multicollinearity was not considered problematic.

Latent Variables.

Principle components analyses were run in IBM SPSS version 16.0 for each of the measures to be included in a latent variable to assess whether and how well each scale loaded onto one factor, or multiple factors. Several criteria were used to determine whether or not the scales should be combined into one latent variable: 1) theoretical clarity that the measures were representing a single concept, 2) scree plots examining the number of eigenvalues greater than one, 3) simplicity (parsimonious model), and 4) items loadings at least .40 with no cross-loadings. Given this criteria, self-blame, catastrophizing, and rumination clearly loaded onto one factor, with only one eigenvalue greater than one, and were deemed to be appropriate candidates to comprise the cognitive emotion regulation latent variable. Similarly, depression, anxiety, and PANAS negative

were theoretically representative of emotional distress and all clearly held strongly together as one component, with only one eigenvalue greater than one, so they were entered into the confirmatory structural equation models as the components of emotional distress. For physical health, general physical health, physical activity, and energy and vitality all loaded onto one factor. However, contrary to expectations, BMI loaded onto a separate factor. Because of this, only general physical health, physical activity, and energy and vitality were used to create the physical health latent variable. Because BMI did not fit with other physical health measures, and did not relate to mindfulness or most of the other variables, it was excluded from the physical health latent variable. There are many possible reasons for this, which will be discussed later. Finally, happiness, life satisfaction, and PANAS positive were all considered to be conceptually representative of well-being, and all strongly loaded onto one factor, with only one eigenvalue greater than one, so all three were used to create the well-being latent variable in the SEM models. Next, each of the latent variables were created using *Mplus* Version 6.11 (Muthen & Muthen, 1998), and the resulting confirmatory factor analysis models for each of the latent variable is shown in Figures 2.1-2.4 below. The CFA latent variable model for cognitive emotion regulation is presented in Figure 2.1, the CFA model for emotional distress is depicted in Figure 2.2, the CFA model for physical health can be seen in Figure 2.3, and the CFA model for well-being can be viewed in Figure 2.4. Each of the four latent variables was assessed to be a sufficient fit for use in the SEM analyses for this study.

Structural Equation Model Analyses

Since the direct correlations between mindfulness and outcome variables, mindfulness and mediator variables, and mediators and outcomes were statistically significant (with the exception of BMI, which was dropped from the analyses), the next step was to analyze the data using structural equation modeling (SEM). The focus of the analyses was to 1) examine the direct relation between dispositional mindfulness and the three latent health outcomes (emotional distress, physical health, and well-being) after controlling for gender, age, and ethnicity (Direct Relation Model), 2) investigate whether the relations between mindfulness and the outcomes were mediated by cognitive emotion regulation, goal-directed self-regulation, stress reduction, and sleep quality while controlling for gender, age, and ethnicity (Basic Comparison Model), and 3) test the theoretical multi-step mediation mindfulness model (Hypothesized Model) to determine whether or not it more closely fit the data. SEM analyses were performed using *Mplus* Version 6.11 (Muthen & Muthen, 1998). Maximum likelihood was employed to estimate all models, and standardized results were reported. The STDXY coefficients were reported, as in MPLUS these were standardized using the variance of the background and/or outcome variables, in addition to the variance of continuous latent variables. Due to attrition at the end of the survey, and the resulting missing variable scores, the total sample size for all SEM model analyses was $N = 440$. The fit for each model was evaluated by several goodness-of-fit indices and this data is presented in Table 7. These included the chi-square to degrees of freedom ratio (χ^2/df), the comparative fit index (CFI), the Akaike information criterion (*AIC*), the Bayesian information criterion (BIC),

standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). Schreiber (2008) outlined several fit indices and the rules for acceptable fit with continuous data. For the model to be considered a good fit, the χ^2/df ratio (an absolute/predictive fit index) should have been ≤ 2 or 3, the CFI $\geq .95$, the SRMR $\leq .08$, and the RMSEA $< .06 - .08$ including the confidence interval around the estimate. The AIC and BIC were used to compare the non-nested models. The literature didn't provide any specific numeric range considered a good fit, but when comparing two models, a smaller numeric value for AIC and BIC has traditionally been considered a better fit. Because sample size has been reported to have a large impact on the chi-square statistic, it was reported, but not considered as a fit index for this study.

Mindfulness and Emotional Distress Models.

For the first model, which examined the direct relation between mindfulness and emotional distress (See Figure 3.1), results indicated a strong direct relation between dispositional mindfulness and emotional distress with a path coefficient of $\beta = -.55$, $p < .01$. As expected, participants who were more mindful exhibited reduced emotional distress (e.g. less anxiety and depression). Age and ethnicity didn't impact emotional distress, however, being female had a small positive relation to more emotional distress (e.g. more depression and anxiety), $\beta = .16$, $p < .01$. Descriptive goodness-of-fit indices generally demonstrated poor fit adequacy, $\chi^2/df = 4.42$; CFI = 0.91; RMSEA = 0.09 (90% CI: 0.07-0.011). However, this model was primarily to examine the baseline direct

relation between mindfulness and emotional distress while controlling for covariates, not to compare for model fit.

The basic comparison mediation model for mindfulness and emotional distress is shown in Figure 3.2. All four proposed mediators, cognitive emotion regulation, goal-directed self-regulation, stress, and sleep, were tested simultaneously in the model. Mindfulness directly related to each mediator which in turn directly related to emotional distress, with the exception of self-regulation goals, which had no direct relation to emotional distress, $\beta = -.05$, $p > .05$. Specifically, there were strong positive relations between mindfulness and goal-directed self-regulation ($\beta = .48$), stress reduction ($\beta = .46$), and cognitive emotion regulation ($\beta = .51$), and a smaller positive relation between mindfulness and sleep quality ($\beta = .14$), all $p < .01$. Stress reduction strongly predicted less emotional distress ($\beta = -.75$), while cognitive emotion regulation ($\beta = -.27$) and sleep quality ($\beta = -.13$) also made modest contributions, all $p < .01$. Interestingly, the direct relation between mindfulness and emotional distress was completely mediated by these variables, $\beta = -.05$, n.s. However, results for this comparison model indicated a less than adequate fit based on the following fit indices: $\chi^2(86) = 314.3$, $p < 0.01$; $\chi^2/df = 3.65$; CFI = 0.86; RMSEA = 0.08 (90% CI: 0.07-0.09). The AIC = 15730 and the BIC = 15894. Thus, this basic comparison mediation model didn't do a good job of explaining the data for mindfulness, mediators, and emotional distress.

Next, the hypothesized mediation model (Figure 3.3) was tested in order to determine whether or not the theory driven predicted paths among variables would in fact

fit the data for mindfulness and emotional distress better. As depicted in the path model, mindfulness strongly predicted goal-directed self-regulation ($\beta = .48$) and cognitive emotion regulation ($\beta = .50$), both $p < .01$. As predicted, these two self-regulatory mechanisms then mediated the relation between mindfulness and stress reduction, with $\beta = .56$ for cognitive emotion regulation, and $\beta = .16$ for goal-directed self-regulation, both $p < .01$. In fact, once these mediators were entered into the model, the direct relations between mindfulness and stress $\beta = .09$, n.s. disappeared. Next, stress reduction mediated the relations from goal-directed self-regulation and cognitive emotion regulation to emotional distress, and very strongly directly predicted lower emotional distress, $\beta = -.62$, $p < .01$. There was no direct relation between goal-directed self-regulation and emotional distress $\beta = -.07$, n.s., whereas better cognitive emotion regulation directly related to reduced emotional distress, $\beta = -.28$, $p < .01$. Furthermore, stress reduction mediated the relation between cognitive emotion regulation and sleep, and directly predicted better sleep quality, $\beta = .21$, $p < .01$, whereas cognitive emotion regulation was not directly related to sleep quality, $\beta = .10$, n.s. Finally, better sleep quality had a small, but significant direct relation to less emotional distress, $\beta = -.12$, $p < .01$. With all of the mediators entered into the model, the direct path from mindfulness to emotional distress was no longer significant, $\beta = -.07$, n.s., which was evidence of full mediation. None of the covariates significantly impacted emotional distress in this model. These data were generally in agreement with the study mediation hypotheses, although several predicted pathways ended up being non-significant. This model resulted in the following fit indices: $\chi^2(83) = 190.2$, $p < .01$; $\chi^2/df = 2.29$; CFI = 0.93; RMSEA = 0.05 (90% CI: 0.40-

0.06); AIC = 15612; and BIC = 15652. The comparison of these fit indices to the fit indices of the prior model suggested that this hypothesized mediation model of emotional distress fit the data better than the comparison model. Moreover, all of these fit indices met the recommendations for a good model fit, with the exception of CFI, which was very close. Although two of the direct predicted pathways didn't materialize, most did, and overall the data were a good fit of this hypothesized model. Additionally, the direct, indirect, and total path coefficients for the hypothesized model for emotional distress are presented in Table 4, which provides a clear picture of the total contribution of each variable to this outcome. For example, while goal-directed self-regulation didn't significantly directly relate to emotional distress, when taking into account the indirect path coefficients, the total added up to what would be considered a meaningful overall contribution.

Mindfulness and Physical Health Models.

The direct relation between mindfulness and physical health was tested, and is shown in Figure 4.1. There was a clear positive direct relation between dispositional mindfulness and physical health with a path coefficient of $\beta = .37$, $p < .01$. More specifically, participants who had higher levels of dispositional mindfulness tended to have better physical health. Age didn't impact physical health; however, being female relative to male had a modest negative relation to physical health, $\beta = -.24$, $p < .01$, as did being Hispanic, relative to Caucasian $\beta = -.21$, $p < .01$. In other words, males reported better physical health than females and Caucasians reported better health than Hispanics.

Descriptive goodness-of-fit indices indicated a very good fit of this model, $\chi^2/df = 1.1$; CFI = 0.99; RMSEA = 0.02 (90% CI: 0.00-0.05). This good fit of the direct relation between mindfulness and physical health was interesting, and in the expected direction.

Next, the mindfulness and physical health comparison mediation model is provided in Figure 4.2. Again, the four proposed mediators are all entered into the model in a single step, and tested simultaneously in the model. The path coefficients for mindfulness directly predicting each mediator were identical to what was already described in the comparison model for emotional distress above. In contrast to the emotional distress comparison model where goal-directed self-regulation was not directly related to emotional distress, for physical health it was actually the strongest predictor of better health, $\beta = .32$, $p < .01$. Stress reduction ($\beta = .22$) and sleep quality ($\beta = .14$) also made modest yet meaningful contributions to better physical health, $p < .01$, while cognitive emotion regulation didn't, $\beta = .10$, n.s. The direct relation between mindfulness and physical health just missed significance, as it was primarily mediated by these variables, $\beta = .15$, $p = .06$. Two covariates, gender ($\beta = -.23$, $p < .01$) and age ($\beta = -.14$, $p < .01$) did have statistically significant negative effects on physical health in this model, with male and being younger related to better physical health. Altogether, the fit indices indicated a fairly poor fit for this model: $\chi^2(86) = 261.4$, $p < 0.01$; $\chi^2/df = 3.04$; CFI = 0.77; RMSEA = 0.07 (90% CI: 0.06-0.08). The AIC = 15506 and the BIC = 15669. Therefore, the data suggested this model was not an accurate portrayal of the mediation of relations between mindfulness and physical health.

The predicted mediation model (figure 4.3) was run next to establish the degree to which the data would fit the theory driven SEM mediation model of mindfulness and physical health. As shown in the model, mindfulness strongly predicted goal-directed self-regulation ($\beta = .48$) and cognitive emotion regulation ($\beta = .50$), both $p < .01$. As anticipated, these two potential mechanisms then mediated the relation between mindfulness and stress reduction, with $\beta = .56$ for cognitive emotion regulation, and $\beta = .16$ for goal-directed self-regulation, both $p < .01$. Similarly to the hypothesized emotional distress model above, with the mediators in the model, the direct relations between mindfulness and stress $\beta = .11$, n.s., and mindfulness and physical health, $\beta = .13$, n.s., were eliminated. Further, stress reduction partially mediated the relation between goal-directed self-regulation and physical health, fully mediated the relation from cognitive emotion regulation to physical health, and was modestly directly related to better physical health, $\beta = .23$, $p < .01$. In contrast to the emotional distress model, there was a moderate direct relation between goal-directed self-regulation and physical health $\beta = .32$, $p < .01$, whereas better cognitive emotion regulation didn't directly relate to better physical health, $\beta = -.08$, n.s. Again similar to the previous hypothesized emotional distress model, stress reduction mediated the relation between cognitive emotion regulation and sleep quality, and directly related to better sleep quality, $\beta = .21$, $p < .01$, while cognitive emotion regulation was not directly related to sleep quality, $\beta = .10$, n.s. Better sleep quality had a modest, significant direct relation to better physical health, $\beta = .14$, $p < .01$. Gender ($\beta = -.23$, $p < .01$) and age ($\beta = -.14$, $p < .01$) covariates did have modest significant relations to physical health in this model, with being male and younger age

relating to slightly better physical health. In this model ethnicity was also related to physical health, where Asian ($\beta = -.16$), African American ($\beta = -.13$), and Hispanic ($\beta = -.23$) reported lower levels of physical health relative to Caucasians, all $p < .05$. Overall the data were supportive of the physical health hypothesized mediation model, although the cognitive emotion regulation direct predicted pathways to physical health and sleep quality were not significant. Still, as can be seen in Table 5, cognitive emotion regulation was related to physical health via indirect paths. The hypothesized mindfulness and physical health mediation model resulted in the following fit indices: $\chi^2(83) = 135.8$, $p < .01$; $\chi^2/df = 1.64$; CFI = 0.93; RMSEA = 0.04 (90% CI: 0.03-0.05); AIC = 15386; and BIC = 15562. The comparison of these fit indices to the fit indices of the basic comparison physical health mediation model suggested that this hypothesized mediation model of physical health fit the data substantially better. Likewise, all of these fit indices exceeded the criteria for a good model fit, with the exception of CFI, which was approaching the good fit guideline. Overall, the data demonstrated a good fit to this mindfulness and physical health hypothesized model, and a better fit versus the comparison model. Furthermore, the direct, indirect, and total path coefficients for this hypothesized model for physical health are presented in Table 5.

Mindfulness and Well-Being Models.

The results for the model for the direct relation between mindfulness and well-being are provided in Figure 5.1. There was a strong, positive direct relation between dispositional mindfulness and well-being, $\beta = .57$, $p < .01$, wherein participants with high

scores on dispositional mindfulness had higher levels of well-being. None of the covariates significantly related to well-being. The goodness-of-fit indices suggested a fairly poor fit of this model, $\chi^2/df = 3.33$; CFI = 0.92; RMSEA = 0.07 (90% CI: 0.05-0.09). While it was not a good fit, the direct relation model did establish a strong baseline direct relation from mindfulness to well-being while controlling for covariates.

Second, the comparison mediation model of mindfulness and well-being are presented (see Figure 5.2). As described for the prior comparison models, the proposed mediators were entered as a single mediation step and tested all together in the model. The results for mindfulness directly predicting each mediator were identical to what was already described in comparison model for emotional distress above. For this model, the two mediators that directly related to well-being were goal-directed self-regulation ($\beta = .32$), and stress reduction ($\beta = .49$), both $p < .01$. In contrast, cognitive emotion regulation and sleep quality were not directly related to well-being. As can be seen in Table 6, while the total effect of sleep on well-being was small, for cognitive emotion regulation there was actually a large indirect effect. Interestingly, the direct relation between mindfulness and well-being maintained significance, as the direct relation was only partially mediated by the mediator variables, $\beta = .20$, $p < .01$. The covariates did not relate to well-being in this model. Altogether, the fit indices indicated a very poor fit for this model: $\chi^2(86) = 345.2$, $p < 0.01$; $\chi^2/df = 4.01$; CFI = 0.79; RMSEA = 0.08 (90% CI: 0.07-0.09). The AIC = 17070 and the BIC = 17234. This model was rejected because the fit indices suggested that the data did not support this mediation model of mindfulness and well-being.

Finally, the hypothesized well-being mediation model (figure 5.3) was run to reveal the degree to which the theory driven model of mindfulness and well-being would fit the data. As described in the previously predicted health models, mindfulness strongly predicted goal-directed self-regulation ($\beta = .48$) and cognitive emotion regulation ($\beta = .50$), both $p < .01$. With a similar pattern to the prior hypothesized health models, these variables then mediated the direct relation between mindfulness and stress reduction, with $\beta = .56$ for cognitive emotion regulation, and $\beta = .16$ for goal-directed self-regulation, both $p < .01$. Correspondingly, with the mediators in the model, the direct relations between mindfulness and stress became nonsignificant, $\beta = .11$, n.s. However, a smaller direct relation between mindfulness and well-being persisted, as this relation was only partially mediated, $\beta = .20$, $p < .01$. Additionally, stress reduction partially mediated the relation between goal-directed self-regulation and well-being and fully mediated the relation between cognitive emotion regulation and well-being. At the same time, stress reduction had a strong direct relation to greater well-being, $\beta = .47$, $p < .01$. In contrast to the emotional distress model, but similarly to the physical health model, there was a moderate direct relation between goal-directed self-regulation and well-being, $\beta = .31$, $p < .01$, whereas better cognitive emotion regulation didn't directly relate to better well-being, $\beta = .00$, n.s. Still, as Table 6 shows, cognitive emotion regulation did have an indirect relation to well-being. As reported for the prior hypothesized models, stress reduction mediated the relation between cognitive emotion regulation and sleep quality, and directly related to better sleep quality, $\beta = .21$, $p < .01$, while cognitive emotion regulation was not directly related to sleep quality, $\beta = .10$, n.s. Contrary to its relation to

physical health and emotional distress in the previous models, better sleep quality was unrelated to well-being in that there was neither a substantial direct or indirect effect. The covariates were also unrelated to well-being in this model. While much of the data support the proposed mindfulness and well-being mediation model, the sleep quality variable didn't play a role in this model of well-being. In addition, cognitive emotion regulation didn't directly predict well-being, yet it did have an important indirect relation to well-being through its strong path to stress reduction as can be seen in Table 6. This model of mindfulness and well-being resulted in the following fit indices: $\chi^2(83) = 219.4$, $p < .01$; $\chi^2/df = 2.64$; CFI = 0.89; RMSEA = 0.06 (90% CI: 0.05-0.07); AIC = 16950; and BIC = 117126. When comparing these fit indices to the basic comparison well-being mediation model, there was clearly a meaningful improvement in fit. These fit indices supported the criteria for a good model fit for χ^2/df ratio and RMSEA, however the CFI was lower than desired. Altogether, the data demonstrated a moderately good fit to this mindfulness and well-being hypothesized model, and a much better fit versus the comparison model.

DISCUSSION

The primary goal of this dissertation was to gain insights into the processes by which dispositional mindfulness increases physical and psychological health during emerging adulthood in a sample of young college students. With the increasing stress and pressure in our society, psychopathology and physical health problems are on the rise. Increasing mindfulness is a potential healthy solution for coping with life's challenges,

and emerging adulthood is an important developmental period for learning to cope on one's own. Although many correlational and empirical studies have examined the direct relations of mindfulness to a variety of health outcomes, there has been a lack of research into the mediators, or mechanisms of these relations. In the current investigation, 554 young adults took a survey which included measures of mindfulness, the proposed mediators (goal-directed self-regulation, cognitive emotion regulation, perceived stress, and sleep quality), and well-being, physical health, and emotional distress. Structural equation modeling was used to explore potential pathways of the relations among the variables. Two possible mediation models were compared for each of the latent outcome variables. As predicted, the results clearly supported goal-directed self-regulation, cognitive emotion regulation, stress reduction, and to a lesser degree sleep quality as mediators of the relations between mindfulness and the emotional distress, physical health, and well-being latent variables. While some of the resultant patterns were similar across the models, there were some interesting differences in the degree to which each of these factors was important across the three different outcomes. Further, there were a few predicted paths that did not manifest. Initially, the discussion section will review the meaning of the results as they relate to answering the questions proposed by the hypotheses for this study. Subsequently, the study strengths and limitations, as well as directions for future research will be discussed.

Discussion of Direct Effect Hypotheses

Question 1a: Did Mindfulness have a Direct Relation to Emotional and Physical Health and Well-being in Emerging Adulthood?

Mindfulness and Emotional Distress. An initial goal of this study was to first establish the direct relation between self-reported mindfulness to measures of emotional distress (e.g. anxiety, depression, and Positive and Negative Affect Schedule (PANAS) negative), physical health (e.g. Body Mass Index, general health, physical activity, and vitality), and well-being (e.g. happiness, life satisfaction, and PANAS positive) in college students during the developmental period of emerging adulthood. Based on the Pearson correlations (see Table 3), dispositional mindfulness had strong negative correlations to depression, anxiety, and PANAS negative, which comprised the emotional distress latent variable. Furthermore, the confirmatory factor analysis examining the direct relation between mindfulness and the emotional distress latent variable demonstrates that even when controlling for gender, age, and ethnicity, there was a strong direct relation. Explicitly, as expected, mindfulness directly related to less psychopathology and emotional distress in this young college student sample.

Mindfulness and Physical Health. Next, as predicted the bivariate correlations showed that higher levels of mindfulness were found to modestly relate to better physical health including levels of physical activity, self-reported general health, and energy and vitality. Moreover, the confirmatory factor analysis examining the direct relation between mindfulness and the physical health latent variable demonstrated that when taking into account the contribution of gender, age, and ethnicity, there was clearly a solid direct relation between mindfulness and physical health. In fact, the model fit estimates suggested a very close fit of the data to this direct relation model of mindfulness and physical health in this young college sample. This finding adds to the literature, in that

the direct relation between mindfulness and general health and physical activity levels had not been well studied.

However, in contrast to the study hypothesis, self-reported mindfulness was unrelated to Body Mass Index (BMI). There are multiple possible explanations for this. One possibility is that mindfulness was in fact unrelated to healthy body weight and obesity. Certainly, there are many other factors such as genes, diet, and physical exercise that are known to be related to healthy body weight that were not accounted for here. Nevertheless, this issue should be further explored. It is plausible that this result was found due to measurement issues with the BMI, was due to the young age of the students, or that the actual effect was being masked by a moderator, such as beliefs around whether or not having healthy body weight was an important goal relative to other priorities. BMI is the most commonly used measure for obesity research, is convenient, and is used by the Centers for Disease Control, so it was considered a reasonable measure for the purposes of this study. However, it also has a number of drawbacks. For instance, it didn't take into account muscle and body fat composition, lifestyle, or ethnic group differences. The lack of adjustment for ethnic group differences may have been detrimental for this study, given the diversity of the UC Riverside student sample. Therefore some scientists have suggested that BMI needs to be adjusted to account for these factors or that alternate or additional measures such as waist circumference, body fat composition, and waist to hip ratio should be considered (Huxley, Mendis, Zheleznyakov, Reddy, & Chan, 2010). Another issue was that BMI was self-reported, which allowed for reporting bias. Interpretation of this research finding on BMI and

mindfulness was challenging given that the study did not address these issues.

What can be said is that dispositional mindfulness did not have a direct relation to BMI in this group of young college students. As a result, it did not make sense to examine mediators of mindfulness for this outcome. However, as mentioned previously there have been several small intervention studies that have shown benefits of mindfulness and mindful eating for attaining a healthy body weight and/or reducing eating disorders (Daubenmier et al., 2011; Kristeller & Wolever, 2011). The study designs differed from the present study in that the programs were interventions targeted specifically for individuals who had a goal to lose weight or reduce unhealthy eating habits, with measures before and after the intervention, whereas this study measured dispositional mindfulness and BMI at a single time point. Another possibility is that less mindfulness, and more stress, leads to differing patterns of unhealthy weight loss and weight gain that cancel each other out when studied at a single time point. This idea will be explored further when discussing the lack of relation between stress and BMI. Future research should incorporate alternate measures of obesity that ameliorate some of the measurement issues associated with the BMI. Further, longitudinal research should be done to assess the ways that mindfulness and healthy body weight relate to each other as they change over time, taking into account participants starting weight, and ideal body weight and/or body weight goals. In conclusion, mindfulness and BMI were unrelated during emerging adulthood when measured at a single point in time; however, additional research is required in this area.

Mindfulness and Well-being. This study also examined the direct relation between

self-reported mindfulness to measures of well-being as measured by happiness, life satisfaction, and PANAS Positive in college students during emerging adulthood. The Pearson correlations (see Table 3) showed that dispositional mindfulness had a moderate to strong positive relation to happiness, life satisfaction, and PANAS Positive, which were combined to create the well-being latent variable. Additionally, the confirmatory factor analysis, which examined the direct relation between mindfulness and the well-being latent variable demonstrated a strong direct relation wherein young college student with higher levels of self-reported mindfulness had corresponding increases in their levels of well-being. Moreover, gender, age, and ethnicity were not significant, indicating that the relation is the same across these groups. In conclusion, the first hypothesis that increased mindfulness would directly relate to less emotional distress and improved physical health (except for BMI) and well-being in young college students was confirmed.

Question 1b: Did Mindfulness have a Direct Relation to the proposed mediators, Cognitive Emotion Regulation, Goal-directed Regulation, Stress Reduction, and Sleep Quality in Emerging Adulthood?

It was hypothesized that self-reported mindfulness would relate to higher self-regulation capabilities, lower levels of stress, and improved sleep quality. As can be seen in Table 3, mindfulness was directly correlated to substantially better goal-directed self-regulation, improved cognitive emotion regulation, reduced stress, and modestly better sleep quality. The relation with sleep quality was not quite as strong as was expected. However, it was still statistically significant, and potentially meaningful. In sum, the

hypothesis of direct relations between mindfulness and the proposed mediators was supported.

Question 1c: Did the Proposed Mediators have Direct Relations to Emotional Distress, Physical Health, and Well-being in Emerging adulthood?

To answer this question, the direct relations between each of the mediators and outcomes were studied in this young adult sample. These correlations were also reported in Table 3.

Goal-directed Self-regulation. The first mediator variable examined was goal-directed self-regulation. As predicted, goal-directed self-regulation was positively correlated to stress reduction and better sleep quality. Further, in line with the hypothesis, it was related to lower reports of depression, anxiety, and PANAS Negative, which comprised the emotional distress latent variable. Goal-directed self-regulation was also correlated to modestly increased general health, physical activity levels, energy and vitality, and BMI. These relations made sense in that individuals with a better capacity to work towards their goals likely did a better job of engaging in health promoting activities, especially if good health was one of their goals. Interestingly, goal-directed self-regulation was the only mediator to directly relate to BMI. It was a small correlation, but may warrant further consideration as a variable of interest in future obesity research. While these correlations with physical health were not quite as large as anticipated, they were all in the expected directions, and statistically significant. Finally, as expected, goal-directed self-regulation was also directly related to greater happiness, life satisfaction, and PANAS Positive, which created the well-being latent variable. This could have been

because people who were better able to achieve their goals lived lives that were more fulfilling. Further, this finding was in line with data showing that working towards an important goal (especially one that was intrinsically motivated) was associated with greater happiness (Sheldon & Houser-Marko, 2001; Sheldon et al., 2004).

Cognitive Emotion Regulation. The direct relations between cognitive emotion regulation and the study outcomes were examined next. As anticipated, cognitive emotion regulation was associated with lower stress and improved sleep quality. Further, higher reported cognitive emotion regulation related to lower emotional distress in that it was correlated with lower depression, anxiety, and PANAS Negative. In contrast to the hypotheses, cognitive emotion regulation was unrelated to BMI, general physical activity levels, and energy and vitality. This was unexpected and difficult to explain as over eating is often a coping mechanism. They may have actually been unrelated, or perhaps there was a moderating variable, or some individual differences in patterns of BMI, physical activity, and energy responses which canceled each other out for those who had maladaptive cognitive emotion regulation strategies. However, cognitive emotion regulation did weakly directly relate to greater general physical health in the predicted direction. Lastly, as hypothesized, cognitive emotion regulation was directly correlated with higher levels of happiness, life satisfaction, and PANAS Positive, which were used to measure well-being. Thus, cognitive emotion regulation appeared to be more closely linked to emotional distress and well-being than to physical health.

Stress Reduction. Next, correlations between stress reduction and study outcome variables were looked at. In line with the study predictions, stress reduction related to

significantly improved sleep quality. Additionally, as was hypothesized, stress reduction was very strongly related to lower reports of depression, anxiety, and PANAS Negative, which comprised the emotional distress latent variable. These direct correlations to emotional distress outcomes were the strongest seen, suggesting that stress and emotional distress were closely connected. Stress reduction was also positively correlated to two of the four physical health outcomes, including increased general health and energy and vitality, but not with physical activity or BMI. Thus, the predictions around the relation between stress reduction and physical health was partially supported. Last but not least, as expected, stress reduction was substantially related to greater happiness, life satisfaction, and PANAS Positive, which formed the well-being latent variable.

The lack of relation between stress and physical activity and BMI was puzzling given that previous literature had supported these relations. Measures of stress and stress hormones such as cortisol have been generally been associated with obesity and increased visceral fat, yet the findings haven't been entirely consistent (Bose, Olivan, & Laferrere, 2009; Dockray, Susman, & Dorn, 2009; Marniemi et al., 2002). Most of these studies have been done in older adults, so this process may differ in younger adults. The finding in this study could also be because people respond to stress differently. For example, some people when stressed out may have become overwhelmed and inactive and/or had less time for engaging in physical activities, while others may have decided to increase their physical activity levels as a healthy coping mechanism for increased stress. In this case, these two patterns of responses could have canceled each other out, resulting in zero relation between stress and physical activity. Alternatively, stress may have led to less

physical activity for many, yet those who did engage in more physical activity might have experienced less stress. Again, these two opposing patterns could have canceled each other out. Similarly, when people become stressed, some eat more and become less active as a coping mechanism, which could lead to higher BMI, whereas others eat less and/or exercise more, and lose weight, especially under extreme stress, which could lead to lower BMI for others. Some evidence for this was found with workplace stress, particularly for men, in the Whitehall II Study (Kivimaki et al., 2006). Although previous data had suggested workplace stress and BMI were unrelated, this longitudinal data showed that men with low starting BMI lost weight in response to stress, whereas those with higher starting BMIs gained weight. Moreover, a recent publication found that higher levels of cortisol hormones and Peptin YY were both associated with disordered eating psychopathology, and particularly anorexia nervosa independent of BMI in women across the weight spectrum (Lawson et al., 2011). Because mindfulness was so strongly related to stress, this may in part also explain why mindfulness was unrelated to BMI in this study. Because the present study data was cross-sectional, and not longitudinal, it wasn't possible to specifically determine why stress reduction was unrelated to physical activity and BMI. However, the aforementioned possibilities should certainly be explored longitudinally and/or experimentally.

Sleep Quality. Finally, better sleep quality was predicted to relate to reduced emotional distress and improvements in physical health and well-being during emerging adulthood. In looking at the correlations in Table 3, it can be seen that this hypothesis was supported for the direct relation between sleep quality and the three measures that

were used to assess emotional distress. Better sleep quality was related to lower depression, anxiety, and PANAS Negative. Next, the predicted relation between sleep quality and physical health was partially supported, with small but statistically significant positive correlations between better sleep quality and general physical health and energy and vitality. Yet contrary to much of the literature, and the study hypotheses, sleep quality was unrelated to BMI and physical activity levels. This could mean that sleep quality was truly unrelated to BMI and physical activity levels, or this outcome could have been accounted for by a number of other explanations, some which were touched upon previously such as measurement issues with the BMI. Further, as this study was done during emerging adulthood, it could be that the relation between sleep quality and obesity doesn't emerge until later in life. An example of an alternate explanation is the Cardiovascular Health Epidemiology Study, which found that while sleep quality was associated with obesity in African American women, this association was modified by perceived stress, with increased obesity specifically occurring in those with poor sleep plus medium levels of stress exposure (Bidulescu et al., 2010). Thus, there might be a mediator or moderator of these relations such as stress that needed to be accounted for. Further, longitudinal analysis may have been helpful in order to assess patterns of change over time. For example, poor sleep quality may have predicted reduced physical activity due to lack of energy, but also increased physical activity may have increased sleep quality, thus canceling each other out. Again, longitudinal and/or experimental data would have been necessary to detect different trajectories in this situation. Finally, as hypothesized, sleep quality was modestly related to better well-being, as measured by

happiness, life satisfaction, and PANAS Positive. In sum, with the exception of physical activity levels and BMI, the hypothesis around the direct relations between sleep quality and the outcome variables was supported. Although the strength of the relations were rather modest, they were considered sufficient to include sleep quality in the mediation models.

Discussion of Mediation Hypotheses

Question 2a: Did Goal-directed Self-regulation Mediate the Relations between Mindfulness, Stress Reduction, and the Health and Well-being Outcomes in Emerging Adulthood?

The study hypothesis proposed that goal-directed self-regulation would partially mediate, or explain the relations between mindfulness and stress, mindfulness and emotional distress, mindfulness and physical health, and mindfulness and well-being. First, it was predicted that once goal-directed self-regulation was entered into the models as a mediator between mindfulness and stress reduction, it would partially account for the direct relation between mindfulness and stress reduction. This hypothesis was supported, with a modest relation between self-regulation goals and stress reduction, and a non-significant relation between mindfulness and stress reduction. Therefore, when young college students reported better capacity of making progress towards their goals, they were more likely to experience less stress. When goal-directed self-regulation and cognitive emotion regulation were concurrently entered into the model as mediators between mindfulness and stress reduction, the direct relation between mindfulness and stress reduction became non-significant. The path coefficient for goal-directed self-

regulation was about one-third of the size of that for cognitive emotion regulation, so cognitive emotion regulation likely played a larger role. Still, goal-directed self-regulation was also important, and it was very interesting that when taken together, these two types of self-regulation completely mediated the relation between mindfulness and stress reduction. Further, this mediation of the relation of mindfulness to stress reduction by self-regulation was consistent across the hypothesized mediation models for all three outcomes.

Interestingly, the hypothesis that goal-directed self-regulation would mediate the relation from mindfulness to emotional distress was not supported at all by the basic comparison model of mindfulness and emotional distress. In fact, the relation between mindfulness and emotional distress was explained by all of the other mediators except for goal-directed self-regulation. Further, once self-regulation was in the model with other mediators, the direct correlations which had existed between self-regulation goals and emotional distress variables disappeared. There was a similar pattern, wherein there was no direct mediation of the relation between mindfulness and emotional distress by goal-directed self-regulation in the hypothesized mediation model; however, in this model there was evidence of some indirect mediation through the relation from self-regulation goals to stress reduction, which then impacted emotional distress. In other words, stress reduction effectively mediated the relation from goal-directed self-regulation to emotional distress. Overall, while it played a moderate role as an indirect mediator (as shown in Table 4), goal-directed self-regulation wasn't a meaningful direct mechanism of the relation between mindfulness and emotional distress as measured by depression,

anxiety, and PANAS positive. The reason for this appears to be that stress reduction, and to a lesser degree cognitive emotion regulation and sleep quality, were more important in accounting for the variability in emotional distress. From looking at the entire hypothesized mediation model predicting emotional distress, it appeared that self-regulation played a role in mediating the relation between mindfulness and stress reduction, yet stress reduction was the strongest factor relating to emotional distress, and that goal-directed self-regulation was primarily important to the extent to which it related to stress-reduction.

This hypothesis also predicted that goal-directed self-regulation would mediate the direct relation from mindfulness to physical health. This hypothesis was consistently supported by the comparison and hypothesized mediation model data. Self-regulation goals was directly and indirectly (through stress reduction) positively related to the physical health latent variable. Furthermore, when goal-directed self-regulation was entered into the model along with the other mediators, the direct relation from mindfulness to physical health became smaller and was not statistically significant. Therefore, the capacity to regulate behavior in order to achieve goals appeared to be a key aspect of maintaining good physical health. Behavioral self-regulation may be an important target for future health interventions, especially during youth, prior to the development of disease.

Finally, goal-directed self-regulation was also predicted to mediate the direct relation from mindfulness to well-being. The pattern of results was similar to that of the physical health model. Self-regulation goals was directly and indirectly (through stress

reduction) positively related to the well-being latent variable. Moreover, when goal-directed self-regulation was entered into the model along with the other mediators, the direct relation from mindfulness to well-being did become smaller, yet the mindfulness path coefficient remained statistically significant. Thus, in both the comparison and hypothesized mediation models of well-being, there was partial mediation of the relation of mindfulness to well-being by self-regulation goals and stress reduction, yet mindfulness still made an independent contribution to well-being. This was noteworthy, as there may be something qualitatively different about the importance of mindfulness to well-being above and beyond its benefits to self-regulation, stress reduction, and sleep. It's also possible that there was an additional mediator that wasn't measured, such as self-compassion. Thus, the capacity to make progress towards life goals played a key role and was a possible mechanism of the relation from mindfulness to well-being. Interestingly, mindfulness made an additional contribution to well-being above and beyond all four study mediators.

Question 2b: Did Cognitive Emotion Regulation Mediate the Relations between Mindfulness, Stress Reduction, Sleep Quality, and Health and Well-being Outcomes in Emerging Adulthood?

It was hypothesized that cognitive-emotion regulation (comprised of rumination, catastrophizing, and self-blame) would be a strong mediator of the relation between mindfulness and stress reduction. This hypothesis was clearly accurate. As can be seen in the hypothesized mediation model of mindfulness and emotional distress, once cognitive emotion regulation and goal-directed self-regulation were entered into the model as

mediators between mindfulness and stress reduction, the direct relation between mindfulness and stress reduction became non-significant. A visual inspection of the SEM path coefficients indicated that while the paths from mindfulness to the two types of self-regulation were virtually equal, the path between cognitive emotion regulation and stress reduction was quantitatively greater than the path from self-regulation goals to stress reduction. Accordingly, this path was likely driving a more substantial proportion of the mediation. This was affirmed by the greater strength of the indirect effects reported for cognitive emotion regulation compared to goal-directed self-regulation in Tables 4 – 6. The data supported the hypothesis that cognitive emotion regulation was an important mechanism in the relation between mindfulness and stress reduction. However, while the data suggested a good fit, this must be tested empirically in order to establish causality and the direction of effects.

There was also a predicted path from cognitive emotion regulation to sleep quality in the hypothesized model. While this path was in the predicted direction, it was small and not strong enough to reach statistical significance¹. Therefore, cognitive emotion regulation did not mediate the relation from mindfulness to sleep quality. However, it did indirectly relate to better sleep quality through its strong relation to stress reduction, which then had a positive relation to the emotional and physical health outcomes (but not well-being). However, this would ultimately be a modest mediated relation between

¹ Since the path from cognitive emotion regulation to sleep was not significant, and there is also literature on the role of sleep in emotion regulation, this path was also run in the opposite direction (i.e. sleep predicting cognitive emotion regulation). However, the path was even closer to zero and non-significant, and the modification didn't impact the model fit, so the original path was retained.

cognitive emotion regulation and sleep quality through stress reduction, and a multiple step indirect mediation for it to then have a minor relation to emotional and physical health through sleep.

Additionally, cognitive emotion regulation was predicted to largely mediate the relations between mindfulness and the study outcomes. In agreement with this hypothesis, there was a significant direct path from cognitive emotion regulation to reduced emotional psychopathology (e.g. anxiety, depression, and PANAS negative), as well as a substantial indirect path to better emotional distress through stress reduction. Essentially, when cognitive-emotion regulation and the other mediators were added to the structural equation model, the direct relation between mindfulness and emotional distress was eliminated. This data supported the hypothesis that cognitive emotion regulation was an important mechanism between mindfulness and emotional distress. In fact, Table 4 shows that it had the largest total path coefficient when direct and indirect relations were summed. While the direction of causality of this relation should be confirmed through randomized, controlled trials, this data suggested that cognitive emotion regulation may be a skill that is particularly critical to learn through mindfulness interventions, as it could be of great benefit particularly in participants who have high stress and/or greater negative emotionality, anxiety and depression. In fact, this has likely been a contributing factor in the efficacy of mindfulness based cognitive therapy, which has helped patients to notice and change their relationship with their thoughts and emotions. Further, the aspects of mindfulness such as awareness, non-judgment, and acceptance may be most important to cognitive emotion regulation, as these approaches would be expected to

decrease the types of thinking that lead to emotional dysregulation.

However, in conflict with the study hypothesis, cognitive emotion regulation had no direct relation to the physical health latent variable. It did have a small indirect relation to physical health through its relation to stress reduction, which had a modest positive path to physical health. Because of this indirect relation, cognitive emotion regulation made a small contribution to the mediation of the relation between mindfulness and physical health in the hypothesized mediation model. However, this relation was primarily mediated through the other variables (e.g. self-regulation goals and stress reduction). Altogether, the direct path between cognitive emotion regulation and physical health was not statistically significant, and did not mediate the relation from mindfulness to physical health. It may be that cognitive emotion regulation, which is essentially thinking in a way that regulates the emotions, only had a positive impact on physical health to the degree that it led to decreased stress, and only had a negative effect on physical health when engaging in thinking such as rumination and catastrophizing led to increased stress.

Lastly, cognitive emotion regulation was expected to mediate the relation from mindfulness to the well-being latent variable (e.g. happiness, life satisfaction, and PANAS Positive). Conversely, the direct path from cognitive emotion regulation to well-being was essentially zero for both the basic comparison and the hypothesized mediation model. It did, however, have a moderate indirect relation to well-being through its strong positive link to stress reduction, which was then highly positively related to well-being. Due to the strength of these indirect paths, the hypothesis that cognitive emotion

regulation mediates the relation from mindfulness to well-being was partially supported. However, this mediation is indirect via its path to stress reduction. There was no direct mediation, and no relation through sleep quality, so the data did contradict these hypotheses. What stood out was how important the relation between cognitive emotion regulation and stress reduction was. This may be a potential target for future interventions. Based on the theory proposed in this study, mindfulness predicted better cognitive emotion regulation (e.g. less rumination, self-blame, and catastrophizing), which then predicted reduced stress, which led to improved well-being. However, each of these steps should be examined experimentally and/or longitudinally in order to establish the direction of causality.

Question 2c: Did Stress Reduction Mediate the Relations between Mindfulness, Sleep Quality, and Health and Well-being Outcomes in Emerging Adulthood?

This study hypothesized that stress reduction would be a key mediator of the relation from goal-directed and cognitive emotional self-regulation to each of the study health and well-being outcomes. In accordance with this hypothesis, for both mediation models there was a sizeable direct path from stress reduction to less emotional distress (e.g. less anxiety, depression, and PANAS negative) for young adults. In effect, when stress reduction and the other mediators were added to the mediation model, the direct relation between mindfulness and emotional distress was diminished and non-significant. Additionally, stress reduction had an indirect impact on emotional distress through its positive relation to improved sleep quality. In line with the study hypothesis and the work of Kabat-Zinn (Ludwig & Kabat-Zinn, 2008) and other mindfulness practitioners and

researchers, this data supported the hypothesis that stress reduction was an important mechanism between mindfulness and emotional distress. Although the direction of causality of this relation must be verified through randomized, controlled trials, the data suggested that that reducing stress is a likely mechanism by which mindfulness reduces emotional distress.

This study also predicted that stress reduction would mediate the direct relation from mindfulness to physical health. Although the strength of the path coefficients was not as strong as for emotional distress, this hypothesis was consistently supported by the data from the basic comparison and hypothesized mediation models. Stress reduction was directly positively related to the physical health latent variable in this young adult sample. Furthermore, when stress reduction was entered into the model along with the other mediators, the direct relation from mindfulness to physical health was lessened and became non-significant. Therefore, the study hypothesis that stress reduction was a mediator of the relation of mindfulness to physical health was supported. This makes sense, as stress has been shown to have a negative impact on physical health in a number of ways.

Further, stress reduction was hypothesized to mediate the direct relation from mindfulness to well-being. This prediction was supported, as stress reduction was very strongly directly linked to the well-being latent variable. Specifically, increased stress was associated with impaired well-being, whereas reduced stress was associated with improved well-being. In addition, when stress reduction was entered into the model along with the other mediators, the direct relation from mindfulness to well-being health

became smaller, yet the mindfulness path coefficient remained statistically significant. For this mediation model of well-being, stress reduction and self-regulation goals were the primary mediators of the relation from mindfulness to well-being. Hence, in both the comparison and hypothesized mediation models of well-being, there was partial mediation of the relation of mindfulness to well-being by stress reduction and self-regulation goals, yet mindfulness still made an independent contribution to well-being. A possible reason that the direct relation of mindfulness to well-being remained is that there was another mediator that wasn't measured. For example, mindfulness has also been known to engender a sense of kindness and compassion towards the self and others. This is certainly an aspect of mindfulness that would likely be related to greater well-being. This could be incorporated in future studies of the mechanism of mindfulness and well-being.

Moreover, through the paths from self-regulation goals and cognitive emotion regulation, stress reduction also indirectly mediated the relation from mindfulness to the three latent outcome variables. Finally, stress reduction was expected to mediate the relation of cognitive emotion regulation to sleep quality. This hypothesis was confirmed across all three outcomes, as cognitive emotion regulation was related to stress reduction, and stress reduction was related to better sleep quality. As a result of this mediation, the direct relation of cognitive emotion regulation to sleep quality was non-significant. Yet cognitive emotion regulation was indirectly linked to sleep quality through its strong path to stress reduction.

Question 2d: Did Sleep Quality Mediate the Relations between Mindfulness, Stress

Reduction, and Health and Well-being Outcomes in Emerging Adulthood

It was hypothesized that sleep quality would mediate the relation from cognitive emotion regulation to physical health, emotional distress, and well-being. In addition, sleep quality was anticipated to mediate the relation from stress reduction to these study outcomes. Overall, the path from cognitive emotion regulation to sleep quality was not significant, so it was not a mediator of the relation from cognitive emotion regulation to the study outcomes. In contrast, there was a significant path from stress reduction to better sleep quality in all three hypothesized models. Sleep quality was then directly related to lower emotional distress (e.g. less depression and anxiety), and marginally (e.g. $p = .017$) related to better physical health, but not significantly related to well-being. Therefore, it was a partial mediator of the relation from stress reduction to emotional and physical health, demonstrating that improving sleep quality is one of the downstream mechanisms of mindfulness and confirming the hypotheses for these two outcomes. Yet overall sleep quality played a much smaller role than the other mediators. In comparison, sleep quality was not a mediator in the model of well-being. In looking at the hypothesized path model, it can be seen that partial mediation of the relation from mindfulness to well-being was primarily occurring directly through self-regulation goals and stress reduction, and also indirectly through cognitive emotion regulation. It is interesting that sleep quality did have an impact on the latent measures of emotional distress such as depression and anxiety, but not on well-being. This may speak to qualitative differences between these two outcomes, and should be explored in further research.

Discussion of Model Fit Hypotheses

Question 3a: How Well Did the Hypothesized Model of Mindfulness and Emotional Distress Fit the Data?

For the purposes of this study, two models of the mediation of the relation between mindfulness and emotional distress were studied and compared for model fit. As predicted, the SEM fit indices supported a substantially better fit of the hypothesized mediation model of mindfulness and emotional distress compared to the general comparison mediation model of mindfulness and emotional distress. This improvement in fit was consistent across all of the fit indices examined. This indicates that as predicted, the relation from mindfulness to stress reduction was mediated by improvements in behavioral and cognitive emotional self-regulation capabilities. Moreover, when looking at the model, along with the Table 4 data on direct, indirect, and total effects, it was apparent that each of the mediators played a role in explaining the relation from mindfulness to emotional distress, and that both direct and indirect paths were important. While not perfect, the fit indices for the hypothesized mediation model for emotional distress were really quite good based on the published literature on SEM model fit criteria standards. Based on the data for the emotional distress latent variable, the hypothesized multi-step mediation model did a significantly better job of explaining the relations among the measured variables than did the basic comparison mediation model. As this was not an experimental study, it isn't possible to rule out other, equally plausible models of the direction of effects. Therefore, these relations should be studied experimentally and/or longitudinally in the future. Yet overall, the model was a good fit and should

therefore be considered a highly plausible model to explain the relations among mindfulness, mediators, and emotional distress.

Question 3b: How Well Did the Hypothesized Model of Mindfulness and Physical Health Fit the Data?

In order to better understand the mediators of the relation of mindfulness to physical health, again two models different models were run and the model fit indices were compared. As hypothesized, the SEM fit indices supported a substantially better fit of the hypothesized mediation model of mindfulness and physical health compared to the basic comparison mediation model of mindfulness and physical health. In fact, each of the fit indices examined was meaningfully improved across the board. Though the pattern of relations differed somewhat for physical health versus emotional distress, when examining the hypothesized model, and taking into account the data in Table 5, it is still clear that each of the proposed mediators played a role in explaining the relation from mindfulness to physical health, and that direct and indirect relations were all consequential. The fit indices for the hypothesized mediation model for physical health exceeded the published standards for a good model fit, with the exception of the CFI, which was still quite good. Therefore, this data confirmed the prediction that the hypothesized multi-step mediation would do a significantly better job of explaining the relations among the measured variables than the basic comparison mediation model would. Again, this was not an experimental study, so it didn't exclude other plausible models and these relations should certainly also be studied experimentally. However, this hypothesized model was a very good fit and should therefore be accepted as a highly

probable model with potential explanatory value for the relations among mindfulness, mediators, and physical health.

Question 3c: How Well Did the Hypothesized Model of Mindfulness and Well-being Fit the Data?

Similarly to with the other latent variables, two different mediator models of mindfulness and well-being were run and the model fit indices were compared. As hypothesized, the SEM fit indices supported a substantially better fit of the hypothesized mediation model of mindfulness and well-being compared to the basic comparison mediation model of mindfulness and well-being. All fit indices examined were consistently improved for the hypothesized model. All of the fit indices for the hypothesized mediation model of mindfulness and well-being met the recommended thresholds to be considered a good fit except for CFI. However, the fit for well-being was not quite as good as for the emotional and physical health models. Because this wasn't an experimental study, other plausible models are possible, and as noted previously, there may be another variable important to well-being that wasn't included. For this model, mindfulness, self-regulation goals, cognitive emotion regulation, and stress reduction all made important contributions to well-being when both direct and indirect effects were considered. However, sleep quality did not. The fit indices for the hypothesized mediation model for well-being were within the published standards for a good model fit, with the exception of the CFI, which was a little low. However, when taken together, this data definitely confirmed the prediction that the hypothesized multi-step mediation would do a significantly better job of explaining the relations among the measured variables

than the basic comparison mediation model would. Moreover, this hypothesized model was a fairly good fit and should therefore be considered as a likely model that may help to explain the relations among mindfulness, mediators, and well-being.

In sum, the primary goal of this study was to elucidate the underlying mechanisms by which dispositional mindfulness impacts psychological health and well-being during emerging adulthood. This study tested of the fit between the data and the proposed theoretical and comparison models in order to gain insights about the relations among mindfulness, the proposed mediators, and latent health and well-being endogenous variables. The study largely supported the hypothesis that cognitive emotional regulation, behavioral self-regulation, sleep quality, and stress reduction mediated the relationship from mindfulness to emotional distress, physical health, and well-being. Moreover, insights were gained into the complexities of the relations among these variables. While there were some differences in the relations among the variables across the well-being, physical health, and emotional distress models, overall this study has identified four key mediators of the relation from mindfulness to improved physical and psychological health, and the proposed theoretical mediation models were a good fit to the data.

Effects of Covariates

Gender, age, and ethnicity were included in each of the models as covariates in order to account for their impact on health and well-being. None of the covariates influenced emotional distress or well-being in either of the mediation models. On the other hand, all three covariates were tied to self-reported physical health. Being male, younger, and Caucasian (vs. Asian, African American, or Hispanic) were all related to

better reported physical health. Because this latent variable included general health, physical activity, and energy and vitality, there are multiple possible interpretations. In looking at the means on each of these variables by gender, males consistently reported higher levels of all three health measures. Customarily, males tend to be involved in more physical and athletic activities, so this may account for these health difference (Trost, Owen, Bauman, Sallis, & Brown, 2002). It is somewhat surprising that age was significant, in that all of the participants were young adults. However, the direction of results is expected, as youth has traditionally been affiliated with better health and greater physical activity levels. Moreover, the reported ethnic group physical health differences could possibly be due to genetic differences, and/or cultural norms for health behaviors. For example, African Americans and Mexican Americans were found to be less physically active during leisure time compared to Caucasians (Crespo, Smit, Andersen, Carter-Pokras, & Ainsworth, 2000).

Strengths, Limitations, and Future Directions

This study was unique in that it was the first to propose and test a model of the relation from mindfulness to health and well-being outcomes that involved multiple steps of mediation. By using structural equation analysis, this study was able to shed light on the potential underlying processes by which mindfulness works to impact health and happiness. While prior research has established a direct relation between mindfulness and stress reduction, and suggested a direct relation from mindfulness to self-regulation, this is the only study that has demonstrated that together, two types of self-regulation, goal-

directed and cognitive emotional, fully mediated the direct relation from mindfulness to stress reduction. In fact, the strong fit of the model suggests that mindfulness likely works to reduce stress by 1) changing the cognitive process in a way that reduces thinking patterns such as self-blame, catastrophizing, and rumination that lead to dysregulated emotions 2) enabling individuals to have better behavioral self-regulation and capacity work towards and accomplish their goals. This is a very interesting finding that if confirmed, has considerable implications for the value of learning to be more mindful, when all of the potential down-stream effects of greater behavioral and cognitive emotional self-regulation and reduced stress are considered.

By using this multi-step model, it was possible to also examine the ways that goal-directed self-regulation, stress reduction, and cognitive emotion regulation then directly and indirectly related to emotional and physical health, and well-being latent outcomes. While the direction of effects can't be absolutely verified using cross-sectional data, the good fit of the models indicate that the hypothesized direction of the paths are quite probable. Clearly, reducing stress had a tremendous relation to less emotional distress and better well-being, and to a lesser but still important degree, general physical health. Another benefit of this study is that distinct models were run for each latent endogenous variable. This allowed for examination of the differences in the relations among variables across the different outcomes and to establish a model fit that was specific for each outcome. These differences did emerge when studying the direct paths from goal-directed self-regulation, cognitive emotion regulation, and sleep to each outcome. For example, goal-directed self-regulation did not have a significant direct path

to emotional distress, but did have important direct paths to better physical health and well-being. Quite the reverse, when looking at the role of cognitive emotion regulation, there was a direct pathway to reduced emotional distress, but no direct path to physical health or well-being. By using separate models it was possible to detect and consider the meaning of these differences.

Further, this was the first study to examine sleep quality as an indirect mediator of mindfulness, and a direct mediator of the relations from stress reduction and cognitive-emotion regulation to health and well-being outcomes. Interestingly, sleep quality did have a direct relation to emotional distress and a marginally significant direct relation to physical health, and partially mediated the relation from stress reduction to these outcomes. However, sleep quality did not directly relate to well-being. Further, while partial mediation of stress reduction did occur, it was a relatively small contribution relative to the direct relation from stress reduction to emotional distress and physical health. Also, while cognitive emotion regulation didn't directly impact sleep, it did have a meaningful indirect effect through stress reduction. These findings have expanded the knowledge base on the relation of mindfulness to sleep quality by demonstrating that this relation is mediated by stress reduction.

Another distinction for this study was the large, ethnically diverse, young college student sample. This allowed for the study to specifically focus on the mechanisms of mindfulness during emerging adulthood, as students were all aged 18-28, which is a time when they are learning to be independent and becoming responsible for their own mental

and physical health. Further, the findings can be translated across diverse ethnic groups. Importantly, the sample size was sufficiently large, which powered the study to be able to detect these complex relations among multiple variables using structural equation modeling.

In sum, this study has furthered the research in this field by examining whether and in what ways the relations from mindfulness to emotional distress, physical health, and well-being are mediated by cognitive-emotional and goal-directed behavioral self-regulation, stress, and sleep in a multiple mediator model. This has led to a better understanding of these potential mechanisms of mindfulness, and suggests that each of the paths is a good potential target for experimental research. The proposed model is also worthy of further examination via longitudinal research. Altogether the data largely supported the hypothesized mediation models, which provides insights into probable change mechanisms for mindfulness.

However, the results of this study must also be interpreted in light of its limitations. So the study limitations will be discussed, and recommendations for future research to address these issues will be made. First, as has been discussed, the data for this study is cross-sectional, which doesn't allow for causality of the effects to be established. In their paper on the importance of studying mechanisms of action, Kazdin and Nock (2003) concluded that no one study can meet all of the criteria that are necessary to conclusively demonstrate mediation. Thus, this study has provided a good start to this process, by providing theory driven path models with good data fit. Yet

additional research is required. For instance, a single time point doesn't facilitate the ability to detect when bidirectional effects are occurring or opposing processes are taking place over time. In particular, one of the key mediators investigated in this study was stress reduction, and as was noted, there are often individual differences and/or different patterns of response to stress. For example, this study found no relation between stress and BMI. Yet some people may gain weight while others will lose weight in response to stress. Longitudinal data would have the capability to look for patterns of change over time in different subgroups, whereas cross-sectional data doesn't. The advantage of using cross-sectional data is that it was possible to quickly collect data from a large sample which provided the necessary power to support the analysis of the data in complex structural equation models. Unfortunately, this study was not designed to follow changes in the student reported study variables over time. However, future studies should study this model longitudinally in order to address these issues. Moreover, the only way to truly establish causality is through randomized, controlled trials. Given the fit of the models in this study, future randomized controlled trials should be done to determine causality.

With structural equation modeling, another ever present challenge is the possibility of equally plausible models. This study sought to address this issue by planning a comparison of the hypothesized model to a plausible basic mediation model. Further, these hypothesized models were based on theory, and had a very good fit with the data overall. In considering the numerous variables that were measured in this study, it was impractical to test every possible path in the model, and there were also disadvantages to doing this (e.g. fishing) as opposed to using theory to drive the analyses.

Yet that means it is possible that there is an equally plausible model that hasn't been identified. When there was ambiguity as to the direction of the path (e.g. does cognitive emotion regulation predict sleep quality, or does sleep quality predict cognitive emotion regulation), the models were run both ways in order to check for this. In these cases, either the model fit didn't change or the fit got worse. As a result, the hypothesized model was retained. Nevertheless, it isn't possible to rule out all other potential models with these analyses because the analyses don't establish causality, and not all conceivable models were run.

Another consideration is that it is always possible that there are other mediators that are also important, that were not measured. For example, attention and working memory have been related to mindfulness and have also been proposed as mechanisms of mindfulness (Jha et al., 2007; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). These attributes weren't measured, so it is impossible to say how important these variables are compared to those that were included in this study. However, it is likely that aspects of attention and/or memory abilities are captured in the goal-directed self-regulation variable, as it likely requires these skills to work towards and accomplish goals. Further, if they do play a role, theoretically, they might actually be good candidates to mediate the relation from mindfulness to goal-directed behavioral self-regulation. Additionally, it is possible that not all of the important covariates were captured. For example, socioeconomic background wasn't measured or considered. At the same time, the covariates were not instrumental to this study, as the processes were not expected to differ across groups, only the mean levels were.

Another drawback is that the measures used in this study were all self-reported, which allows for reporting bias by the participants. For example, some students could have completed some survey answers based on their ideals (e.g. how much physical activity he thinks he should do per week, what body weight she wishes she is, how happy he wants to be, etc.), instead of providing the real life levels. Reporting bias can vary from measure to measure, and person to person. This may have been one more reason that the self-reported (BMI) measure didn't correlate to most of the other variables, as young people can be very concerned about their body weight. Therefore, if possible, future research should directly measure participant height and weight, and use physical activity monitors, and utilize multiple measures that are not dependent on self-report in order to address this issue.

Finally, that the sample was taken entirely from college students at University of California, Riverside may limit the degree to which the findings are applicable to other young adults and the broader population. Because the student sample at UC Riverside is so diverse, it is very likely that these findings would be applicable for young adults who are college students at other universities. Additionally, theoretically, the processes by which mindfulness works to improve health would probably be the same in young adults in community colleges or who are not students. However, it is possible that for some subgroups such as those who are mentally ill, developmentally delayed, or have substance addictions, that there would be other factors that would interfere with mindfulness and/or the processes found in this study. Also, in a non-college sample it is highly conceivable that there would be significant mean differences in many of the

variables measured here. For example, college attendees may tend to be more or less mindful and more or less stressed than young people who decide not to attend college. In addition, college students may be more likely to have better goal-directed self-regulation, and it may be more closely linked to their well-being than for non-students as it is a skill that is required in order to complete college. At the same time, the ability to accomplish goals is important to all humans, so it may not differ. Therefore, while it is probable that the processes of mindfulness are similar across all young adults, in future research it would be good to include young adults from a broader non college population. Further, it would be of value to study whether or not mindfulness plays a role and if the processes are the same in young adults with developmental delay or mental illness.

Summary of Key Learnings, Implications and Conclusions

When looking at the study results altogether, several key findings emerge. First, this study clearly demonstrated that cognitive emotion regulation and goal directed self-regulation both mediate the relation from mindfulness to stress reduction. While many authors have proposed self-regulation as a mechanism of mindfulness, this had not been proven. Understanding this is of great consequence, as it can provide insights into who might benefit from learning greater mindfulness the most. For example, individuals who have poor cognitive emotion regulation capabilities and are prone to rumination and self-blame may benefit even more so from mindfulness training than someone who already effectively cognitively regulates their emotions, especially if they are experiencing emotional problems. Similarly, individuals who experience high levels of stress, and/or

who have a difficult time making progress towards their goals may also benefit to a greater degree from learning to be more mindful. This finding also suggests that the aspects of mindfulness training and exercises that develop these self-regulation capabilities may be particularly critical to focus on in order to reduce stress and improve health and happiness.

This study was also unique in that it separated out these two types of self-regulation. While mindfulness had an equal relation to both, there was variation in the degree to which each variety of self-regulation mediated the relation from mindfulness to each of the outcomes. Expressly, cognitive emotion regulation had stronger paths to stress reduction and emotional distress than did goal-directed self-regulation, which makes sense as these are more emotion based outcomes. In contrast, goal-directed self-regulation directly mediated the relation from mindfulness to physical health and mindfulness to well-being, whereas cognitive emotion didn't. This also makes sense in hind sight, as physical health often requires behavioral regulation and self-control in order to make healthy choices. Also, the literature has shown that working towards meaningful goals increases happiness. The fact that there were differences in the degree each mediator was important across outcomes has important implications. For one, it means that the degree to which these mediators are important may vary for other outcomes as well, so this should be considered. Another implication is that in mindfulness interventions for participants struggling with depression, anxiety, and/or high stress, the teacher may want to focus the teachings more on aspects of mindfulness that will support cognitive emotion regulation. Whereas if the purpose for participation is to improve

physical health or well-being, the mindfulness teacher may want to support students in translating what has been learned in the class to mindfully connect with and work towards meaningful goals.

This study also supported the hypothesis and longstanding assumption that stress mediates the relation from mindfulness to health and well-being. However, this study differed in that multiple steps of mediation were proposed, so stress reduction didn't directly mediate the relation. Instead, goal-directed and cognitive emotional self-regulation first mediated the relation from mindfulness to stress reduction. Then, stress reduction fully or partially mediated the relations from each type of self-regulation to sleep quality, emotional distress, physical health, and well-being. This multiple step mediator model fit the data better than the single step mediator model. Certainly, based on these results, for individuals who are experiencing a degree of stress that is interfering with well-being, or leading to physical and/or psychological problems, learning to be more mindful could be a good approach. Furthermore, experimental research should test whether interventions targeted specifically at goal-directed self-regulation, and especially cognitive emotion regulation will directly decrease stress.

Another finding highlighted by this study is that stress reduction mediated the relation from mindfulness to sleep quality, and that sleep quality then played a small role in impacting emotional distress and physical health, but not well-being. Although there was a direct relation from mindfulness to sleep in the basic comparison model, in the hypothesized model, the relation from mindfulness to sleep quality is mediated by stress

reduction. Similarly, cognitive emotion regulation only indirectly impacted sleep through stress reduction. This makes sense as stress would be expected to interfere with sleep. While the magnitude of the path from stress reduction to sleep quality was modest, for people with insomnia and/or difficulty sleeping it could be meaningful. Therefore, learning to be more mindful, or finding other ways to reduce stress may be something for sleep deprived individuals to consider that could supplement other more traditional treatment recommendations.

Finally, this study was rare in that it focused specifically on understanding these mechanisms of mindfulness during the developmental period of emerging adulthood. Clearly, these young college students who were more mindful had corresponding increases in emotional and behavioral self-regulation, reductions in stress and emotional distress, and improvements in physical health and well-being. This indicates that this age group is certainly an appropriate group to target for mindfulness interventions.

In conclusion, overall the three hypothesized multiple step mediation path models were a good fit of the data on mindfulness, the four mediators, and emotional distress, physical health, and well-being. This study affirmed the remarkable role of mindfulness in physical and psychological health during emerging adulthood, while shedding light into the process by which it relates to these outcomes. These findings helped to break down some of the mechanisms of self-reported mindfulness, and indicate that improving goal-directed self-regulation, cognitive emotion regulation, and sleep quality (to a lesser degree for physical health and emotional distress only), and reducing stress may be

important places to intervene with young adults to improve their health and well-being. Teaching greater mindfulness would be an effective way to improve all of these areas, but probably not the only way to do this. Yet there are also likely to be insights gained, and qualitative health and well-being benefits that are gained specifically by practicing mindfulness that would not be gained only by doing something else to reduce stress or improve self-regulation. The knowledge gained into goal-directed self-regulation, cognitive emotion regulation, stress reduction, and sleep quality as potential mechanisms of mindfulness in this study have meaningful real world implications for mindfulness based programs, and can also help to guide future research aimed at improving mental health, physical health, and well-being.

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Table 1

Demographic Information ($n=554$)

Demographic Information	$M (SD)$
Age (years)	20 (2.6)
Demographic Information	%
Gender	
Male	28
Female	72
Ethnicity	
Asian	34
Latino	30
Caucasian	16
African American	8
Middle Eastern	3
Mixed/Other Ethnicity	9

Notes: M = mean. SD = standard deviation.

Table 2

Means and Standard Deviations of the Study Variables (n=554)

	<i>M</i>	<i>SD</i>
<u>Predictor</u>		
Mindfulness (0-25)	16.19	2.02
<u>Mediators</u>		
Self-regulation Goals (1-5)	3.72	0.63
CERQ (3-15)	6.44	0.88
Stress (0-4)	1.64	0.64
Sleep Quality (0-8)	3.03	0.98
<u>Outcomes</u>		
Emotional Distress		
Depression (1-4)	1.77	0.44
Anxiety (0-4)	0.6	0.53
PANAS - (10-50)	20.82	7.13
Physical Health		
General health (1-5)	3.85	0.72
BMI (14-51)	23.56	4.84
Physical activity (0-28)	2.97	3.68
Vitality (1-5)	2.88	.72

Table 2 (Continued)

Means and Standard Deviations of the Study Variables (n=554)

	<i>M</i>	<i>SD</i>
<u>Outcomes</u>		
Subjective Well-Being		
Happiness (1-5)	3.38	.87
Life Satisfaction (1-5)	3.79	.85
PANAS + (10-50)	33.53	7.10

Notes: *M* = mean. *SD* = standard deviation.

Table 3

Intercorrelations Among Predictor, Mediators, and Outcomes

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Mindfulness	1.00														
2. Self-regulation Goals	.48*	1.00													
3. Cognitive Emotion Regulation	.30*	.21*	1.00												
4. Stress Reduction	.46*	.33*	.34*	1.00											
5. Sleep Quality	.14*	.20*	.14*	.25*	1.00										
6. Depression	-.48*	-.38*	-.37*	-.76*	-.34*	1.00									
7. Anxiety	-.27*	-.19*	-.30*	-.63*	-.20*	.60*	1.00								
8. PANAS -	-.50*	-.30*	-.39*	-.63*	-.22*	.60*	.54*	1.00							
9. General Health	.25*	.24*	.11+	.27*	.14*	-.31*	-.24*	-.18*	1.00						
10. BMI	-.05	-.11+	-.04	-.05	-.08	.05	.00	.05	-.22*	1.00					
11. Physical Activity	.12+	.18*	-.05	.04	.06	-.07	-.08	.02	.21*	.00	1.00				
12. Vitality	.22*	.13+	.09	.33*	.14+	-.37*	-.18*	-.25*	.42*	-.09	.32*	1.00			
13. Happiness	.36*	.34*	.18*	.48*	.20*	-.50*	-.34*	-.39*	.28*	.01	.08	.35*	1.00		
14. Life Satisfaction	.42*	.39*	.27*	.55*	.21*	-.64*	-.38*	-.43*	.32*	-.02	.04	.34*	.58*	1.00	
15. PANAS +	.53*	.52*	.18*	.33*	.20*	-.44*	-.20*	-.17*	.32*	.02	.24*	.29*	.37*	.47*	1.00

Note. + = $p < .05$. * = $p < .01$.

Table 4

Direct, Indirect, and Total Effect Coefficients for Emotional Distress

<i>Variable</i>	<i>Direct Coefficient</i>	<i>Indirect Coefficient</i>	<i>Total Coefficient</i>
1. Mindfulness	-.07	-.46	-.53
2. Self-regulation Goals	-.07	-.32	-.39
3. Cognitive Emotion Regulation	-.28	-.48	-.76
4. Stress Reduction	-.62	-.02	-.64
5. Sleep Quality	-.12	-.07	-.19

Table 5

Direct, Indirect, and Total Coefficients for Physical Health

<i>Variable</i>	<i>Direct Coefficient</i>	<i>Indirect Coefficient</i>	<i>Total Coefficient</i>
1. Mindfulness	.13	.24	.37
2. Self-regulation Goals	.32	.13	.45
3. Cognitive Emotion Regulation	-.08	.32	.24
4. Stress Reduction	.23	.03	.26
5. Sleep Quality	.14	.02	.16

Table 6

Direct, Indirect, and Total Coefficients for Well-being

<i>Variable</i>	<i>Direct Coefficient</i>	<i>Indirect Coefficient</i>	<i>Total Coefficient</i>
1. Mindfulness	.20	.37	.57
2. Self-regulation Goals	.31	.26	.57
3. Cognitive Emotion Regulation	.00	.49	.49
4. Stress Reduction	.47	.04	.51
5. Sleep Quality	.06	.05	.11

Table 7.

Fit Indices to Compare Alternative Models of the Relation between Mindfulness and Outcomes

<i>Model</i>	<i>X²</i>	<i>df</i>	<i>P</i>	<i>X²/df ratio</i>	<i>CFI</i>	<i>AIC</i>	<i>BIC</i>	<i>SRMR</i>	<i>RMSEA (CI)</i>
<u>Emotional Distress</u>									
Direct Model	70.8	16	.00	4.42	.91	8457	8527	.03	.09 (.07 - .11)
Comparison Model	314.3	86	.00	3.65	.86	15730	15894	.07	.08 (.07 - .09)
Hypothesized Model	190.2	83	.00	2.29	.93	15612	15652	.04	.05 (.04 - .06)
<u>Physical Health</u>									
Direct Model	17.6	16	.35	1.10	.99	7855	7925	.02	.02 (.00 - .05)
Comparison Model	261.4	86	.00	3.04	.77	15506	15669	.06	.07 (.06 - .08)
Hypothesized Model	135.8	83	.00	1.64	.93	15386	15562	.04	.04 (.03 - .05)
<u>Well-being</u>									
Direct Model	53.2	16	.00	3.33	.92	9539	9608	.03	.07 (.05 - .09)
Comparison Model	345.2	86	.00	4.01	.79	17070	17234	.06	.08 (.07 - .09)
Hypothesized Model	219.4	83	.00	2.64	.89	16950	17126	.04	.06 (.05 - .07)

Figure 1.1: Proposed Mediation Model:

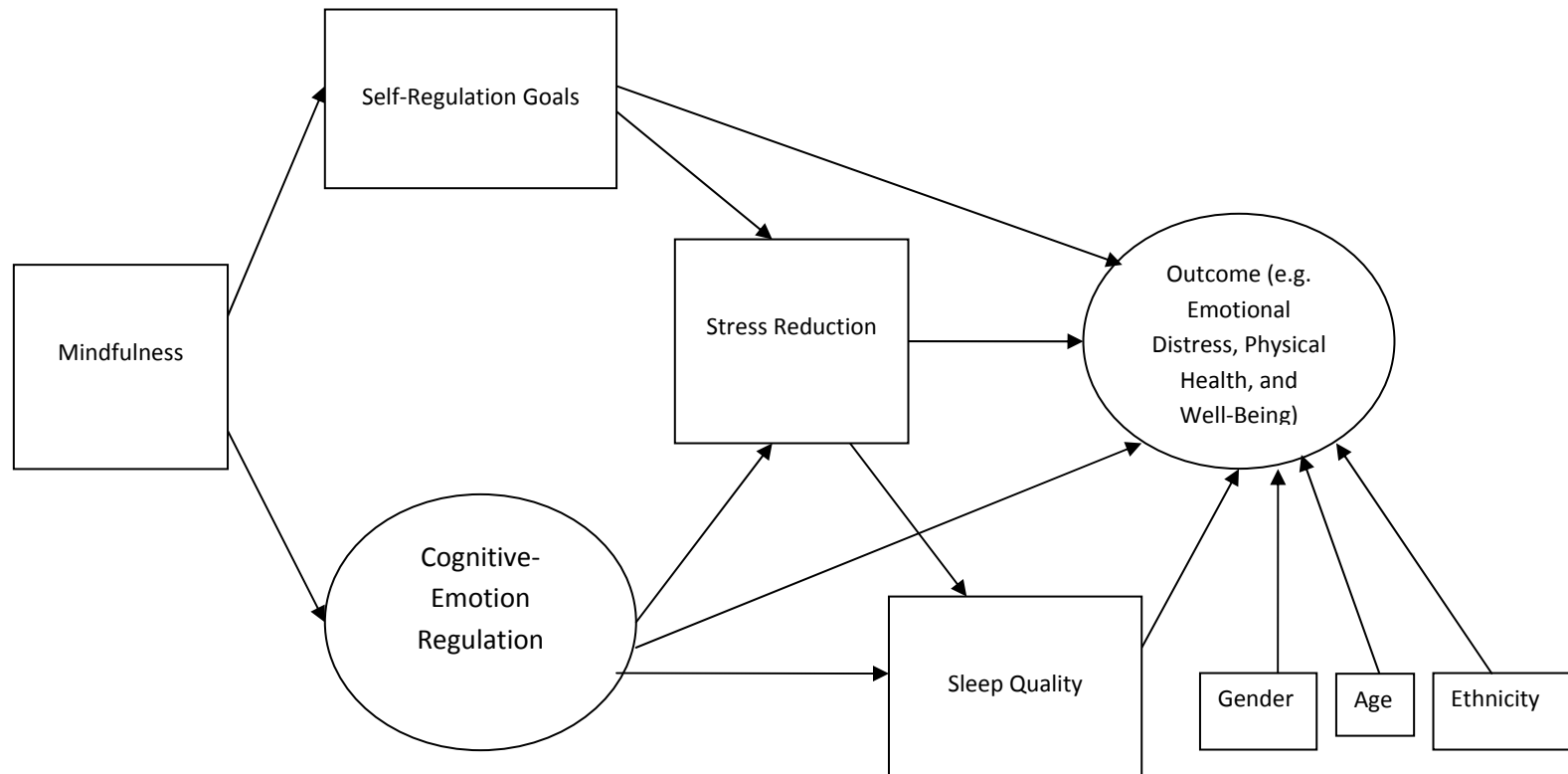
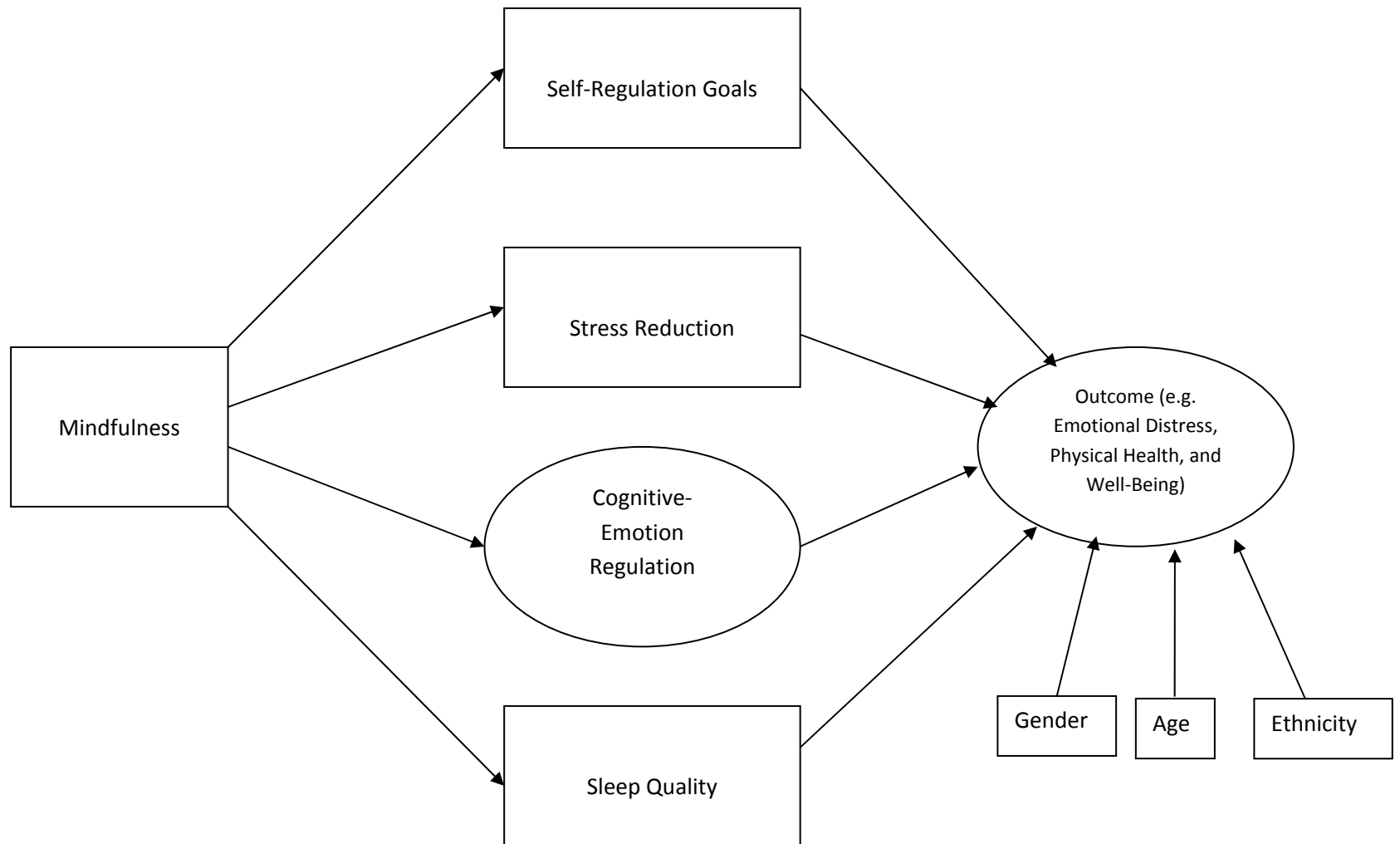


Figure 1.2: Basic Comparison Mediation Model:



Figures 2.1-2.4: Confirmatory Factor Analyses for Latent Variables:

Figure 2.1: Cognitive Emotion Regulation CFA

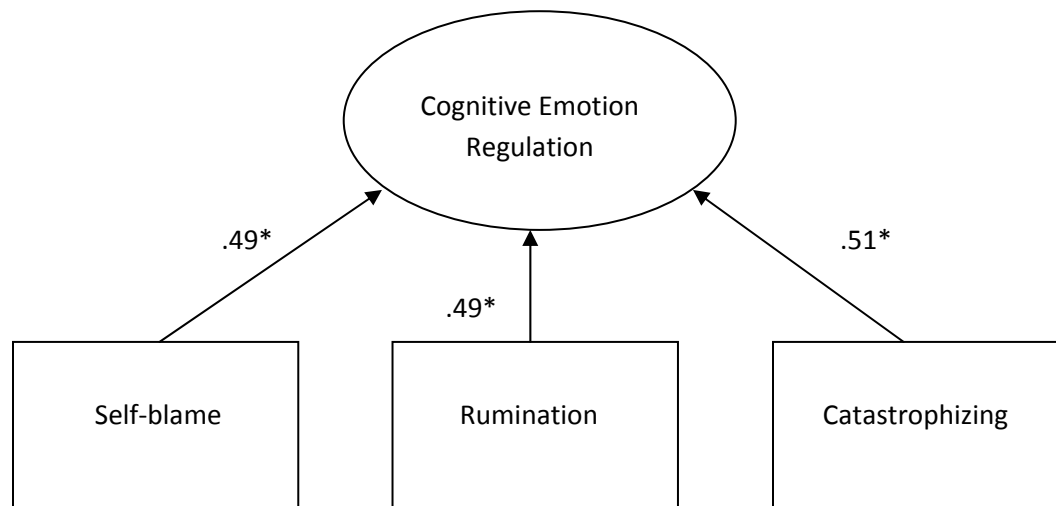
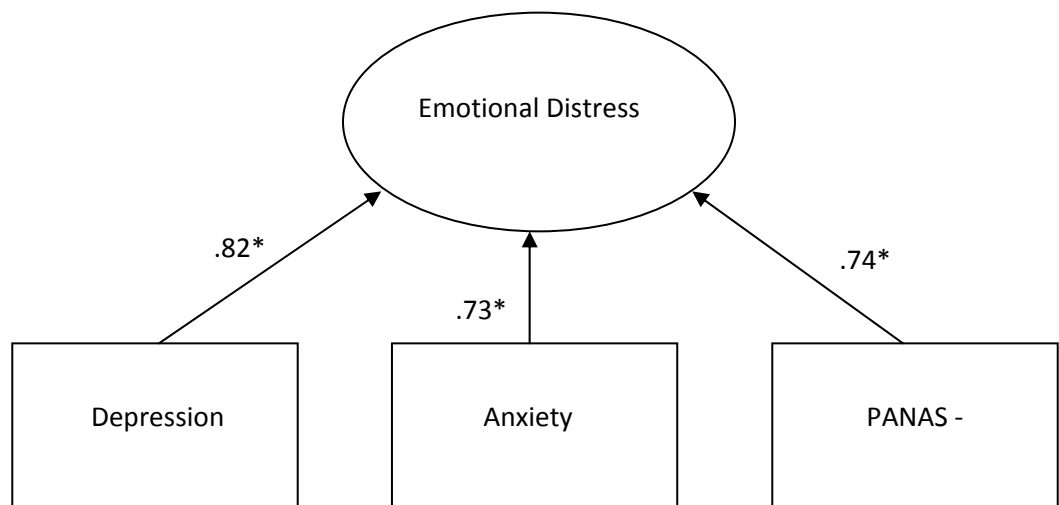


Figure 2.2: Emotional Distress CFA



Note. + = $p < .05$. * = $p < .01$.

Figure 2.3: Physical Health CFA

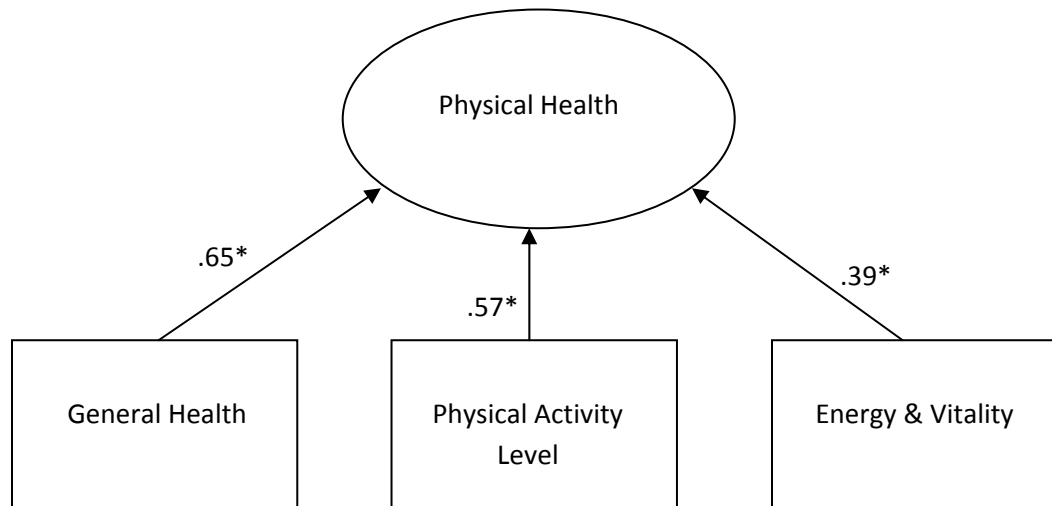
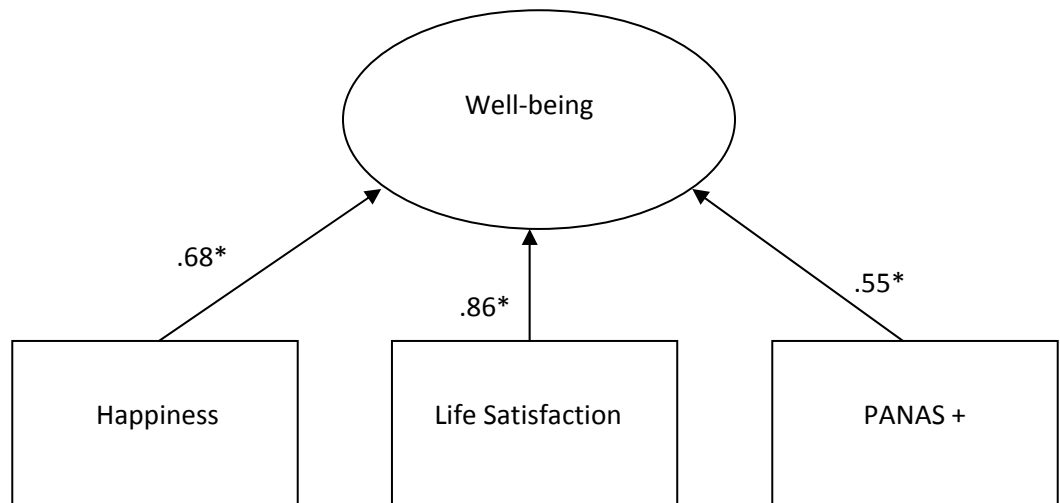
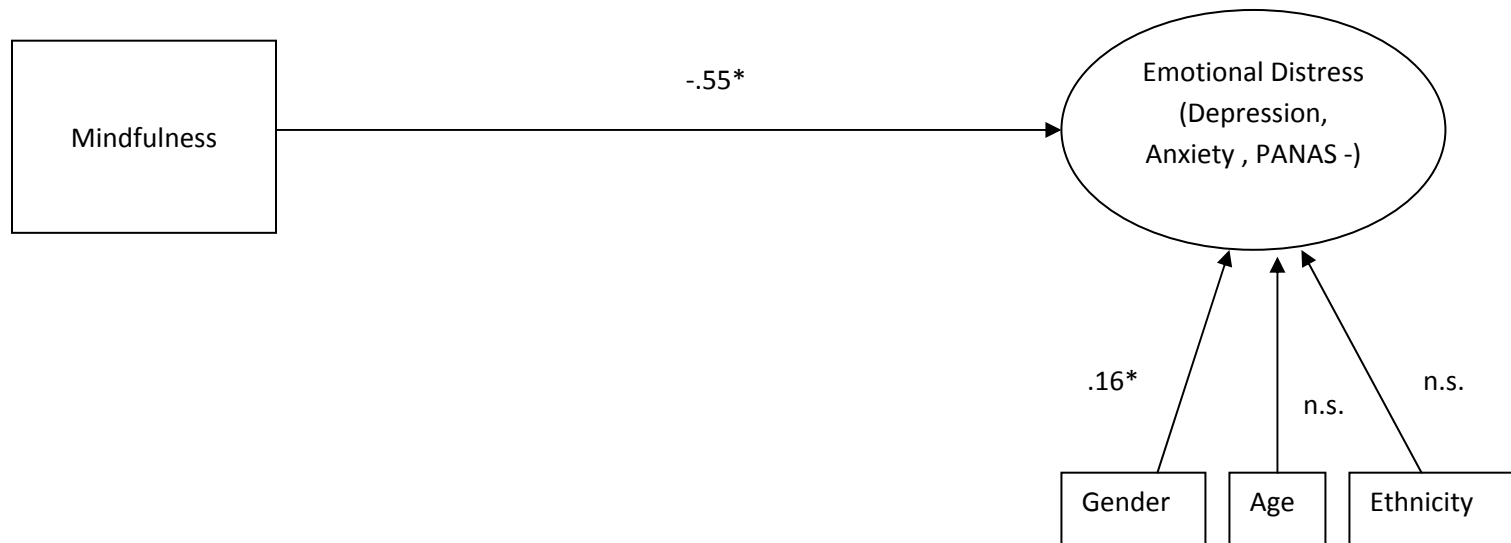


Figure 2.4: Well-being CFA



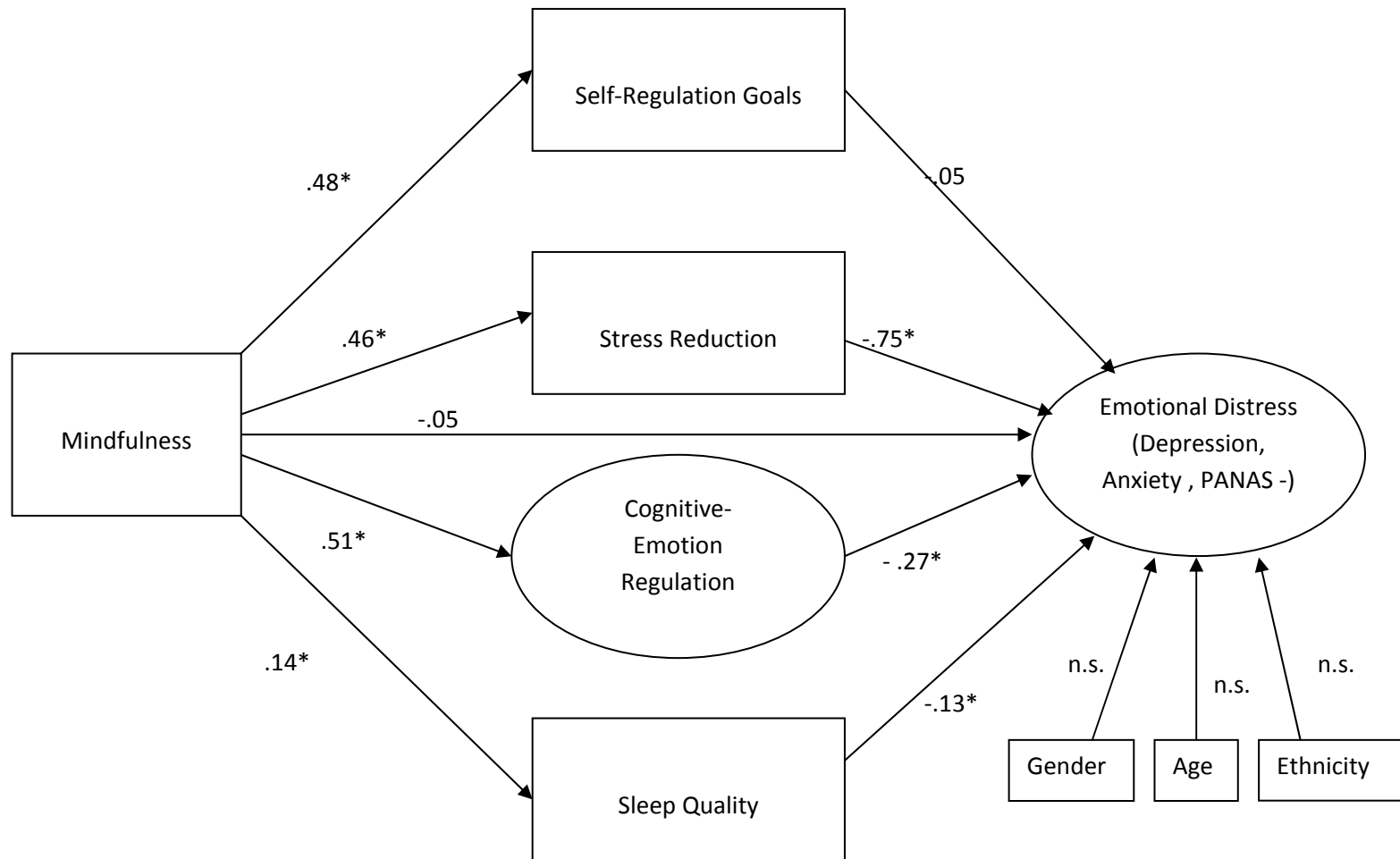
Note. + = $p < .05$. * = $p < .01$.

Figure 3.1: Direct Relation Model for Emotional Distress:



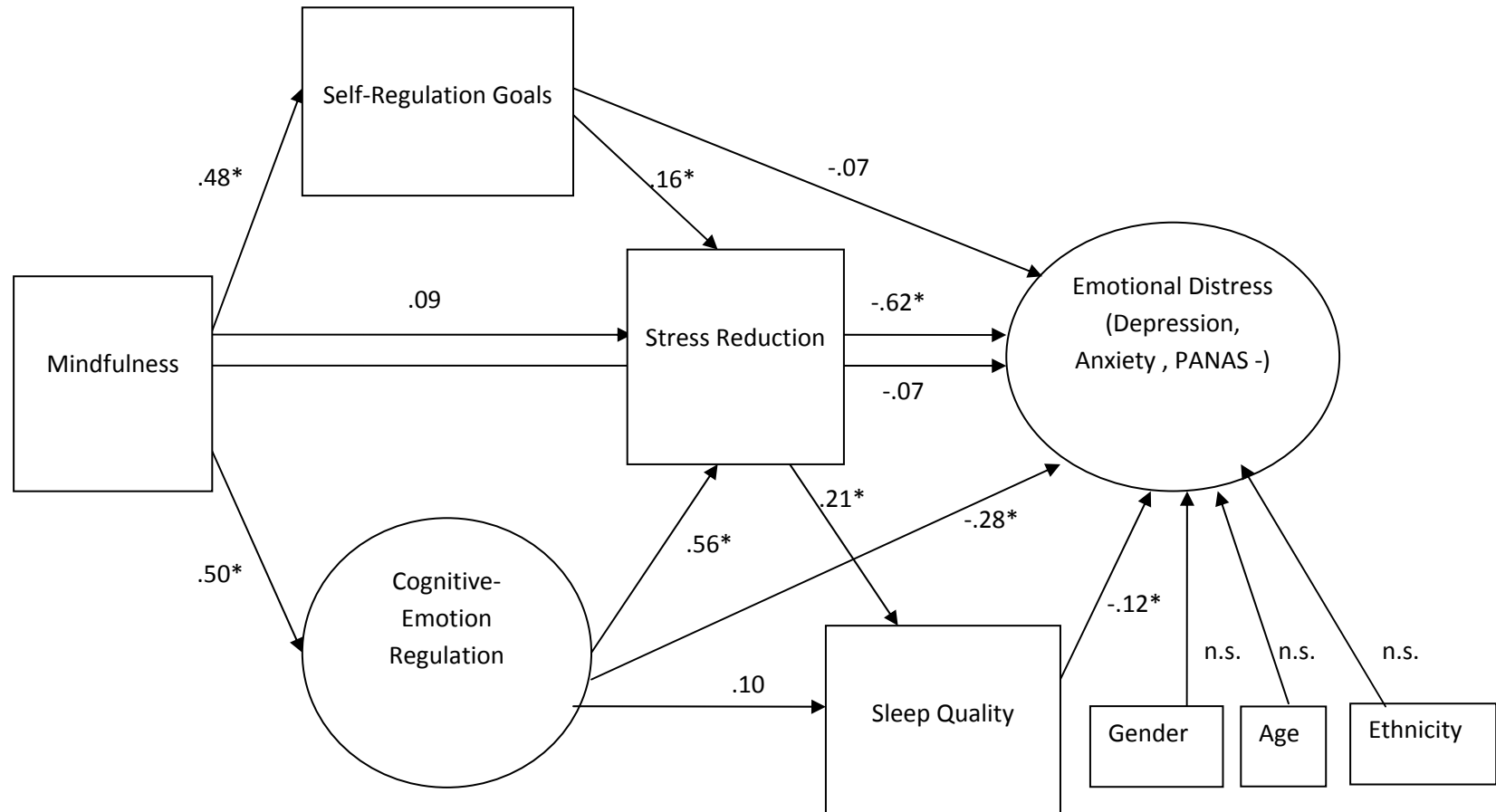
Note. $+=p < .05$. $^*=p < .01$.

Figure 3.2: Basic Comparison Mediation Model for Emotional Distress:



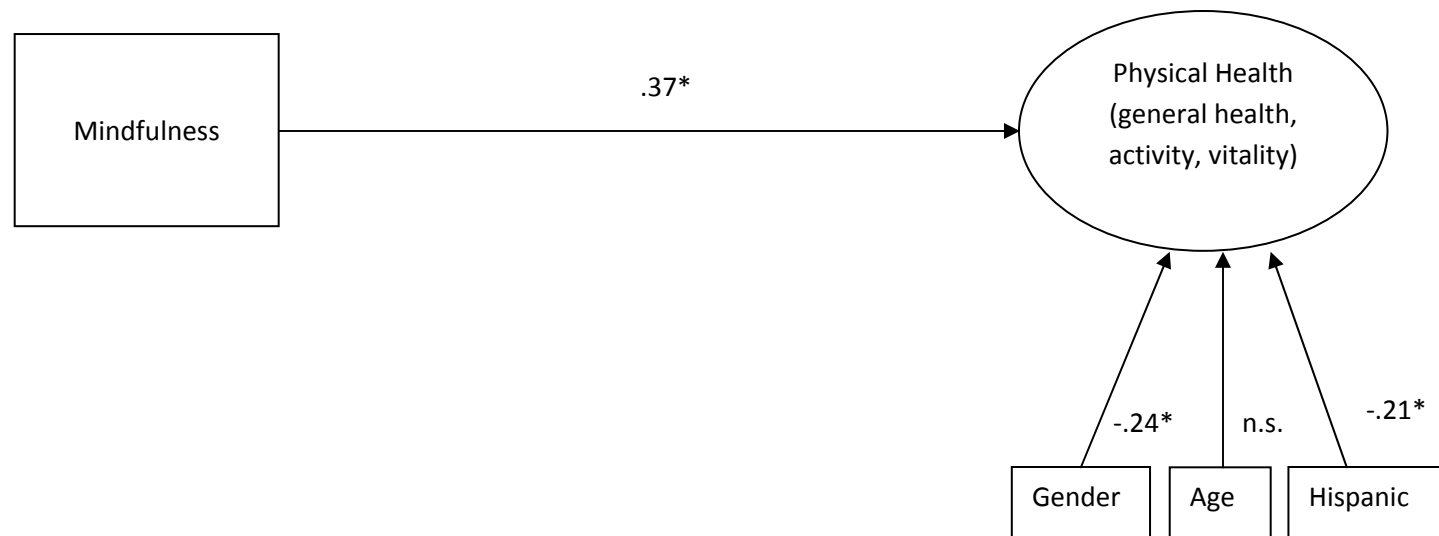
Note. + = $p < .05$. * = $p < .01$.

Figure 3.3: Hypothesized Mediation Model for Emotional Distress:



Note. + = $p < .05$. * = $p < .01$.

Figure 4.1: Direct Relation Model for Physical Health:



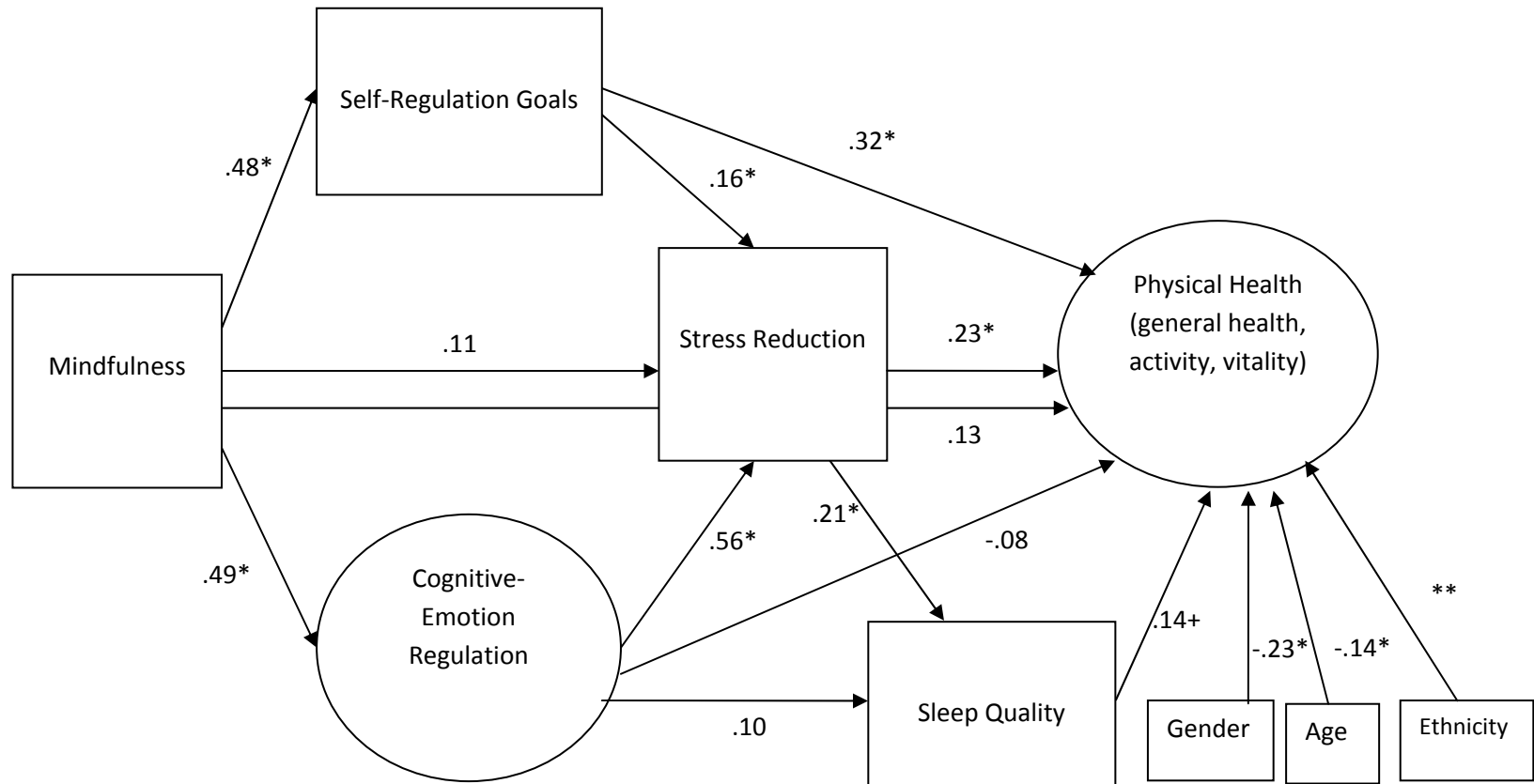
Note. + = $p < .05$. * = $p < .01$.

Figure 4.2: Basic Comparison Mediation Model for Physical Health:



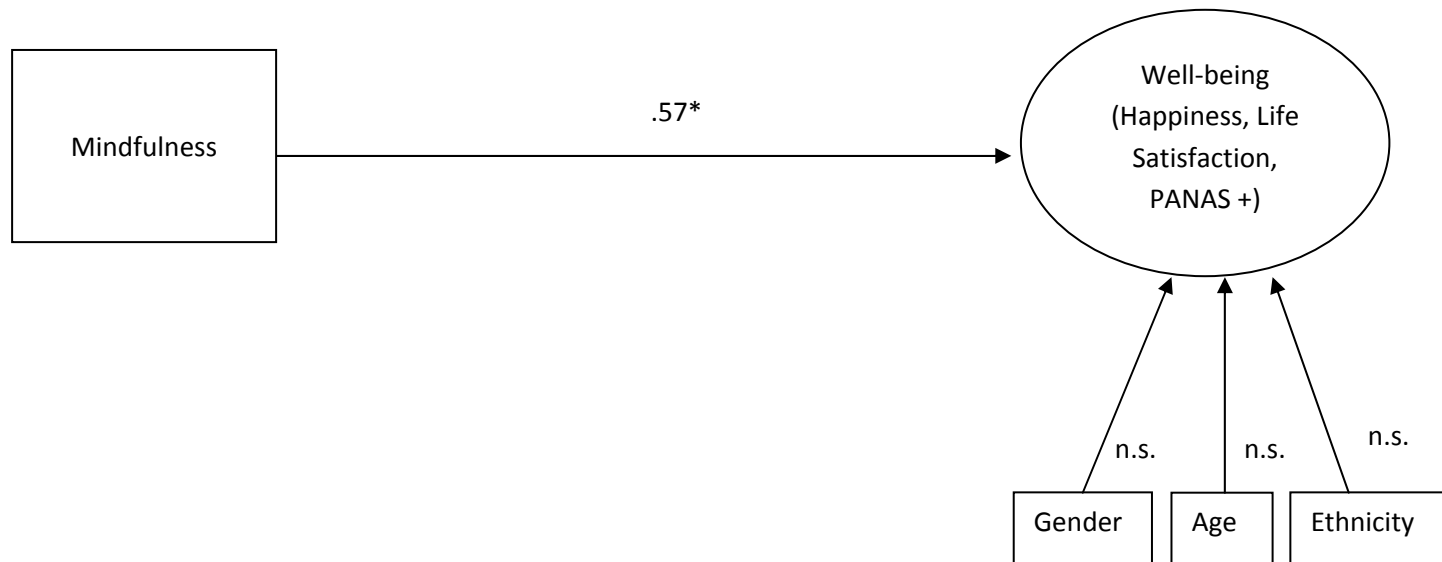
Note. + = $p < .05$. * = $p < .01$. ** = Physical health vs. Caucasian: Asian = $-.16$, African American = $-.13$, Hispanic = $-.23$, all $p < .05$.

Figure 4.3: Hypothesized Mediation Model for Physical Health:



Note. + = $p < .05$. * = $p < .01$. ** = Physical health vs. Caucasian: Asian = $-.16$, African American = $-.13$, Hispanic = $-.23$, all $p < .05$.

Figure 5.1: Direct Relation Model for Well-being:



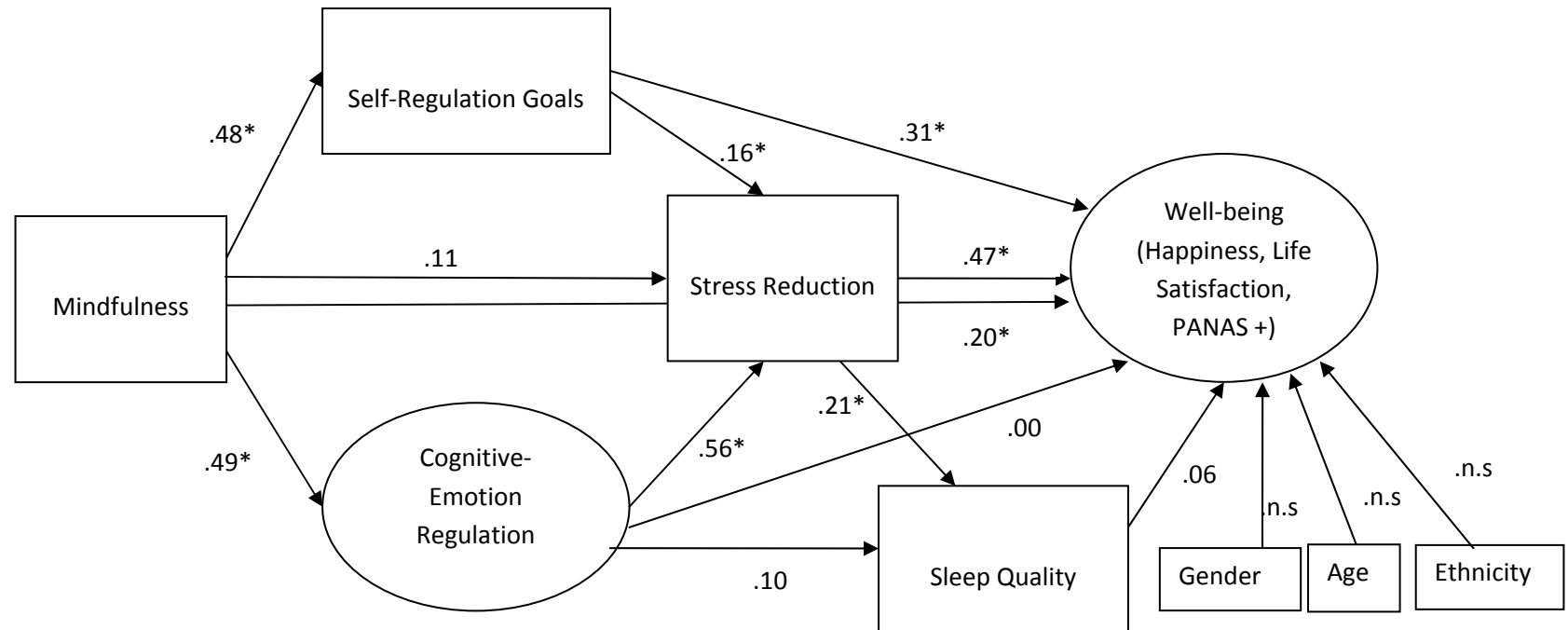
Note. + = $p < .05$. * = $p < .01$.

Figure 5.2: Basic Comparison Mediation Model for Well-being:



Note. + = $p < .05$. * = $p < .01$.

Figure 5.3: Hypothesized Mediation Model for Well-being:



Note. $+ = p < .05$. $* = p < .01$.