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An Examination of the Interactive Effects of Mindfulness and Stress on Negative Health Habits in a Primary Care Population

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AN EXAMINATION OF THE INTERACTIVE EFFECTS OF MINDFULNESS AND STRESS ON NEGATIVE HEALTH HABITS IN A PRIMARY CARE POPULATION

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Dissertation Approval

This is to certify that the thesis presented to us by Christina J. DiChiara, M.S.

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Abstract

The overarching goal of this study was to better understand relationships between health habits, stress, and mindfulness. In doing so, this research examined the interaction of mindfulness with responses to stress as it affects negative health habits. There was also a psychometric development study conducted, using confirmatory factor analyses (CFA) to test the applicability of the two-factor model of the PHLMS to a primary care population. Data were collected from 198 adult patients in a primary care medical practice. Participants ranged in age from 18 to 89 years old, were 51% female, and 92% Caucasian. For CFA analyses, three fit indexes were examined, and fit indexes marginally supported a two-factor model (χ^2/df = 2.26, CFI = .871, TLI = .851, RMSEA = .08).

Despite differences in goodness of fit between this researcher's data and the original model, it was found that the two-factor structure of the PHLMS demonstrated acceptable reliability and consistency when administered to a primary care population. Multiple linear regression analyses were then conducted to test the moderator hypothesis of Mindfulness; these regressions approached significance but did not achieve statistical significance. Although mindfulness was not found to moderate the relationship between stress and health behaviors, a further suggestion is to investigate the relationships between mindfulness, particularly mindful or nonjudgmental acceptance, and stress, as well as relationships between stress and health habits. This research demonstrated a clear relationship between acceptance as a factor of mindfulness, and stress. Based on these results, it is suggested that further investigation be carried out into the usefulness of acceptance-based interventions with chronically stressed primary care populations.

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Chapter 1: Introduction

Statement of the Problem

Primary care offices are on the front lines of health care delivery in the U.S. and hold the greatest potential for preventive medicine and health risk management (Coups, Gaba, & Orleans, 2004; Green, Fryer, Yawn, Lanier, & Dovey 2001; Fernald et al., 2008). To date, primary care settings are falling short of their potential to assess and address the most hazardous health risk behaviors, including smoking, physical inactivity, poor diet habits, and unmoderated alcohol use (Coups et al., 2004; Pronk et al., 2004; Pronk, Peek, & Goldstein, 2004). These health risk behaviors, or negative health habits, influence the prevalence, development, and course of chronic disease (Antoni et al., 2008; Seime, Clark, Whiteside, 2003; Taylor & Aspinwall, 1996). The high prevalence of negative health habits (Fernald et al., 2008) and their deleterious effects on health and mortality are well established (McGinnis & Foege, 1993; Mokdad, Marks, Stroup, & Gerberding, 2004). Stressors and internal responses to stress are also shown to impact the development and progression of disease (Collins, Sorocco, Miller, & Lovallo, 2003). Negative health habits can be employed in response to the psychological and physical experience of stress, and the relationship between stress and health habits can derail efforts to prevent or manage existing disease (McEwen, 1998; Steptoe, 2000; Wiebe et al., 2003).

Improving the ability of primary care to address negative health habits requires improvements in an understanding of the biopsychosocial factors involved in initiating and maintaining negative health habits. Furthermore, it is necessary to expand an understanding of people who are more vulnerable to negative health habits in order to

improve assessment and intervention for these issues. Mindfulness-based therapeutic interventions were initially designed to assist specific, chronic medical populations in managing the deleterious effects of stress on health (Kabat-Zinn, 1982; Kabat-Zinn, 2003). According to Ludwig and Kabat-Zinn (2009), practicing mindfulness may decrease psychological and physiological stress responses and enhance motivation toward positive health habits. By impacting appraisals of stress, mindfulness may alter the intensity of the psychological and physiological stress response, which may therefore impact the need to engage in negative health habits as coping mechanisms (Kabat-Zinn, 1990).

An emerging body of literature supports the ability of mindfulness to impact health. Today, mindfulness-based treatments are administered across a variety of clinical presentations. Researchers increasingly demonstrate associations between mindfulness interventions and both physical and mental health benefits (Baer, 2003; Bishop et al., 2004; Didonna, 2009). Therapeutic changes in physical and psychological well being from increased mindfulness are demonstrated across many stress-related medical conditions (e.g., psoriasis, Type 2 diabetes, fibromyalgia, rheumatoid arthritis, chronic pain, coronary artery diseases, and various types of cancer) and psychiatric concerns (e.g., symptoms of stress, depression, and anxiety; Greeson, 2008; Grossman, Niemann, Schmidt, & Walach, 2004; Kabat-Zinn, 2003). Meta-analyses indicate that mindfulness training may alter perceptions of chronic conditions and may improve coping with daily stressors, condition-specific stressors, and pathogenic stress responses (Baer, 2003; Greeson, 2008; Grossman et al., 2004).

Kabat-Zinn (1982) designed the Stress Reduction and Relaxation Program (SR&RP), now called Mindfulness-Based Stress Reduction (MBSR), to outfit patients with internal, mindfulness-based resources for responding to stress (Kabat-Zinn, 2003). Several different models have built upon this effectiveness of MBSR in applying mindfulness to psychiatric and medical problems. Most notable are the following: Dialectical-Behavioral Therapy (DBT; Linehan, 1993), which utilizes mindfulness-based treatment to reduce impulsive and suicidal behaviors in patients suffering from borderline personality disorder; Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), which utilizes the principles of mindfulness but does not include meditation training; and Mindfulness-based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002), which combines principles of cognitive therapy and MBSR.

If mindfulness-based interventions can facilitate salutary effects within specific medical populations or across psychiatric populations, it can be hypothesized that mindfulness might also demonstrate health benefits throughout a general medical population. Operating under this assumption, mindfulness *in general* may facilitate better health by altering the impact of stress and stress-related factors on general health. Primary care medicine may be able to facilitate the experience of mindfulness to prevent or adaptively manage how stress impacts negative health habits and overall well-being. Theory loosely illustrates the relationship between stress, negative health habits, and mindfulness (Kabat-Zinn, 1990). Empirical investigation into the nature and direction of relationships between these factors, however, is limited. Until recently, research has focused predominately on implementing mindfulness techniques and measuring outcomes, but not on the benefits related to the untrained experience or inherent cognitive

orientation of mindfulness, or on the processes through which salutary effects occur (Weinstein, Brown, & Ryan, 2009).

The impact of natural variations of mindfulness on health behaviors is not yet known. To date, much of the literature on mindfulness as a therapeutic technique or as an attitude examines trained mindfulness. Few authors have examined variations in mindfulness as an untrained or dispositional characteristic (Brown & Ryan, 2003). Awareness and attention are commonly identified components of mindfulness that are also assumed by cognitive theory to be inherent and untrained in human beings (Cardaciotto et al., 2008; Shapiro, Carlson, Astin, & Freedman, 2006). Several authors regard mindfulness as an intrinsic human ability (Brown, Ryan, & Creswell, 2007; Goldstein, 2002; Kabat-Zinn, 2003). Brown and Ryan (2003) argue that although awareness and attention are inherent features of the human experience, the frequency, intensity, and duration of these qualities are highly variable between individuals. If the attentional aspects of mindfulness vary between individuals and within an individual, then logic follows that this variability may influence individual perceptions and responses to stress, because they relate to health and wellness, in differing ways. If the components or processes of mindfulness naturally vary among individuals, mindfulness as a multidimensional construct may naturally vary as well.

Although many researchers agree that mindfulness is a multifaceted construct (Bishop et al., 2004; Brown & Ryan, 2003; Shapiro et al., 2006), most mindfulness measures are designed to assess only global mindfulness without differentiating factors within that construct. Identifying and understanding the mechanisms of change activated through mindfulness interventions hinges on accurate assessment of the processes or

components of mindfulness (Bishop et al. 2004; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). Awareness and acceptance are mutually agreed upon components of the larger construct of mindfulness (Cardaciotto et al., 2008; Kabat-Zinn; 2003; Siegel, Germer, & Olendzki, 2009). Both constructs of acceptance and of awareness are inherent parts of the human cognitive experience, but it is the combination or interaction of these constructs that constitutes mindfulness. When taken separately, awareness and acceptance demonstrate varied effects on well-being (Cardaciotto et al., 2008). In the examination of mindfulness, it may therefore be useful to understand the varying effects of awareness and acceptance as constructs of mindfulness, including how these variations may impact health.

Purpose of the Study

The overarching goal of this study was to better understand relationships between health habits, stress, and mindfulness. In doing so, this researcher explored natural variations in mindfulness within a primary care medical population and how these variations relate to health. Beyond examining the occurrence and variability of mindfulness, this research sought to identify future directions for mindfulness-based assessment and intervention and alternative targets of primary care prevention and treatment services. It was intended to achieve these goals in the following ways: 1) by examining the interactive effects of mindfulness and stress on negative health habits in a primary care population, 2) by examining the interactive effects of the components of mindfulness (i.e., Awareness and Acceptance) and stress on negative health habits, and 3) by conducting a confirmatory factor analysis of the Philadelphia Mindfulness Scale (PHLMS) in a primary care population.

This research examined the interaction of mindfulness with responses to stress as it affects negative health habits. Kabat-Zinn (1990) theorized that mindfulness alters the relationship between the experience of a stressful event and the internal response of stress that follows. According to Kabat-Zinn's theory, mindfulness allows for a non-judgmental stance when people appraise and perceive stressful events, which then shapes how people respond to and cope with stressful events. Awareness of the present moment with an attitude of acceptance impacts appraisals of stressful events, and therefore also impacts the response to such events. Therefore, in people who are dispositionally more mindful, awareness and acceptance may create a particular attitude or mindset through which stress is appraised; this may alter threatening appraisals of stress and reduce the employment of negative health habits in order to cope. The researcher examined the moderating effects of mindfulness on stress responses to determine whether or not the interaction between mindfulness and stress responses alters the relationship between stress and negative health habits. Mindfulness was then broken down to examine whether or not the factors of awareness and acceptance produce different interactive effects with stress in predicting negative health habits.

In order to examine the moderating effects of mindfulness on stress and health, it is necessary to ensure that mindfulness is being measured accurately. To do this, confirmatory factor analysis of the PHLMS was conducted to determine the reliability of the established two-factor model when administered among a primary care population. The PHLMS uses a two-factor model (Awareness and Acceptance), which was previously tested on a student sample, representing the general population (Cardaciotto et al., 2008). Awareness and Acceptance factors did not correlate significantly and good

internal consistency was demonstrated among both clinical and nonclinical samples. Separately assessing the underlying factors of mindfulness allows an evaluation of those components of mindfulness which may be more essential or facilitative in terms of targeted interventions. Understanding the essential components of mindfulness may assist health care providers in selecting those mindfulness-based interventions which may be most effective within a medical population or with particular medical issues.

Chapter 2: Review of the Literature

Concerns in Modern Healthcare

Managing health is one of our nation's most challenging and expensive concerns of the 21st century. In the current climate of rising health care costs, the urgency for improved disease prevention is supported by research linking health related costs and mortality with preventable health behaviors. Roughly 15 years ago, Sobel (1994) reported that a sizable portion of health care costs are devoted to treat illnesses that are impacted, caused, or exacerbated by psychosocial variables. In recent years, scientific and public health approaches overwhelmingly agree that psychosocial and behavioral factors significantly contribute to chronic illness prevention and mortality (Fine, Philogene, Gramling, Coups, & Sinha, 2004; Woolf, 1999).

Behavioral health habits have specifically been identified as preventable external or nongenetic factors impacting premature death in the U.S. (McGinnis & Foege, 1993; Mokdad et al., 2004). The World Health Organization estimates that health habits such as smoking tobacco, alcohol misuse, physical inactivity, and poor dietary habits are among the top five risk factors to injury and disease worldwide (Murray & Lopez, 1997). These factors are continuously upheld as indicators of health within the epidemiological and prevention literature and have been referred to as the "big four" which account for illness related mortality (Barbor, Sciamanna, & Pronk, 2004; Fine, et al. 2004; McGinnis & Foege, 1993). Roughly half of all deaths that occurred in the U.S. in 2000 were partially attributable to preventable health behaviors (Mokdad et al., 2004).

Clinical health psychology grew out of a mass effort toward disease prevention and management through behavioral and psychosocial intervention (Antoni, Millon, &

Millon, 2008). The growth and popularity of clinical health psychology is attributed to numerous factors. In addressing its great importance, Gentry (1984) suggested that health psychology provided an important response to: 1) increased concern for prevention and health maintenance, 2) the failure of the biomedical model comprehensively explain and address health and disease, and 3) increasing complexities and costliness in health care. In part, clinical health psychology provided a medium for challenging the current paradigm in medicine (i.e., the biomedical model) and responding to modern challenges in healthcare.

Impacting Health Habits

Early research on redirecting healthcare expenditure posited that health care professionals must prioritize health habit interventions to impact the prevention of and adjustment to disease, and that medical care may become more cost effective and save more lives by emphasizing preventive strategies which underscore patient behavioral change (Woolf, 1999). To best impact mortality rates, health care professionals, providers, and researchers were challenged to refocus efforts and resources toward diminishing negative health habits. In our current health care system, however, the bulk of resources are still directed toward tertiary treatment efforts, addressing health problems at later stages of advancement, and later in life (Woolf, 999). Clinical health psychologists have a responsibility to advocate for and investigate low-cost, low-risk interventions that can address behavioral lifestyle problems and thus address disease prevention and health maintenance.

Primary care offices are the chief settings of healthcare delivery in the U.S. (Green, Fryer, Yawn, Lanier, & Dovey 2001; Fernald et al., 2008). Because they are on

the front lines of health care delivery, primary care settings have the potential to assess health risk habits and address prevention better than any other health forum (Coups, Gaba, & Orleans, 2004). Coups et al. (2004) found that patients assume that healthcare providers, and specifically primary care physicians, will supply information, screening, and prevention recommendations regarding negative health habits (Coups et al., 2004). In the U.S., however, primary care settings are falling short of their potential to assess and address patients with the most hazardous negative health habits, including smoking, physical inactivity, poor diet habits, and unmoderated alcohol use (Coups et al., 2004; Pronk et al., 2004; Pronk, Peek, & Goldstein, 2004).

Delivery rates of preventive services in primary care settings continue to be low, despite the demonstrated importance and effectiveness of preventive service recommendations[1] for negative health habits (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). Yarnall et al. (2003) argue that time restraints, inadequate insurance reimbursement, patient non-compliance, and low physician expertise impede the ability of primary care physicians to incorporate prevention with ongoing medical care. Even when preventive recommendations are made, Fernald et al. (2008) found that roughly 90% of U. S. adults fail to practice recommended health habits. Fernald et al. further reported that nearly 70% of adult patients in primary care maintain two or more negative health habits, with the combination of unhealthy diet and physical inactivity being the most prevalent. Clearly, the issue of negative health habits in primary care practices is significant and troubling. Highly prevalent negative health habits are not being sufficiently assessed and addressed in primary care.

[1] Services recommended by the 1996 United States Preventive Services Task Force (USPSTF): Guide to Clinical Preventive Services (Yarnall et al., 2003).

Today, clinical health psychologists address behavioral and psychosocial factors in primary care settings because it has been demonstrated that change to these variables alter how they contribute to overall risk of disease (Henderson & Baum, 2004). In general terms, both clinical health psychology and mindfulness-based approaches strive to reduce patient suffering by maintaining existing health and improving health care delivery (Kabat-Zinn, 2008). Interventions for negative health habits continue to emphasize prevention by addressing behavioral factors of disease. Health behaviors and habits are an issue in terms of cost-effectiveness, treatment effectiveness, and mortality. Therefore, health habits are worthy of scientific and clinical focus because health behavior modification can seriously affect modern health concerns. If mindfulness can play a role in improving low-cost healthcare intervention and preventing negative health habits, then it is worthwhile to examine the role mindfulness in modern conceptualizations of health.

Kabat-Zinn (1982) began researching the efficacy of mindfulness meditation with chronic pain patients to address the same concerns noted previously (i.e., increased focus on prevention, shortcomings in disease conceptualization and treatment, and increased healthcare intricacy and cost). Kabat-Zinn (1982; 1990) began research on mindfulness in medicine to fill in the gaps of the biomedical paradigm in health care delivery. He emphasized the importance of considering the whole person, not simply the biology of the person, or factors of the person in isolation, but the interconnectedness between physiology, cognition, and behaviors (Kabat-Zinn, 1990). His seminal research on MBSR with chronic pain patients suggested that attitudinal and behavioral changes appeared to enhance patients' health outcomes (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth,

& Burney, 1985; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987). These preliminary findings were consistent with the mission of clinical health psychology and suggested the potential of a low-cost, low-risk program to improve patient's overall health. Mindfulness models in healthcare provide the opportunity to develop and test new knowledge that may impact health care delivery. Meditative and yogic traditions may offer complimentary views and practices to enhance existing approaches in behavioral medicine (Kabat-Zinn, 1985).

Health Behaviors are an Issue

Primary prevention in health care is an effort towards overall health maintenance and towards reductions in susceptibility to disease among healthy individuals who are at elevated risk for specific illnesses (Antoni et al., 2008, Henderson & Baum, 2004). Behavioral health habits, which include risk behaviors (e.g., smoking tobacco or overeating), and protective behaviors (e.g., physical activity and limiting alcohol intake) are instrumental in maintaining health and are common targets of primary prevention efforts (Henderson & Baum, 2004; McGinnis & Foege, 1993; Mokdad et al., 2004). These health habits also influence adjustment to existing disease and the course of illness, particularly in chronic medical conditions (Antoni et al., 2008). Lifestyle behaviors, which include, but are not limited to negative health habits, are estimated to account for more than 50% of the variance in mortality from cardiovascular disease (CVD), cancer, chronic obstructive pulmonary disease (COPD), and chronic pain, hypertension, and type-II diabetes (Berlant & Pruitt, 2003; Seime, Clark, & Whiteside, 2003). The role of health habits in the prevalence and development of chronic diseases is increasingly clear

(Taylor & Aspinwall, 1996). The following section elaborates on the connection between negative health habits and the development of, and adjustment to, chronic disease.

Physical inactivity. Physical inactivity is consistently identified as a significant negative health habit influencing both acute and chronic disease (Fine et al., 2004; Kypri & McAnally, 2005; Mokdad et al., 2004). Sedentary or physically inactive lifestyles are specifically shown to predict CVD and associated symptoms. Physical inactivity is further associated with hypertension, COPD, and the exacerbation of symptoms of osteoarthritis, as well as numerous other medical conditions (Barbour et al., 2003). In their examination of multiple risk behavior prevalence and clustering in the U.S. population, Fine et al. (2004) report that being overweight or significantly obese contributes to mortality, which is causally related to poor dietary habits and physical inactivity. Physical inactivity was the most commonly reported behavioral risk in this study; the most common cluster of risk behaviors include smoking, being overweight, and being physically inactive (Fine et al., 2004). Overweight and obesity, as related to physical inactivity, also represents a major risk factor in the development of chronic disease (e.g., hypertension, CVD, and type 2 diabetes mellitus; Barbour et al., 2003). In addition to physiological risk, physical inactivity and obesity are further found to impact psychological functioning. Physical inactivity is strongly related to emotional distress (Fine et al., 2004), but physical activity is commonly associated with positive emotional well being and improved mood (Barbour et al., 2003).

Dietary habits. Patterns of eating, including the amount and the type of food intake, are additionally identified as behavioral risk factors to chronic disease and mortality. As with physical inactivity, dietary habits are closely linked to the public

health epidemic of obesity. Binge eating, high sodium and low potassium diets, as well as diets high in fat and cholesterol and low in vegetables, fruits, and fiber have established links to obesity and hypertension (Geleijnes, Kok, & Grobbee, 2004). These dietary habits are further identified as modifiable risk factors in the development of chronic disease such as type-II diabetes mellitus, CVD, cancer, stroke, and arthritis (Faith & Thompson, 2003, Kypri & McAnally, 2005; Rehm, Taylor, & Room, 2006). Dietary change and caloric regulation is the standard for behavioral change with obesity. Poor dietary practices are often accompanied by physical inactivity and smoking; numerous authors have noted the relationship between smoking status and greater dietary fat intake (Shah et al., 1993; Sherwood et al., 2000; Shinton, 1997).

Tobacco smoking and alcohol misuse. Smoking tobacco and unmoderated alcohol consumption constitute a major risk factor linked with over 80 acute and chronic diseases globally (Rehm et al., 2006). Smoking tobacco may be the most negative or the most risky health habit because it is specifically linked to chronic diseases with a high risk of mortality. Unmoderated alcohol use is associated with acute and with chronic disease (e.g., physical injury versus cancer), which may or may not have high mortality risk (e.g., liver cirrhosis versus depression; Rehm et al., 2006). Smoking is one of the most preventable risk factors for death and illness, accounting for more deaths globally than alcohol and illicit drug use combined (Cohen et al., 2003; Rehm et al., 2006; Sherwood et al., 2000). As mentioned previously, smoking is commonly clustered with co-occurring risk behaviors such as negative eating habits and physical inactivity. Sherwood et al. (2000) suggest that smokers in general have poorer health habits and lifestyle patterns because of the comorbidity of smoking with additional risk behaviors.

Furthermore, these authors found that smokers with clustered negative health habits were at an increased risk for more significant problems with smoking and poorer treatment prognosis in general (also supported by later findings; Cohen et al., 2003; Fine et al., 2004).

Excessive alcohol consumption is a demonstrated risk factor for hypertension, cardiovascular diseases, cancers and neoplasms, diabetes mellitus, stroke, kidney failure, and other devastating diseases, most of which are controllable through behavioral health modification (al'Absi & Hoffman, 2003; Fodor, Whitmore, Leenen, & Larochelle, 1999 Fuschs, Chambless, Whelton, Nieto, & Heiss, 2000; Rehm et al., 2004). Unmoderated drinking should be differentiated from moderated or limited alcohol consumption. In some instances, moderate, controlled drinking has been associated with protective effects, particularly with coronary heart disease. Protective effects, however, vary greatly between alcohol type, volume of consumption, and individual characteristics (Rehm et al., 2003; Rehm, Sempos, & Trevisan, 2003).

Stress Impacts Health

Chronic, stress-related illnesses affect millions of Americans and cost billions of dollars in lost productivity and healthcare utilization in the U.S. (Murphy, 1996; Hughes, Pearson, Reinhart, 1984). Substantial empirical evidence supports the assertion that psychological stress impacts physical and physiological illness (Antoni et al., 2008; Garland, 2007). Perceived stress may interact with health habits and derail efforts to prevent or manage existing disease (Wiebe et al., 2003). Furthermore, stress related factors might moderate the relationship between health habits, disease prevention, and

psychological adjustment to disease (Antoni et al., 2008; McCann et al., 1995; Treharne, Lyons, & Kitas, 2004).

According to the biopsychosocial model of stress, the stress process can pathologically affect health by precipitating physiological (e.g., CVD, gastrointestinal disorder), psychological (e.g., anxiety, depression), and social or behavioral symptoms (e.g., substance abuse) (Carlson & Thomas, 2007; Collins et al., 2003). However, the term "stress" is vague, and is commonly used to describe a variety of behavioral, psychosocial, and physiological factors. For research purposes, the broad construct of stress can be broken down into three basic processes: 1) an environmental event (i.e., stressor), 2) a physiological and psychological responses (i.e., stress response), and 3) internal factors which mediate the effects of the stress response on physiological functioning (i.e., neurochemicals and stress hormones; Collins, Sorocco, Haala, Miller, & Lovallo, 2003; McEwen, 2004). In basic terms, the process of stress disrupts the body's normal functioning and homeostasis through the interaction of a stressor and a stress response (Collins et al., 2003).

Collins et al. (2003) define a stressor as "any physical or mental challenge to the body that threatens homeostasis" (p. 169). Stressors, therefore, include both physical and psychological events that disrupt normal functioning. Physical stressors may include physical exertion or injury, exposure to extreme heat or cold, or exposure to intense noise or overcrowding (Cohen & Weinstein, 1981; Collins et al., 2003; McEwen, 2000). Psychological stressors may include events such as bereavement, isolation, overcrowding, and interpersonal conflict (Cohen, Kamarck, & Mermelstein, 1983; Collins et al., 2003; McEwen, 2000). The stress response can be defined as the effects of

a physical or a psychological stressor on homeostasis. Stress responses are manifested in physiological, psychological, and environmental levels within an individual.

The physiological response to stress activates changes in the body, such as increases in blood pressure and heart rate, disrupted metabolic functioning, and cognitive impairments, all of which disrupt homeostasis (McEwen, 2000). Psychological responses, such as appraisals of stressors as threatening or challenging to the individual, or the evaluation that individual resources for coping with the stressor are inadequate, moderate the impact of the stressor (Lazarus & Folkman, 1984). The psychological stress response is detrimental to health when it creates abnormality or imbalance across physiological systems.

The internal factors that mediate the physiological stress response involve an interaction between the hypothalamus, pituitary gland, and the adrenal or suprarenal glands, which are commonly referred to as the hypothalamic-pituitary-adrenal (HPA) axis (Collins et al., 2003; Huyser & Park, 2002). The hypothalamus organizes the nervous system response and controls the release of hormones related to stress. The interaction within the HPA axis mediates the stress response on homeostasis and facilitates physiological and behavioral responses, including the secretion of stress-related hormones such as cortisol and epinephrine (Collins et al., 2003; Thompson & Van Loon, 2002). Elevated cortisol secretion triggers sympathetic nervous arousal, which increases glucose, heart rate, and blood pressure, and restricts immune functioning, digestion, and reproductive functioning. Increases in sympathetic nervous activity trigger the release of epinephrine, which prepares the body to address the stressor through metabolic and behavioral management (Collins et al., 2003; Chrousos & Gold, 1992).

The corticolimbic system is made up of several areas of the brain and is generally responsible for threat appraisals (Collins et al., 2003). Through a reaction in the corticolimbic system, the prefrontal cortex receives sensory information related to a stressor and appraises or evaluates that information in the context of past information and future preparation. Appraised information is relayed to the amygdala, which processes information about the stressor in an emotional context (Collins et al., 2003). The corticolimbic system responds to appraisals of threat by stimulating several physiological reactions. These reactions include signaling the peripheral and autonomic nervous system to engage in a motor response to the stressor, as well as initiating reactions in the neuroendocrine and immune systems (Collins et al., 2003).

According to Lazarus and Folkman (1984), cognitive appraisal is most easily understood as a process of categorizing and organizing events in ways in which those events are meaningful to each individual. Appraisal is more than information processing; it is a conscious, evaluative process that imposes meaning on an encounter between a person and the environment. In the context of stress, appraisal is used to characterize the transaction between person and stressor, a transaction which is considered bidirectional or mutually dependent (Folkman et al., 1986; Lazarus & Folkman, 1984). An individual evaluates a stressor through cognitive appraisal and manages the stressor through coping (Folkman et al., 1986).

Lazarus and Folkman differentiate between *primary appraisal* and *secondary appraisal*. Both types of appraisal are evaluative processes with different evaluative purposes. Through primary appraisal, a person evaluates whether an encounter with the environment is either: 1) irrelevant (i.e., does not affect the person's well being), 2)

benign-positive (i.e., can maintain or enhance the person's well being) or 3) stressful. Stressful appraisals occur if the encounter is judged as damaging, in which harm or loss is sustained, threatening, or challenging. Stressful appraisals are not necessarily contingent upon the environment. Instead, Lazarus (1999) emphasizes the idea that stress appraisals are contingent upon a person's construal and interpretation of the event.

A person orients to his or her environment through primary appraisals (Lazarus & Folkman, 1984). Once the transaction between person and environment is construed, the person must then evaluate what course of action to take, and what is at stake. Secondary appraisal takes the evaluation further, toward what can and should be done. Secondary appraisal is not simply a problem-solving checklist of what might be done; it is an evaluative consideration of available resources for coping and the efficacy of these resources for the given transaction. In sum, primary appraisals judge the transactional impact on well being, and secondary appraisals judge coping options for navigating the transaction (Lazarus & Folkman, 1984).

The impact of stressful appraisals is particularly concerning, considering the deleterious effects of stress on health and well being (Garland, 2007). Cognitive appraisal and coping are found to mediate the relationship between stressful person-environment encounters and outcomes on well being (Folkman et al., 1986). A strong body of literature demonstrates that when a person appraises his or her relationship with illness as stressful, these stressful appraisals impact the course of the disease (Antoni et al., 2008). A psychological stress response occurs when a person appraises his or her resources for coping (personal, social, and contextual) as insufficient for the stressful

encounter; this triggers a physiological stress response in several systems of the body (Collins et al., 2003; Garland, 2007; Lazarus & Folkman, 1984).

Physiological and psychological responses to stress manifest into behavioral responses for coping with stress, and appraisals of threat shape and may trigger behavioral coping (McEwen, 1998; Steptoe, 2000). Coping can be conceptualized as the purposeful effort to deal with the experience of stress (Boothby, Kuhajda, & Thorn, 2003). The process of coping includes behavioral, emotional, and cognitive components, all of which interact in response to stress. When negative health habits are employed as coping, the frequency, intensity, and duration of negative health habits may moderate the extent to which stress responses negatively affect health (Antoni et al., 2008). Health habits are also caused by a variety of lifestyle, sociocultural, and socioeconomic factors that may be unrelated to stress. For example, physical inactivity and dietary habits have sociocultural and economic components unrelated to stress. Furthermore, coping responses to stress can include avoidance or escape behaviors, which may indirectly impact health, but which are not negative health habits (Dantzer, 2000). Still, substantial evidence supports the link between internal stress responses and behavioral coping.

Stress commonly precedes alcohol use (Erblich & Earleywine, 2003), smoking, and substance use in general (Cohen et al., 2003; Collins et al., 2003). Drinking can be a behavioral response to stress and has been linked with a variety of stressors (Erblich & Earleywine, 2003). Alcohol use is often a repetitive response to life stressors and psychological stress responses (Allan & Cooke, 1985; Brown, Vik, Patterson, Grant, & Schuckit, 1995). Following the induction of a psychological stressor, individuals with stronger stress responses exhibited predictably stronger or more severe drinking

behaviors (Sinha & O'Malley, 1999). Smoking behavior follows a pattern similar to alcohol use. For example, stress responses to CVD appear to trigger negative health habits and result in the development and worsening of atherosclerosis in patients with CVD (Rozanski, Blumenthal, & Kaplan, 1999). Smoking and poor dietary habits are frequently engaged following physiological and psychological responses to CVD.

Poor dietary habits are frequently used to cope with uncomfortable and destabilizing stress responses. For individuals who are obese, stressors and stress responses commonly trigger behavioral responses of overeating and binge eating (Faith & Thompson, 2003). Lillis, Hayes, Bunting, and Masuda (2009) suggest that individuals who engage in poor dietary habits in response to psychological stress and emotional distress are susceptible to being overweight and appear to engage in poor coping behaviors in general, such as avoidance and impulsivity. In patients with type II diabetes, stress is thought to deregulate metabolic functioning directly through the physiological stress response and indirectly through negative health habits, such as overeating or poor diet (Hoff, Wagner, Mullins, Chaney, & 2003). Stress which is related to the complexity of diabetes treatment may result in poor eating habits and physical inactivity because patients transfer coping efforts away from lifestyle maintenance and toward treatment efforts. Diet and physical activity influence blood glucose levels, and derailing these health habits can destabilize internal functioning which is related to disease, similar to the destabilizing effects of the physiological responses to stress (Goetsch, Wiebe, Veltum, & Van Dorsten, 1990).

In sum, chronic physiological and psychological stress responses negatively impact health by overwhelming normal systems functioning in the body. If stressors

further impact health by triggering negative health habits, altering health behaviors, then, should alter the impact of stress on health. For example, Erblich and Earleywine (2003) suggest that because stress predicts alcohol use, improving alternative or healthier coping skills may reduce dependency on alcohol use as a behavior for coping with stress.

All people experience life stressors. The goal of health care providers is not to minimize life stress in patient's lives, but instead, the goal is to minimize the negative impact of life stressors on patient's health. The internal response to stressors shapes the impact of a stressor on overall health. Identifying mindfulness as a moderator between stress and negative health habits may further describe the process between stress response and coping through negative health habits. If it is possible to identify factors that might alter or impact the likelihood that a person would cope by using negative health habits, those impacting factors may then provide new targets for programs designed to alter the deleterious effects of stress. Identifying mindfulness as a moderator between stress response and negative health habits is worthwhile for the improvement of primary care prevention and intervention efforts towards negative health habits.

Mindfulness Impacts Health Habits through Stress

Recent psychosocial research has examined mindfulness-based psychotherapeutic interventions to address the relationship between stress, coping, and health. Various definitions of mindfulness consist of several common factors, including acceptance of experience, a compassionate attitude toward others and oneself, and the capacity to self-observe in a non-judgmental fashion. It is possible therefore to operationalize the construct of mindfulness as an attentive and present-focused state of consciousness through which an individual observes, accepts, and experiences the reality of living.

Underlying these components is the assumption about human cognitive functioning, i.e., that individuals are able to attend to present-moment experiences and to observe and understand the nature of those experiences (Didonna, 2009).

Ludwig and Kabat-Zinn (2008) suggest several mechanisms of action through which mindfulness may influence the risk and the preventative factors of illness, as well as mechanisms associated with recovery from illness. The potential mechanisms identified by Ludwig and Kabat-Zinn include: 1) decreased subjective pain sensitivity, 2) increased toleration of pain or disability, 3) decreased stress, anxiety, or depression, 4) decreased psychopharmacology utilization, 5) increased ability to think reflectively and critically about medical treatment options, 6) increased medical treatment compliance, 7) increased motivation toward positive health habits (e.g., diet, physical activity, reduced nicotine and alcohol consumption, etc.), 8) enhanced social engagement and connectedness, and 9) changes in biological pathways which affect health (e.g., autonomic nervous system functioning, neuroendocrine functioning, and immunological functioning). Ludwig and Kabat-Zinn offer these mechanisms as possibilities through which mindfulness may affect health; most of these mechanisms have not been adequately examined in the existing literature. However, many of the proposed factors are associated with perceptions and appraisals of stress, which maintains a well-established relationship with numerous medical conditions (Ludwig & Kabat-Zinn, 2009).

According to Ludwig and Kabat-Zinn's (2009) theorized mechanisms, practicing mindfulness may decrease psychological and physiological stress responses and enhance motivation toward positive health habits. As was previously established, stress and

health habits are related in several different ways (Steptoe, 2000). Kabat-Zinn (1990) summarizes this relationship by emphasizing that those perceptions and appraisals influence the subjective experience of stress. Kabat-Zinn (1990; 2003; 2008) argues that awareness of one's habitual and negative ways of perceiving and reacting to stress, and acceptance of stressors as impermanent, passing events decreases impulsive stress reactions. Instead of reacting to stress in ways that are unconscious and automatic, moment-to-moment awareness and acceptance slows down the process of appraisal and reaction, allowing for more time to make better, more realistic decisions about whether or not stressors are actually threatening and how to adaptively respond and cope with stressors. In this way, mindfulness may alter the relationship between the stress response (i.e., appraisals of stress and physiological response to appraisals) and coping (i.e., negative health habits).

Mindfulness is an attitude of objectivity in which a person is aware of sensations or experiences without judgment or evaluations, and is similarly aware of the accompanying cognitive processes which contribute to the evaluation and labeling of the sensation or experience as irrelevant, benign, or stressful and dangerous (Kabat-Zinn, 1982). Appraising cognitions simply as mental events that are not necessarily true or helpful appears to halt the domino effect from sensation to evaluation to habitual reaction. Detached, objective awareness alters the relationship between the person and experience, and subsequently changes the relationship between the experience and habitual response (Bishop et al., 2004; Kabat-Zinn, 1990).

As constructs of mindfulness, awareness and acceptance are interdependent. Hayes (2004) defines acceptance as "the active nonjudgmental embracing of experience

in the here and now" (p. 21). Acceptance is a receptive attitude toward the reality of an experience as opposed to an avoiding, a catastrophizing, or a ruminating over an experience as it occurs (Cardaciotto et al., 2008; Hayes et al., 1999). Cardaciotto et al. (2008) make the important distinction between accepting an experience versus resigning to an experience. Acceptance does not mean passivity, approval, or resignation. Instead, acceptance is more realistically an attitude of openness or willingness to take thoughts, feelings, and sensations in the moment, as they are. With mindfulness practices, an attitude of nonjudgmental willingness or acceptance is taught and learned through meditation training or other mindfulness techniques. However, a general, trait-like attitude of acceptance may naturally vary among people, with some people more dispositionally inclined toward willingness and nonjudgment than others. Both constructs of acceptance and awareness are inherent parts of the human cognitive experience, but it is the combination or interaction of these constructs that constitutes to mindfulness.

In addition to nonjudgmental acceptance, mindfulness is also characterized by awareness of the here-and-now (Baer, 2003; Roemer & Orsillo, 2003). Mindful awareness is defined here as continued observation and attention to the present moment, approached with an attitude of acceptance. When taken separately, awareness and acceptance demonstrate varied effects on well being. Without acceptance, increased awareness is associated with increased emotional distress, displeasure, and increased perceptions of pain or discomfort (McCracken, 1997; Roelofs, Peters, Patijin, Schouten, & Vlaeyen, 2004). Awareness can result in both positive and negative effects. Although general self-focus has been related to negative affect, self-focus on positive personal

attributes or self-focus following positive experiences has been associated with decreases in negative affect (Mor & Winquist, 2002). Among persons with depression, some evidence suggests that increased self-focused awareness can worsen negative affect and increase self-criticism and guilt (Mor & Winquist, 2002; Sloan, 2005). People with negative mood states generally demonstrate heightened self-focused awareness more than do individuals without negative mood (Woodruff-Borden, Brothers, & Lister, 2001).

Awareness impacts a variety of psychological sensibilities. Among individuals with panic disorders, heightened awareness of somatic cues and sensations is shown to contribute to panic attacks (Zoellner & Craske, 2000). Hypervigilance, or heightened awareness of and attention, to pain sensations and stimuli may lead to more intense experiences of pain in chronic pain patients (Roelofs, Peters, Patijn, Schouten, & Vlaeyen, 2006). Low awareness (e.g., distraction) may temporarily relieve feelings of fear or anxiety, but may invariably lead to problematic patterns of avoidance (Greeson & Brantley, 2009). When performing compulsive behaviors, people with obsessive-compulsive disorder or other obsessive problems tend to have low to no awareness of their cognitions in the moment (Didonna, 2009a). Thus, awareness without acceptance demonstrates varied effects on health and well being. Variability in the impact of awareness on health may be attributable to the relationship between awareness and an attitude of acceptance (Cardaciotto et al., 2008). Experiential avoidance can be conceptualized as an attitude of unwillingness and rigidity, in which a person rejects his or her internal, moment-to-moment experience and works to change, control, or escape that experience or the environment in which that experience occurs (Hayes, Wilson, Gifford, Follete, & Strosahl, 1996; Hayes et al., 1999; Hayes, 2004). Experiential

avoidance is often a reaction to awareness of mental activities *without* the attitude of acceptance (Cardaciotto et al., 2008; Hayes, 2004).

Avoidant coping, detachment, and emotional suppression are components of experiential avoidance (Kashdan, Barrios, Forsyth, & Steger, 2005); these processes are comparable to unwillingness and non-acceptance. It has been demonstrated that experiential avoidance plays a critical role in the development and maintenance of psychological distress (Gross, 1998; Hayes et al., 2004). Tendencies to avoid or inhibit internal experiences (i.e., thoughts, feelings, sensations) are shown to increase the intensity and frequency of these unwanted experiences (Gold & Wegner, 1995; Gross, 1998). Rigid tendencies to avoid unpleasant or aversive experiences may lead to anxiety-related symptoms (Barlow, 2000), and experiential avoidance is shown to mediate the relationship between maladaptive emotional coping and anxiety-related distress (Kashdan et al., 2005). Experiential avoidance may also partially mediate the relationship between interpersonal trauma experiences and post-traumatic stress symptoms (Orcutt, Pickett, & Pope, 2005). Furthermore, numerous studies demonstrate associations between experiential avoidance and symptoms of anxiety, depression, and stress (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

Between these two constructs of mindfulness, acceptance seems more closely related to processes that result in negative health habits than does awareness. D'Antonio, Donnelly, Closson, and Scardapane (2007) suggest that alcohol and drinking behavior can be conceptualized as a type of experiential avoidance, because drinkers commonly report using alcohol to avoid aversive internal experiences. Forsyth, Parker, and Finlay (2003) report that substance abusers with higher awareness of anxious symptoms and low

acceptance or tolerance of autonomic arousal showed higher emotional avoidance and low appraisals of ability to handle or control these sensations. Based on these findings, D'Antonio et al. (2007) suggest that nonacceptance of distressing appraisals and sensations may mediate the relationship between psychological stress and hazardous alcohol use. Although findings linking stress, avoidance, and alcohol use are limited, other findings suggest that experiential avoidance can motivate the heavy use of alcohol as coping (Stewart, Zvolensky, & Eifert, 2002).

Some evidence demonstrates similar relationships between experiential avoidance and negative health habits. We have previously demonstrated that obesity is a disease associated with the negative health habits of physical inactivity and poor dietary habits (Fine et al., 2004; Geleijnes et al., 2002). Findings show that obese individuals tend to respond to stressors and to negative stress responses by overeating (Rydén et al., 2003), and habitually cope through avoidance or impulsive behaviors (i.e., binge eating, Byrne, Cooper, & Fairburn, 2003; Fassino et al., 2002). Some recent evidence suggests that teaching acceptance and mindfulness skills may assist obese individuals in managing uncomfortable psychological states more appropriately, especially those states which lead to overeating (Lillis, Hayes, Bunting, & Masuda, 2009). Increasing acceptance and mindfulness through an ACT treatment program was found to improve the ability of obese individuals to manage their weight better than wait-list controls, without implementing any dietary-focused interventions (Lillis et al., 2009). Furthermore, Lillis et al. (2009) measured the ability of obese participants to tolerate distress, invoking a stress response by asking participants to hold their breath indefinitely while being timed. The ACT treatment group demonstrated less psychological stress and distress related to

the breath-holding task than the wait-list controls group. These findings suggest a beneficial relationship between acceptance, mindfulness, stressors, and stress response, because these factors relate to problematic health behaviors. Similar ACT programs targeting experiential avoidance by increasing acceptance and mindfulness have shown higher cessation rates among smokers, reductions in body mass index among obese persons, and reductions in avoidance and cognitive inflexibility across both samples (Gifford et al., 2004; Gifford & Lillis, 2009).

Thus, awareness without acceptance is not only mindless, but also may have negative effects on psychological well-being (Cardaciotto et al., 2008). Heightened awareness of physiological and psychological stress responses without acceptance may negatively impact well being and may increase the risk of engaging in negative health habits as coping. Awareness and acceptance have varied effects when taken separately, and the ability to measure these constructs both separately and in combination will help grow the understanding of the interaction of these components of mindfulness.

Mindfulness Interaction with Stress Response

Supporting evidence of the effects of mindfulness on the relationship between stress and health habits is limited and preliminary; however, the available research suggests evidence of an interaction. First, mindfulness may alter the impact of stress on an individual by altering the amount or degree of physiological stress response an individual experiences from a stressor. In a randomized-controlled trial (RCT), Ditto, Eclache, and Goldman (2006) found that mindfulness meditation activated the parasympathetic nervous system (as measured by increased heart rate volatility linked with respiration) more strongly than progressive muscle relaxation, which suggests that

mindfulness attenuates the negative physiological stress response. In another RCT, Tang et al. (2007) found that mindfulness meditation was associated with decreased stress-related cortisol and increased immunofunctioning. The influence of mindfulness interventions on reductions in psychological and physiological symptoms of stress and improved immunofunction were replicated in RCTs sampling of cancer patients (Carlson, Labelle, Garland, Hutchins, & Birnie, 2009).

In sum, mindfulness appears to alter stress reactivity and increase parasympathetic functioning, and may therefore be a protective factor to health (Greeson, 2009). Although most of the available published studies are limited by small sample sizes, effect sizes were sufficient enough to suggest a causal relationship between mindfulness meditation and reduced maladaptive physiological stress responses. Speca, Carlson, Goodey, and Angen (2000) demonstrated similar effects in a randomized, wait-list controlled trial of MBSR using a larger sample of patients with assorted cancer diagnoses. These authors reported significant reductions across physical, behavioral, and psychological symptoms of stress, including gastrointenstinal and cardiopulminary symptoms, depression, irritability, and cognitive disorganization, as well as health habits related to stress (Carlson & Thompson, 2007; Speca et al., 2000).

In a recent RCT, Jain et al. (2007) compared mindfulness meditation (MM; which included components of the MBSR intervention) involving somatic relaxation (SR) with a waitlist control group, using a graduate and undergraduate student population. Both intervention groups demonstrated decreased psychological distress, as measured by a total average of scores on the Brief Symptom Inventory (BSI) and scores on the Positive States of Mind Scale (PSOM). Participants in the MM group were better able to reduce

rumination and distraction than the SR or control groups. The Jain et al. (2007) study enhanced the existing mindfulness literature by utilizing more stringent methodological procedures. However, this study failed to measure mindfulness directly. Thus, despite large effect sizes, this study provides no evidence that *increased mindfulness* was responsible for reductions in psychological distress. Although several of the instruments employed in this study measure constructs *related* to mindfulness, without the direct measurement of mindfulness as a separate construct from positive psychological states, spiritual experience, or psychological symptoms change may be attributed to any number of components included in the MM intervention (e.g., walking meditation, Hatha yoga, focused attention).

Non-randomized, controlled research proposes similar associations between increased mindfulness and decreased symptoms of stress. Carlson, Speca, Faris, and Patel (2007) noted overall decreases in physiological stress response, including decreased cortisol, improved immunofunctioning, and decreased systolic blood pressure, which was positively correlated with improved self-reported stress symptoms. A previous study reported similar reductions in symptoms of stress, which these authors suggest may be connected to improvements in HPA axis functioning (Carlson, Speca, Patel, & Goodey, 2004). Reductions in cortisol levels and improved immune functioning were also repeated in a non-randomized MBSR intervention (Witek-Janusek et al., 2008). Carmody and Baer (2008) report a relationship between increased mindfulness and decreased perceived stress for participants in a MBSR program. However, this research was neither randomized nor controlled and measured perceived frequency of stressors and not internal stress response. Overall, uncontrolled research may support findings

from more robust mindfulness-based interventions, but again, the generalizability of such findings is limited.

Grossman, Niemann, Schmidt, and Walach (2004) conducted a meta-analysis on the published empirical studies on MBSR. Of 64 studies published, only 20 were considered suitable for meta-analysis due to inadequate methodological information, inadequate statistical analyses, or inadequate assessment. Of these 20, only 10 studies were RCTs. Across the RCTs analyzed, Grossman et al. reported consistent and significantly strong effect sizes across various clinical and stressed non-clinical samples. These results were also consistent across controlled versus observational studies, and both controlled and observational studies reported a variety of mental and physical health benefits related to mindfulness. Despite relatively consistent outcomes, this meta-analysis also highlights the methodological deficits and the need for more robust assessment in mindfulness research.

In sum, the existing literature on mindfulness demonstrates that mindfulness-based interventions show efficacy in reducing various types of stress and distress. However, without directly and specifically measuring mindfulness, the effects of these interventions cannot be attributed to improved or increased mindfulness, nor can there be a understanding of the mechanisms by which mindfulness may create change. Very recent studies are beginning to address this issue. To date, several current studies have found that the relationship between meditation training or practice and well being is meditated by scores on mindfulness measures (Baer et al., 2008; Carmody & Baer, 2008; Carmody, Baer, Lykins, & Olendzki, 2009; Lau et al., 2006). These findings indicate that meditation influences mindfulness, which then influences well being. Although the

relationship between mindfulness, mindfulness meditation or interventions, and well-being needs to be further elaborated, these current studies provide the support missing from the previous literature regarding the actual measurement of mindfulness. Now that research is beginning to show links between mindfulness interventions, increased mindfulness, and improved well being, the next step is to determine the nature of the relationship between mindfulness (or mindlessness), prior to or without intervention, and health and well being. Understanding the naturally occurring effects of mindfulness will enhance the understanding of how mindfulness interventions can be applied effectively to improve mindfulness and therefore improve health.

Dispositional mindfulness refers to mindfulness as an inherent characteristic, or a naturally occurring level of mindfulness, which is not the result of meditation training or mindfulness intervention. A recent study measuring differences in dispositional mindfulness found that individuals with dispositional mindfulness showed improved prefrontal and corticolimbic functioning when confronted with stimuli designed to elicit negative affect (Creswell, Way, Eisenberg, & Lieberman, 2007). These findings show that individuals with greater dispositional mindfulness may have greater control over neuronally-related processes of primary and secondary appraisal, and may therefore have less reactivity to stressors in the form of reduced psychological stress response and reduced negative emotions associated with stress response.

Both EEG and behavioral studies suggest that mindfulness as an experience may be represented in a unique neurological pattern. Neurological evidence of improved attention and awareness and improved emotional regulation is related to mindfulness meditation (Greeson, 2008). Furthermore, mindfulness appears to be associated with

long-term structural and functional changes in the brain that are related to these psychological factors (Treadway & Lazar, 2009). These findings contribute to the overall understanding of mindfulness mechanisms of action by demonstrating that a general tendency to be aware and accepting of present moment experiences may be related to protective neurological functioning related to stress. This research is preliminary, but the positive relationship between dispositional mindfulness on neurological functioning is supported elsewhere (Davidson et al., 2003; Lazar et al., 2005).

Mindfulness Interventions in Healthcare

Mindfulness-based interventions have been applied to an extremely broad range of medical conditions, including cardiovascular disease, chronic pain, diabetes, cancer, and numerous other medical conditions (Baer, 2003; Greeson, 2008; Ludwig & Kabat-Zinn, 2009). Pain, for example, is common in primary care, and chronic pain affects roughly 20% of patients in a primary care practice (Gardner-Nix, 2009). Mindfulness interventions for pain focus awareness both of painful and of non-painful sensations, acceptance of pain as the current experience, and reductions in expectations and efforts to return to a pain-free experience (Gardner-Nix, 2009). Persons who are naturally prone to heightened stress responses to pain appear to prolong pain experiences. Dysfunctional coping strategies (e.g., catastrophizing, avoidance, and rumination) are demonstrated to mediate the experience of pain and stressful reactions to pain (Garland, 2007). By acting on these mediators, awareness and acceptance may reduce psychological and physiological pain stress responses.

The efficacy of mindfulness interventions in treating medical symptoms is reported in Baer's (2003) meta-analysis of mindfulness training in clinical interventions. Mindfulness training has been linked to significant improvements on a variety of other medical symptoms, which include but are not limited to improvements in subjective pain ratings in patients with chronic pain and fibromyalgia, and also in clearer skin among psoriasis patients (Baer et al., 2003; Grossman et al., 2004). Among non-clinical populations, significant effects on sub-clinical psychological symptoms, medical symptoms, and stress levels were demonstrated (Baer, 2003). In another meta-analysis, Greeson (2009) reports findings that suggest mindfulness training may reduce maladaptive health behaviors that are utilized to cope with stress and negative affect.

Preliminary data have linked mindfulness training directly to improved health habits, including improved capacity to stop smoking, to decreased maladaptive eating habits, and to decreased alcohol and illicit substance use (Greeson et al., 2009). Mindfulness training was demonstrated to affect smoking cessation through decreases in perceived stressors, decreased perceptions of problems in coping with stress, and reduced negative affect (Davis, Fleming, Bonus, & Baker, 2007). Mindfulness meditation training that emphasized acceptance, as opposed to avoidance, and to maladaptive thinking was successful in reducing alcohol use among participants incarcerated at a minimum-security prison (Bowen, Witkiewitz, Dillworth, & Marlatt, 2007). In one RCT, Telch, Agras, and Linehan (2001) found that mindfulness training within a DBT program significantly reduced binge eating habits in adult women. Unfortunately, this study did not measure mindfulness separate from the other DBT treatment components, so the effects of mindfulness on eating habits cannot be extrapolated. Again, the findings

reported in the previously mentioned studies are limited by a lack of randomized, controlled research and are further limited by small population size or highly specific participant samples. However, these preliminary findings continue to suggest that more robust research may support the relationship between mindfulness and health habits.

In order to fully understand the impact that dispositional mindfulness or mindfulness-based interventions may have on health and as a moderator of stress, a more comprehensive description of the background, current conceptualization, and measurement of mindfulness is needed. The following section elaborates on these aspects of mindfulness so that the construct can be properly contextualized in its relationship to health.

Mindfulness: Origins and Applications

The concept and practice of mindfulness has existed for more than 2,500 years as a fundamental aspect of Buddhist philosophy (Siegel et al., 2009). Mindfulness is a core teaching in Buddhism, often described as the "heart" of Buddhist meditation, and is the foundation for all branches of Buddhist meditative traditions (Kabat-Zinn, 2003; Thera, 1962). Although historically, mindfulness has been a relatively unfamiliar concept in Western culture and within the psychological community, current interest is quickly growing (Baer, 2003; Kabat-Zinn, 2000). Over the past 25 years, contemporary medicine has slowly accepted the efficacy of mindfulness trainings to augment treatment-as-usual interventions for many existing acute and chronic disorders, as well as the salutary effects related to mindfulness interventions (Bishop et al., 2004). Salmon, Santorelli, and Kabat-Zinn (1998) indicate that, as of 1997, more than 240 hospitals and clinics in the US and abroad offer Mindfulness-Based Stress Reduction (MBSR) programs, which are based on

intensive training in mindfulness meditation, present-focused awareness, and nonjudgmental observation and experience. As the use of mindfulness intervention spreads through the healthcare system, so does the need for accurate assessment of these interventions, as well as an improved understanding of mindfulness as a construct.

Factors that make up the construct of mindfulness are already found within existing psychological theories and practices. Brown and Ryan (2003) maintain that present-focused awareness, which is an essential construct of mindfulness, is also considered important within various personality and psychotherapeutic theories as it relates to self-regulation and enhanced well being. In psychodynamic and humanistic traditions, awareness is believed to facilitate the identification of needs, discord, and concern with life's ambiguities and impermanence. Gestalt theories emphasize the "here and now" and make an association between "relaxed attention" and the ability to form clear gestalts or perceptions, which is reticent of mindful awareness of the present experience (Brown & Ryan, 2003, p. 824; Siegel et al., 2009; Shapiro et al., 2006). Cognitive and behavioral theories are based on developing awareness of internal and external experiences, highlighting how undistorted awareness of the present experience allows for adaptive emotional, cognitive, and behavioral responses to the experience (Hayes et al., 1996; Shapiro et al., 2006).

Mindfulness principles and practices have been utilized by and integrated into a variety of Western psychological theories and treatment approaches. Didonna (2009) maintains that within the past two decades, both the construct and practice of mindfulness has emerged as a unifying factor and discussion point amongst all effective psychotherapies. Didonna (2009) argues that merging the practice of mindfulness into

existing psychotherapies is warranted and acceptable because mindfulness is a trans-theoretical construct. Factors of mindfulness are already present throughout many psychotherapeutic traditions.

However, despite the apparent links between mindfulness and current psychotherapeutic models, Didonna (2009) argues that significant gaps still exist between Eastern and Western therapeutic practice. Mindfulness and Western psychotherapy may conceive of mental health from different perspectives. For example, mindfulness practices are more process focused, and many Western psychotherapies are content focused. Still, both Eastern and Western approaches preserve the underlying tenet that health and well being is improved when suffering is reduced, and that any technique or intervention which reduces individual suffering is worth further investigation.

Current Conceptualization of Mindfulness

Brown and Ryan (2004) note that mindfulness is a "deceptively simple" concept. However, defining mindfulness in a universally acceptable and measurable way is increasingly complex. These authors suggest that the complexity in defining mindfulness is perhaps due to the linkage between mindfulness and consciousness, another ambiguous and difficult to define concept (Brown & Ryan, 2004; Brown, Ryan, & Creswell, 2007). In psychology, the term mindfulness is broadly applied and can be used to connote a philosophical concept, a meditative technique, a discipline or theoretical background, a psychological concept, or a set of behaviors or attitudes (Cardaciotto et al., 2008; Siegel et al., 2009). Bishop et al. (2004) argue that research over the past ten years has suffered from increasingly variable definitions of mindfulness. Refining the definition of mindfulness may therefore increase the precision and specificity of measurement and

prediction. The construct of mindfulness must be concretely defined so that it may be measured accurately, giving consideration to tradition and modern clinical application. Although mindfulness and acceptance-based interventions have efficacy without understanding the construct fully, enhancing the precise definition and accurate measurement of the constructs of mindfulness, will hopefully enhance the efficacy of these interventions.

Several factors of mindfulness are identified in the current literature, including acceptance of the present experience, a compassionate attitude personally and interpersonally, and the capacity to self-observe in a non-judgmental fashion. Underlying these components is the assumption that humans can pay attention to their present-moment experiences and that they possess the capacity to observe and understand the nature of these experiences (Didonna, 2009). Brown and Ryan (2003) argue that most individuals possess the capacity to attend and to be aware. It can therefore be assumed that this capacity, as well as the willingness to engage this capacity, differs between and within individuals. Thus, although all individuals may possess the capacity for mindfulness, individual mindfulness will vary, depending on the motivation and ability to engage that capacity.

Kabat-Zinn (2003) defines mindfulness as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (p. 145). Similarly, Siegel et al. (2009) concisely define mindfulness as "1) awareness, 2) of the present experience, 3) with acceptance" (p. 20). Considering mindfulness as a process, Cardaciotto et al. (2008) maintain that most definitions of mindfulness describe both a behavioral process, which

they refer to as ongoing or continual awareness, and an attitude or orientation of that process, which they refer to as acceptance. Cardaciotto et al. (2008) therefore define mindfulness as "the tendency to be highly aware of one's internal and external experiences in the context of an accepting, nonjudgmental stance toward those experiences" (p. 205). This definition is consistent with the definitions of bothKabat-Zinn (2003) and of Siegel et al. (2009). The following section illustrates how the definition of mindfulness by Cardaciotto et al. (2008), which possesses the two core factors of acceptance and awareness, describes mindfulness as a process with integrity to the traditional origins of mindfulness as a construct.

Awareness. The Pali word *sati* (or Sanskrit *smrti)* is translated to mean mindfulness broken down into three core factors: awareness, attention, and remembering (Siegel et al., 2009; Thera, 1962). In common Buddhist usage, *sati* refers primarily to the psychological constructs of awareness and attention, and refers less to the remembering of past events (Thera, 1962). The remembering aspect of *sati* is much like a reminder to practice awareness at every given moment; remembering to be aware *is* awareness (Siegel et al., 2009). With remembering aside, awareness and attention are the more critical elements, increases in which will lead to increases in mindfulness. This original idea is maintained currently. For example, Bishop et al. (2004) have described mindfulness as an attitude or mode through which awareness is practiced.

Cardaciotto et al. (2008) maintain that the construct of awareness better encompasses the intention of mindfulness than the construct of attention. In mindfulness meditation, for example, awareness of internal and external stimuli as they arise in the moment is practiced. The wandering mind is redirected back to the present experience,

but does not selectively attend to any one aspect of the present-moment. In contrast, concentration-based meditation focuses the attention on a specific point within the present moment: a mantra (e.g., a word or sound), an object or focal point, or a sensation. Mindfulness-based meditation practices are notably different from concentration-based meditation practices, such as transcendental meditation (TM) and Eight Point Program (EPP). These types of meditation differ in how attention should be directed or focused (Baer, 2003). Attention involves anchoring the mind to a concentration point, as opposed to broadly observing the present experience. Thus, Cardaciotto et al. argue that awareness more accurately captures the intention of the behavioral component of mindfulness because awareness does not restrict the present moment experience. Restriction of the present moment to a focused point of attention contradicts the acceptance aspect of mindfulness.

Additional definitions of mindfulness also highlight awareness as the behavioral aspect of mindfulness, defining mindfulness as coping with awareness (Teasdale et al., 2000), or the process of open awareness (Bishop et al., 2004). Focusing attention, or attending to a select, limited part of an experience appears to directly contradict the open and nonjudgmental quality also possessed in mindfulness. The conscious portion of mindfulness is intended to be openly aware and experiential, and not limited in observation or experience. Cardaciotto et al. (2008) reason that the construct of attention contradicts the behavioral component of mindfulness because,"One cannot be fully open and accepting of the full range of psychological experience if one is simultaneously attempting to direct attention in a particular way" (Cardaciotto et al., 2008, p. 205).

Acceptance. Acceptance is the second critical element of the process of mindfulness as translated from *sati*. The attitude of mindfulness is non-judgmental and non-evaluative. Acceptance is the framework through which awareness of internal and external stimuli is practiced in the moment (Baer, 2003; Hayes, 2004). Acceptance connotes a cognitive and attitudinal openness that allows for curiosity towards aversive stimuli, as opposed to desires to avoid, escape, or otherwise limit a present-moment experience (Didonna & Gonzalez, 2009). Acceptance is used interchangeably with nonjudgment and openness across mindfulness definitions in the current literature and appears to capture the essence of these other constructs (Bishop et al., 2004; Didonna & Gonzalez, 2009; Siegel et al., 2009). Awareness is essential to acceptance because acceptance sets the attitude for reality-based awareness of internal and external events (McCurry & Schmidt, 1994).

Hayes, Strosahl, and Wilson (1999) maintain that acceptance requires that a person drop the need to change his or her personal or interpersonal experience. Instead, accepting the reality of an experience allows a person to learn how to respond adaptively. Evaluating or judging particular experiences as aversive, benign, or positive ignores two key mindfulness positions: 1) that life is filled with aversive experiences, most of which cannot be avoided or changed, and 2) that all experiences are transient and impermanent. However, acceptance as a factor of mindfulness does not mean appreciating or resigning to an experience (Cardaciotto et al., 2008). From a stance of willingness and acceptance, an individual is then allowed to differentiate those aspects of an experience that can or cannot be changed. Acceptance further allows the individual to step back from reactive, automatic responding and, instead, respond to events in a thoughtful and realistic manner

(Didonna & Gonzalez, 2009). Overall, the Cardaciotto et al. (2008) inclusion of acceptance as a factor of mindfulness is consistent with current and historical conceptualizations of mindfulness.

Trait and state mindfulness. The study of trait versus state mindfulness examines individual differences in mindfulness processes. Trait mindfulness regards a more consistent, pervasive experience of mindfulness throughout an individual's daily experience. Trait mindfulness may be dispositional or may occur from sustained and persistent practice of mindfulness (Treadway & Lazar, 2009). State mindfulness is considered temporary and short term and may occur during meditation or mindfulness practice but does not sustain between practices (Brown & Cordon, 2009; Treadway & Lazar, 2009). In the available literature, state mindfulness is most often elicited during brief, experimental trials that induce elements of mindfulness to observe the effects on various mental health-related behaviors and affect (Brown & Cordon, 2009). Although the differentiation of trait versus state mindfulness makes the distinction of how long a mindful experience occurs, these categories do not rely on the origins of mindfulness (e.g., whether or not mindfulness results from meditation training, psychological intervention, or is innate and characterological to the individual).

This research refers to dispositional mindfulness, which considers mindfulness as an inherent, naturally occurring ability, and which is not the epiphenomenon of meditation training or clinical intervention (Brown, Ryan, & Creswell, 2007; Goldstein, 2002; Kabat-Zinn, 2003). Little research is dedicated to variations in dispositional mindfulness (Brown & Ryan, 2003), but as an inherent capacity, mindfulness should naturally vary in frequency, intensity, and duration (Brown et al., 2007). For example,

awareness can be dispositional and untrained in human beings and also naturally varies between individuals (Brown & Ryan, 2003; Cardaciotto et al., 2008; Shapiro et al., 2006). By examining dispositional mindfulness, the concern is not only with variations in individual awareness and acceptance, both between individuals and within an individual, but also with how these variations are significant to an individual's well being.

Measuring Mindfulness and Its Components

Mindfulness-based psychotherapy interventions are gaining in popularity, and growing research continues to demonstrate the efficacy of these interventions with various populations and with various disorders (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The assessment of mindfulness has received less attention, but interest in mindfulness measurement is continuing to grow. Several authors note the importance of accurate, psychometrically sound measures of mindfulness and the necessity of well-defined operational definitions for accurate assessment (Baer et al., 2006; Bishop et al., 2004; Brown & Ryan, 2004). Without psychometrically sound means of measurement, the efficacy of mindfulness cannot be determined, nor can the relationship between mindfulness, psychological and physical functioning, and well being be evaluated (Baer, Walsh, & Lykins, 2009). The available instruments for measuring mindfulness are divided between those that measure trait or dispositional mindfulness versus state mindfulness, although most of the available instruments are designed to capture trait mindfulness. The following provides an overview of the mindfulness measures available to date. Among these measures, the Toronto Mindfulness Scale (TMS) and the

Mindfulness Attention Awareness Scale (MAAS) capture the state of mindfulness, but the other measures described here are designed to capture the trait of mindfulness.

Instruments for Measuring Mindfulness

Freiburg Mindfulness Inventory (FMI). The Freiburg Mindfulness Inventory (FMI; Buchheld, Grossman, & Walach, 2001) is a 30-item self-report measure designed to assess nonjudgmental, present-moment awareness and openness to negative experience. Items are rated on a 4-point Likert scale (*rarely* to *almost always*). Items include, "I am open to the experience of the present moment," and "I remain present with sensations and feelings even when they are unpleasant or painful." Explanatory factor analysis revealed that the FMI distinguishes four factors of mindfulness. Authors, however, suggest a unidimensional interpretation expressed as a single total score due to several overlapping factor loadings. The FMI was originally normed on participants in mindfulness meditation retreats in Germany, and thus the authors note that the FMI should be valid only when utilized among populations with mindfulness meditation experience. Internal consistencies of .93 and .94 were reported among participants, measured from before to after the meditation retreat. A reduced version of the FMI was later developed by Walach, Buchheld, Buttenmüller, Kleinknecht, and Schmidt (2006) for populations without meditation experience. This 14-item short form demonstrated adequate to good internal consistency (Cronbach alpha = .86). The 14 items are considered to capture the "core of the mindfulness construct," and correlate with the long 30-item form at r = .95 (Walach et al., 2006, p. 1548).

Mindfulness Attention Awareness Scale (MAAS). The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item self-report measure that

assesses for individual differences in the frequency of present-focused attention and awareness over time. Items are rated on a 6-point Likert scale (*almost never* to *almost always*), where high scores indicate more mindfulness. Items include, "I find it difficult to stay focused on what's happening in the present," and "I do jobs or tasks automatically, without being aware of what I'm doing." Internal consistencies of .82 and .87 are reported, and explanatory factor analysis differentiated a unidimensional factor structure. Convergent and discriminant validity correlations were reported with the hypothesized constructs. Evidence demonstrated positive correlations with openness to experience, emotional intelligence, and well being, as well as negative correlations with rumination and social anxiety. Higher scores on the MAAS have been associated with a greater degree of mindfulness (Baer, Walsh, & Lykins, 2009). However, MacKillop and Anderson (2007) report that the MAAS does not differentiate between individuals with novice-level experience with meditation and individuals with no prior meditation experience, which suggest that experience with meditation is not necessarily indicative of increased mindfulness, as measured by the MAAS.

Kentucky Inventory of Mindfulness Skills (KIMS). The Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith, & Allen, 2004) is a 39-item self-report measure largely based on the DBT theory of mindfulness. The KIMS measures four elements of mindfulness as identified by Linehan (1993): observing, describing, acting with awareness, and accepting (or allowing) without judgment. Items are rated on a 5-point Likert scale (*never or very rarely true* to *always or almost always true*). Items include, "I intentionally stay aware of my feelings," and "When I do things, my mind wanders off and I'm easily distracted." Explanatory and confirmatory factor analyses

supported a clear multidimensional factor structure corresponding with the four elements of mindfulness listed above. Internal consistencies (alpha) for Observe, Describe, Act With Awareness, and Accept Without Judgment were .91, .84, .83, and .87, respectively. Convergent and discriminant validity was evidenced by expected correlations with similar constructs, including emotional intelligence, experiential avoidance, and personality factors such as openness, extraversion, and conscientiousness. The KIMS was the first psychometric measure of mindfulness to support a multidimensional factor structure.

Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). The Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007) is a 12-item self report instrument that measures a mindful approach to thoughts and feelings. Four components of mindfulness (attention, present focus, awareness, and acceptance) are assessed and synthesized into a unidimensional mindfulness score. Items are rated on a 4-point Likert scale (*rarely/not at all* to *almost always*). Items include, "I try to notice my thoughts without judging them," and "I am able to focus on the present moment." Internal consistencies of the overall scale are acceptable at .74 and .77, and confirmatory factor analysis supported one second-order latent factor (mindfulness) and the four first-order latent factors, detailed previously. CAMS-R mindfulness scores were strongly correlated with FMI and MAAS scores, all of which yield a combined total score. The CAMS-R was more strongly associated with the FMI, which also assess for acceptance as a domain of mindfulness.

Southampton Mindfulness Questionnaire (SMQ). The Southampton Mindfulness Questionnaire (SMQ; Chadwick, Hember, Symes, Peters, Kuipers, &

Dagnan, 2008) is a 16-item self-report inventory which assesses a mindful response to distressing thoughts and images. The SMQ reports a unidimensional mindfulness score, which is the synthesis of four related bipolar constructs (decentered awareness, attention without avoidance, acceptance, and letting go without rumination). Items are rated on a 7-point Likert scale (*strongly disagree* to *strongly agree*). All items begin, "Usually when I have distressing thoughts or images…", which is followed by statements such as, "I am able to just notice them without reacting," or "They take over my mind for quite a while afterwards." Good internal consistency was demonstrated, with Cronbach's alpha at .89. SMQ and MAAS scores correlated significantly ($r = .61$, $p < .001$), and correlations were consistent for both clinical and non-clinical populations.

The Five-Facet Mindfulness Questionnaire (FFMQ). The Five-Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) is a 39-item self- report measure which was developed to measure skills developed through the practice of mindfulness. The FFMQ was developed as a hybrid of the existing mindfulness inventories (i.e., MAAS, KIMS, CAMS, and SMQ) in an attempt to capture the most descriptive elements of each previous inventory. Once the psychometric soundness of these instruments was established, Baer et al. combined all items from previous scales into a single data set and performed an explanatory factor analysis, which resulted in a five-factor structure (nonreactivity, observing, acting with awareness, describing, and nonjudging). Items are rated on a 5-point Likert scale (*never or very rarely true* to *very often or always* true). Items which were retained include seven or eight of the highest loadings per each factor and the lowest loadings on all other factors. Items retained include, "I find it difficult to stay focused on what's happening in the

present," "When I do things, my mind wanders off and I'm easily distracted," and "When I have distressing thoughts or images I am able to just notice them without reacting." The word "usually" was removed from SMQ items, which were retained in the FFMQ. Each of the five facets demonstrated adequate to good internal consistency levels, with alphas ranging from .75 to .91. Confirmatory factor analysis found that the five facets are elements of a total mindfulness construct. Correlational analyses demonstrated that four of the five facets (describe, act with awareness, nonjudge, and nonreact) maintained consistent relationships with alternative constructs that reflect mindfulness (e.g., positively correlated with emotional intelligence and self-compassion, and negatively correlated with alexthymia and dissociation). The fifth facet, observe, was demonstrated to correlated with some alternative constructs in unexpected directions, and appeared to explain, in a greater degree, mindfulness in individuals who were already exposed to meditation.

The Toronto Mindfulness Scale (TMS). The Toronto Mindfulness Scale (TMS; Lau et al., 2006) was designed to measure the capacity to invoke a mindfulness state, based on the operational definition of mindfulness identified by Bishop et al. (2004). The TMS is designed for use immediately following mindfulness-based interventions and meditation trainings. The TMS is a 35-item self-report inventory that uses a 5-point Likert scale (*not at all* to *very much*). Items include, "I experienced myself as separate from my changing thoughts and feelings," and I was more concerned with being open to my experiences than controlling or changing them." High internal consistency was demonstrated, with an alpha coefficient of .95. Explanatory factor analysis suggested a bi-dimensional factor structure (*curiosity* and *decentering*), which was supported by

confirmatory factor analysis. Correlational analysis demonstrated expected relationships with alternative constructs (e.g., positive correlation between curiosity and internal awareness, and between decentering and openness to experience).

The Philadelphia Mindfulness Scale (PHLMS). The Philadelphia Mindfulness Scale (PHLMS; Cardaciotto et al., 2008) is a 20-item self-report measure designed to capture awareness and acceptance as distinct components of mindfulness. Items are rated on a 5-point Likert scale (*never* to *very often*). Items include, "I am aware of what thoughts are passing through my mind," and "I try to distract myself when I feel unpleasant emotions." Good internal consistency was demonstrated between scales, with awareness and acceptance alpha coefficients at .81 and .85, respectively. Exploratory factor analysis demonstrated a two-factor model (*awareness* and *acceptance*). Confirmatory factor analysis supports the two-factor model, and awareness and acceptance subscales did not correlate significantly (r = -.02, p > .05). Correlational analyses revealed that the PHLMS awareness subscale significantly correlated with awareness, attention, and reflection. The acceptance subscale was significantly, positively correlated with acceptance and willingness, and negatively correlated with rumination and thought suppression. Initial data suggests that the PHLMS consistently measures awareness and acceptance subscales independently.

Mindfulness Measures Summary

Baer et al. (2009) argue that no single method of psychometric assessment can completely capture the construct it is designed to measure. Different mindfulness inventories offer varying uses for clinical and research purposes. The PHLMS demonstrates several advantages over other measures. First, the PHLMS assesses for a

bi-dimensional conceptualization of mindfulness. The two factor structure allows for the constructs of awareness and acceptance to be assessed separately. Second, the PHLMS is based on a precise definition of mindfulness that is consistent throughout the mindfulness literature and with Buddhist psychology. Clark and Watson (1995) note that psychometrically sound measurement is established by clear and precise definition of the measured construct, which the PHLMS achieves. Some overlap is demonstrated with the KIMS. However, these measures appear to serve different psychometric purposes. The 20-item PHLMS can additionally be administered more quickly (roughly 5 minutes) than longer measures such as the FFMQ or the KIMS.

Cardaciotto et al. (2008) make it clear that the PHLMS does not attempt to capture the whole of the construct of mindfulness, but instead attempts to encapsulate and differentiate between two key components of mindfulness, awareness and acceptance. The PHLMS does not assess for aspects of loving-kindness and compassion, which accompany mindfulness, but are not encompassed within the construct of mindfulness. The PHLMS is unique and valuable because it captures differing factors within mindfulness, and clearly differentiates these factors from each other. The mechanisms of change that are active within mindfulness cannot be understood without the ability to measure these mechanisms differentially, separate from each other, as well as measuring change within mindfulness as a whole construct. The PHLMS provides for both of these processes.

In order to examine the moderating effects of mindfulness on stress and health, it is important to ensure that mindfulness is being measured clearly, with consideration of its original and modern conceptualization. Measuring mindfulness with a total score can

obscure the different dimensions of mindfulness, including how these dimensions are related separately to psychological constructs (Cardaciotto et al., 2008). It is therefore important that measures of mindfulness can independently assess for various constructs of mindfulness. To support the PHLMS as a measure of this capacity, confirmatory factor analysis will be conducted to determine the reliability of the established bi-dimensional factor structure when administered among a primary care population. Confirming the ability of the PHLMS to assess multiple components of mindfulness is useful for future mindfulness research. These analyses will contribute to the psychometric research on the PHLMS, and will also establish the reliability of this measure's bi-dimensional factor structure for future, more detailed mindfulness research with primary care populations.

Conclusion

Several authors regard mindfulness as an intrinsic human ability (Brown, Ryan, & Creswell, 2007; Goldstein, 2002; Kabat-Zinn, 2003). Until recently, research on mindfulness has trended toward supplementing standard psychotherapies with mindfulness techniques. Now, trends in research and practice appear to be shifting toward the development of mindfulness-based psychotherapies, in which the discipline of mindfulness is essential and foundational, not facilitative or supplemental (Cardaciotto et al., 2008). As a discipline or theory, mindfulness is based on inherent human capabilities and processes which affect psychological and physical well being, and which may vary naturally among individuals.

If mindfulness is more than a technique, then it is necessary to argue for the need to examine further the *experience* of mindfulness, and not only the application of

mindfulness. The effects of the *experience* of mindfulness on health and well being may differ in significant ways from the effects of mindfulness *techniques* on health. Furthermore, aspects of the experience of mindfulness may contribute differently to the effects of mindfulness on well being. A better understanding about how awareness and acceptance may alter a person's ability to manage and cope with stress may help physicians and health care providers identify individuals who are more vulnerable to poor coping and poor stress management. Understanding and improving assessment for these characteristics may help streamline the delivery of additional healthcare resources and energies toward individuals who are at higher risk, which may improve prevention efforts and the ability to maintain good health.

Chapter 3: Hypotheses

Psychometric Hypothesis

1. Confirmatory factor analysis will uphold the established two-factor model of the PHLMS when administered among a primary care population.

Mindfulness Hypotheses

2. Mindfulness will moderate the effects between stress response and negative health habits.
3. The interaction between acceptance and stress response will more strongly predict negative health habits than will the interaction between awareness and stress response.

Justification for Hypotheses

1. **Psychometric Hypothesis.** Measuring mindfulness with a total score can obscure the different dimensions of mindfulness and the way in which these dimensions relate differently to psychological constructs (Cardaciotto et al., 2008). It is therefore important that measures of mindfulness can independently assess the varying dimensions of mindfulness. The factor structure of the PHLMS has shown to be reliable and internally consistent among university samples, an outpatient psychiatric sample, and an inpatient psychiatric hospital (Cardaciotto et al., 2008). This researcher hypothesizes that the two-factor model of the PHLMS will continue to be reliable and consistent among a primary care population.
2. **Mindfulness Hypothesis.** Mindfulness may alter the relationship between stress and negative health habits by altering appraisals of stress and reactions to stress

that trigger maladaptive coping (Kabat-Zinn, 1990; 2003). Awareness of the present moment with acceptance may slow down the process of appraisal and reaction, allowing for more time to make better, more realistic decisions about how to respond adaptively to stressors. Although a model has been proposed which details the general impact of mindfulness on stress appraisal (Kabat-Zinn, 1990), no research to date has specifically established mindfulness as a moderator of stress. Furthermore, limited evidence illustrates the nature of the relationship between mindfulness, stress, and health habits, particularly with a focus on primary care populations.

3. **Mindfulness Hypothesis.** As a factor of mindfulness, acceptance may be more closely related than awareness is to processes that result in negative health habits. Variability in the impact of awareness on health may be attributable to the relationship between awareness and an attitude of acceptance (Cardaciotto et al., 2008). Some evidence demonstrates the salutary effects of increased acceptance on health habits in people with obesity (Lillis et al., 2009), with those who smoke tobacco (Gifford et al., 2004), and with those who engage in unmoderated alcohol use (D'Antonio et al., 2007). Based on these results, it is expected that acceptance will play a more critical role in the relationship with health habits, even though both awareness and acceptance are essential components of mindfulness.

Chapter 4: Methods

Overview

The overarching aim of this study was to better understand the relationships between health habits, stress, and mindfulness. To do this, data were collected from a primary care medical practice in New Jersey. These data were used to explore natural variations in mindfulness within a general medical population, including how these variations relate to health.

Design

A psychometric development study was conducted to provide information regarding the PHLMS and regarding moderating interactions between factors of mindfulness, negative health habits, and stress moderators. Using confirmatory factor analyses (CFA), group within-subjects design, the psychometric properties of the PHLMS were explored. Regression analyses then determined the interaction between mindfulness and stress as it affects health habits.

Participants

The participants in this study included 198 patients (49% male, 51% female) from a primary care health center in New Jersey who attended appointments in the spring of 2011. Participants' ages ranged from 18 to 89 years (see Table B1 for percentages of sample by age categories). The majority of the sample ranged from middle-aged to older Caucasian adults who were fairly well educated (at least some college). Detailed demographics of the participants, including gender, race/ethnicity, level of education, level of income, and experience with meditation, are reported in Table B1.

Inclusion/Exclusion Criteria

All patients who met the following criteria were included in the original sample: 1) 18 years of age or older, b) established patient of the medical office, and c) fluency in English of at least a sixth grade reading level. Participants were voluntarily self-excluded from sampling for the following reasons: 1) difficulty reading the testing materials, 2) refusal to complete testing materials, 3) time restraints, or 4) illness or injury which prevented the patient from completing testing materials. Participant data were excluded if more than 10% of questions were not answered or left blank.

Measures

Common Measures, Better Outcomes (COMBO; Fernald et al., 2008). The COMBO is a 21-item self-report questionnaire for adults, which combines items from several health behavior measures into a collective measure of four primary health risk behaviors associated with premature mortality: smoking, alcohol use, physical activity, and eating patterns. Measures which contributed items to the COMBO were selected, based on five factors: 1) sensitivity to change, 2) briefness, 3) general applicability, 4) connectedness with public health goals, and 5) bilingual validation in both English and Spanish. The COMBO was administered to adult and adolescent samples from 75 primary care practices from August 2005 to January 2007. The adult data set comprised 5,358 patients from 67 primary care practices. Patient sampling and data collection methods varied between differing projects within the Prescription for Health project that contributed to the COMBO development. Each risk behavior factor can be assessed individually, or a total risk-behavior score can be calculated by summing three risk

behaviors (physical activity, tobacco use, and eating patterns), with scores ranging from 0-3.

Calgary Symptoms of Stress Inventory (C-SOSI; Carlson & Thomas, 2007). The original Symptoms of Stress Inventory (SOSI; Leckie & Thompson, 1979) was developed through a Stress Management Project at the University of Washington to rate , numerically, aspects of the stress response, including physiological, behavioral, and cognitive factors. The SOSI, a 95-item self-report measure composed of 10 subscales, provides a total stress score. Items are rated on a 5-point Likert (*never* to *frequently*). The SOSI has been frequently used to measure stress in conjunction with MBSR interventions, because it aligns with that model's conceptualization of stress (Carlson & Thomas, 2007; Kabat-Zinn, 1990). However, the SOSI is limited by lengthiness and limited psychometric reliability and validity data.

For these reasons, Carlson and Thomas (2007) sought to modify the SOSI with fewer items, improved reliability and validity, and a strong factor structure. The C-SOSI is a 56-item self-report inventory which retains instructions and items from the original SOSI and measures physiological and cognitive responses to stress. Items are rated on a 5-point Likert scale ranging from *never* to *very frequently*. Items include statements such as "Stress is often accompanied by a variety of emotions. During the last week, have you felt: (alone and sad; you suffer from severe nervous exhaustion)?" and "Have you noticed the following symptoms when not exercising: (thumping of your heart; rapid breathing)?" Explanatory factor analysis identified eight factors remaining from the original ten (depression, anger, muscle tension, cardiopulmonary arousal, sympathetic arousal, neurological/GI, cognitive distortion, and upper respiratory symptoms). Strong internal

consistency was demonstrated (alpha = .95; subscales = .80 – .92). Intercorrelation between subscales was moderate, with the highest correlations between each subscale and the total C-SOSI score (r = .66 – .78). Good convergent and discriminant validity is reported.

Philadelphia Mindfulness Scale (PHLMS; Cardaciotto et al., 2008). The PHLMS is a 20-item self-report measure designed to capture awareness and acceptance as distinct components of mindfulness. Items are rated on a 5-point Likert scale (*never* to *very often*). Items include, "I am aware of what thoughts are passing through my mind," and "I try to distract myself when I feel unpleasant emotions." Good internal consistency was demonstrated between scales, with awareness and acceptance alpha coefficients at .81 and .85, respectively. Explanatory factor analysis demonstrated a two-factor model (*awareness* and *acceptance*). Confirmatory factor analysis supports the two-factor model, and awareness and acceptance subscales did not correlated significantly (r = -.02, p > .05). Correlation analyses revealed that the PHLMS awareness subscale significantly correlated with awareness, attention, and reflection. The acceptance subscale was significantly, positively correlated with acceptance and willingness, and negatively correlated with rumination and thought suppression. Initial data suggest that the PHLMS consistently measures awareness and acceptance subscales independently (Cardaciotto et al., 2008).

Procedure

All patients who attended medical appointments during eight data collection days in the spring of 2011 were asked to fill out anonymous questionnaire packets. The study coordinator remained in the medical office to administer questionnaire packages, answer

participant questions, and collect questionnaires. Participation was voluntary; participants were required to complete the questionnaires within the normal time of their visit. Participants were not allowed to take questionnaires home. Packets included descriptive information regarding the nature of the research being conducted and numeric participant identifiers, with no other identifying information.

Analyses were run through the following statistical programs: M*plus*, R, and Statistical Package for the Social Sciences (SPSS). Confirmatory factor analysis of the PHLMS was conducted using M*plus* and R, followed by the regression of negative health habits onto stress, mindfulness, and the interaction between stress and mindfulness, using SPSS. The construct of mindfulness was then deconstructed, and negative health habits were regressed separately onto awareness, acceptance, the interaction between awareness and stress response, and the interaction between acceptance and stress response.

Confirmatory factor analysis (CFA). CFA was conducted to test the applicability of the two-factor model of the PHLMS to this research data because the factor structure had not yet been confirmed on a general medical population. It was particularly important to confirm the two-factor model because Awareness and Acceptance are hypothesized to have meaningfully distinct effects on negative health habits by moderating stress response. Typically, three statistical analyses are employed in CFA (Hu & Bentler, 1999). These include chi-square analysis as measure of fit, Comparative Fit Index (CFI) for relative fit adjusted for sample size, and root mean square error of approximation (RMSEA) as a non-centrality parameter. Explanatory factor analysis originally demonstrated that the two-factor model (Awareness and

Acceptance) were not significantly correlated, and factor loadings were significant at the $p < .001$ level (Cardaciotto et al., 2008).

Multiple regression. It was hypothesized that the effect of a continuous independent variable (i.e., stress response) on a continuous dependent variable (i.e., health habits) will vary at the level a third, moderating variable (i.e., mindfulness). Regression analyses, performed in SPSS Version 19 were conducted to determine the relationships between the criterion or dependent variable negative health habits, the predictor variable stress response, and the hypothesized moderator variable mindfulness. Second, the dependent variable was regressed on the moderating variable. Third, the effect of the moderator on the relationship between the independent and dependent variable was investigated. In their seminal publication on mediating and moderating variables, Baron and Kenny (1986) note that the appropriate analysis for this relationship is a 2 X 2 ANOVA, and that moderation is expressed by an interaction effect.

Procedures for Maintaining Confidentiality

The study used anonymous, unidentifiable survey data and was therefore expected to cause minimal risk to participants. Participant questionnaires were assigned identification numbers and had no connection to any personal health information; participation was limited to the privacy of the healthcare office. Risk to confidentiality was limited because no identifying information was available. Risk was further minimized because no interventions or treatments were implemented.

Consent to participate was subsumed under the medical practice's standard confidentiality agreement, which is compliant with HIPPA and JACHO requirements. Confidentiality will be ensured through the following procedures: 1) patient identifying

information will not be collected, and 2) data will be collected only within the privacy of the patient's primary care facility.

Chapter 5: Results

Hypothesis 1: Psychometric Hypothesis

It was hypothesized that the two-factor model of the PHLMS would continue to be reliable and consistent among a primary care population. To test this hypothesis, confirmatory factor analyses of numerical approximation, performed in M*plus* Version 6 and R 2.13, were conducted to evaluate and compare goodness of fit (see Figure A1). The analyses were duplicated using two different electronic programs to cross-check and validate the results.

Goodness of fit. Based on the original assumptions of Cardaciotto et al. (2008), relative χ^2 less than 3.00 were recommended to indicate good fit. Three fit indexes were examined: the Comparative Fit Index (CFI) as a population-based relative fit index, the Tucker-Lewis Index (TLI) as a sample-based relative fit index, and the Root Mean Square Error of Approximation (RMSEA) as a noncentrality parameter, or population-based absolute fit index. Values of .90 or higher for CFI (Bentler & Bonett, 1980) and TLI (Tucker & Lewis, 1973) typically specify acceptable fit. RMSEA (Brown & Cudeck, 1993) values that are closer to zero indicate a healthier model (Sun, 2005), and values of .05 or less are considered to indicate close fit.

Fit indexes marginally supported a two factor model: $\chi^2/df = 2.26$, CFI = .871, TLI = .851, RMSEA = .08; these results are additionally reported in Table B3. In comparison, all of the fit indexes fell slightly outside of the standards of fit adopted by Cardaciotto et al. (2008). Neither the CFI nor the TLI were found to be to be above .90 standard for acceptable fit (Bentler & Bonett, 1980; Tucker & Lewis, 1973), and did not

find RMSEA to be less than the .05 standard for a stronger model (Brown & Cudeck, 1993).

There is a tremendous amount of disagreement in the structural equation modeling literature about what constitutes a good fitting model. Given this disagreement, this researches' relative chi-square suggests a reasonable fit to the data. In an attempt to address the discrepancies between this research's findings and the original Cardaciotto et al. (2008) results, Lagrange multiplier (LM) tests were executed to test modification indexes. These analyses were employed to identify those free relationships between the variables that should be constrained to achieve a better model fit. The data suggest that if the parameters are free, the data will numerically fit the model better. Table B4 indicates the best suggestions for free relationships. Following the LM tests, two items that originally loaded on the Awareness factor (i.e., items Q11 and Q15) were found to load on the Acceptance factor. For these items, Q11 reads "When someone asks how I am feeling, I can identify my emotions easily," and Q15 reads "I notice changes inside my body, like my heart beating faster or my muscles getting tense." By allowing the item's errors to correlate, the relationships between Q11 and the factor Acceptance, and Q15 and Acceptance, equal zero. When that parameter is free, allowing these relationships to occur, the data suggest that Q11 and Q15 may load on the latent variable Acceptance.

The results of these modifications indexes potentially threaten the construct validity of the PHLMS. From a purely predictive standpoint, items that load on both latent variables of Awareness and Acceptance are non-parsimonious, because these items are not distinct and are therefore redundant. The underlying theory of mindfulness upon which the PHLMS is based suggests that these factors should remain separate, and that

items Q11 and Q15 should remain on factor Awareness. The face validity of these items suggests a clear separation between these items (i.e., Q11 and Q15) and the alternative factor (i.e., Acceptance). However, from the numeric standpoint of this research's results, this is not the case. If the existing Cardaciotto et al. (2008) model were modified, based purely on numerical and predictive relationships, and not theoretical relationships, these items should be modified. In examining the LM recommendations from a psychological point of view, reorganizing these items onto the Acceptance factor does not align with the underlying theory for designing the PHLMS, despite the support of the numerical data.

These analyses attempted to replicate the exact model established by Cardaciotto et al. (2008). Analyses in this research marginally uphold the two-factor model of the PHLMS. It is not surprising that the model using this data does not fit the model due to validity shrinkage. First, the differences in this researcher's findings may be attributed to sampling differences, including historical differences (i.e., differences in time), as well as differences in sample composition. The original Cardaciotto et al. (2008) normative sample was largely homogeneous (i.e., predominately Caucasian undergraduate university students), whereas our sample was more heterogeneous across certain demographics (e.g., age, education), but more homogeneous in other ways (e.g., race/ethnicity). Additionally, sensitivity to sample size is a significant drawback to the chi-square statistic (Sue, 2005), and it is possible that the sample size in this research was large enough to magnify slight differences between the two populations sampled. This is however an unlikely difference between our samples given the closeness in sample size between our population and the original normative sample (N = 280).

Factor structure. Factor loadings of awareness and acceptance items were fairly robust, with all loadings significant at the $p < .0001$ level. The two factors were allowed to correlate with each other, and moderate correlation was shown among Awareness and Acceptance ($r = –.376$, $p < .001$). These results were directionally consistent with the Cardaciotto et al. (2008) findings. Displayed in Table B5, z-scores for the standardized loadings on the factor Awareness ranged from .37-.83, and the standardized loadings on factor Acceptance ranged from .57-.86. Awareness items Q13 and Q17, and Acceptance items Q10, Q12, and Q16, ranged from .76-.86 and were shown to dominate their respective factors. Higher standardized loadings on the Acceptance factor indicated higher reliability for that factor. Not surprisingly, the low inter-item correlations on the Awareness factor resulted in lower coefficient alphas and lower reliability estimates when regression analyses were conducted.

Hypothesis 2 and 3: Mindfulness Hypotheses

Regression. Of the two mindfulness hypotheses, it was hypothesized initially that overall mindfulness (i.e., the combination of Awareness and Acceptance) would moderate the effects between stress response and negative health habits. An additional hypothesis suggested that the interaction between acceptance and stress response would more strongly predict negative health habits than the interaction between awareness and stress response.

Regression analyses, performed in SPSS Version 19 were conducted to determine the relationships between the criterion variable negative health habits, the predictor variable stress response, and the hypothesized moderator variable mindfulness. Table B1 presents the descriptive statistics of the sample data. Most notably, more than half of the

sample (62.6%) reported two or more negative health habits, which is consistent with the original COMBO data (69.2%; Fernald et al., 2008). Poor dietary habits, or less than recommended fruits and vegetable intake, were by far the most commonly reported negative health habits, affecting nearly the entire sample (91.4%). Physical inactivity was the second most common, reported by roughly half (56.1%) of the sample. Tables B1 and B2 summarize the descriptive statistics and results.

Multiple regression analyses are commonly employed to explain the relationships between one or multiple predictor variables and one dependent variable. Valid regression models rely on the assumptions of linearity, normality, and non-multicollinearity. To determine whether or not multicollinearity was an issue within this data, correlation matrixes across all variables were analyzed. Correlation coefficients of .90 or higher were considered to threaten multicollinearity (Tabachnick & Fidell, 2001). The highest correlation coefficient in this study was .832, indicating significant correlation between Depression and Total Stress at the .01 level. These results demonstrate that multicollinearity should not be a significant problem for this study and multiple regression analysis can be used.

Before analyses of variance were conducted, the abilities of stress and mindfulness were initially tested to independently predict negative health habits. First, the predictor Stress (total stress score) was regressed onto the criterion variable Negative Health Habits (the total of negative health habits endorsed). Surprisingly, Stress was not a statistically significant predictor of Negative Health Habits ($\beta = .132$, $p = 0.065$, $p < .001$). The regression was repeated with predictor variable Mindfulness (total mindfulness score of awareness plus acceptance; $\beta = -.127$, $p = 0.074$). Again, this

predictor approached significance but did not achieve statistical significance. Regressions were then conducted using both factors of Mindfulness, first with predictor Awareness (β = -.058, p = 0.415), then with predictor Acceptance (β = -.087, p = 0.225). Neither of the factors of mindfulness significantly predicted Negative Health Habits.

Multiple linear regression analyses were then conducted to test the moderator hypothesis of Mindfulness. Predictors Stress and Mindfulness were regressed on Negative Health Habits; neither achieved significance. Multiple regressions were repeated again with predictors of Stress, Awareness, and Acceptance, which again did not achieve significance.

Correlations. As reported in Table B6, the following biserial correlations are notable. First, Awareness and Acceptance were negatively correlated and shared between 12-14% of the variance (r = -.340, p > .05; z = -.376) between the two factors. In finding that awareness negatively correlated with acceptance, these results differ from the Cardaciotto et al. (2008) report, which found that awareness and acceptance did not correlate significantly (r = -.02, p >.05). However, the intercorrelation found between Awareness and Acceptance was not significant enough to threaten the standards of multicollinearity adopted for this study (established above).

Given the shared variability between the Awareness and Acceptance factors, regression analyses were conducted, controlling for each respective variable in predicting Stress. Partial correlations demonstrated that Awareness and Acceptance showed inverse correlations with Stress, with Awareness being positively correlated with Stress (p = .146), and Acceptance negatively correlated with Stress (p = -.521). Both Awareness (β = .307) and Acceptance (β = -.571) were predictive of the presence or absence of

overall stress, with Acceptance more strongly predictive of Stress than Awareness. Similar relationships were demonstrated in the correlations between Awareness, Acceptance, and the physiological and psychological subfactors of Stress. In particular, Acceptance showed significant negative correlations across all stress subfactors. Acceptance was most strongly, inversely correlated with Depression (r =-.573), Anger (r =-.483), Muscle Tension (r =-.491), and Cognitive Distortion (r =-.476). Awareness was positively correlated with all stress subfactors excluding Cognitive Distortion, and all correlations were less significant than those between Acceptance and stress subfactors. The low inter-item correlations on the Awareness factor found during CFA analyses impact the lower coefficient alphas reported here.

Mindfulness scores, which are the aggregate of Awareness and Acceptance, were also negatively correlated with most stress subscales, excluding Upper Respiratory Symptoms, which were not correlated, and Muscle Tension and Neuro/GI Symptoms, which were correlated only at the .05 level. Mindfulness therefore appeared less strongly related to total stress, and was more strongly related to the psychological symptoms of stress than the physiological stress symptoms. Furthermore, Mindfulness was marginally, negatively correlated with Stress Total (r =-.278) and weakly correlated with Negative Health Habits at the .05 level (r =-.127). Neither Awareness nor Acceptance correlated with Negative Health Habits. Acceptance, which was most strongly correlated with Stress over total Mindfulness and Awareness, did not correlate with Negative Health Habits. Stress Total was significantly but weakly correlated with Negative Health Habits (r =.132) at the .05 level. Our results found that Stress accounted for only 1.7% of the variance in predicting negative health habits.

Chapter 6: Discussion

The overarching goal of this study was to better understand relationships between health habits, stress, and mindfulness. In doing so, we explored natural variations in mindfulness within a primary care medical population, including how these variations related to stress and negative health habits. By examining the occurrence and variability of mindfulness, we hoped to further the growing body of literature on mindfulness-based assessment. We also intended to describe how dispositional mindfulness might moderate the impact of stress on behaviors that affect heath problems in primary care populations. By exploring these relationships, the aim was to provide suggestions for future directions regarding the use of mindfulness assessment and interventions to enhance prevention and treatment services in primary care.

First, we hypothesized that the two-factor model of the PHLMS would continue to be reliable and consistent among a primary care population. To test this hypothesis, we attempted to replicate the exact model established by Cardaciotto et al. in 2008. Our analyses marginally upheld the two-factor model of the PHLMS. It is not surprising that the original model does not fit as well with our data when we consider validity shrinkage. First, the differences in our findings may be attributed to sampling differences, including historical differences as well as differences in sample composition. The original Cardaciotto et al. (2008) normative sample was largely homogeneous (i.e., predominately Caucasian undergraduate students), whereas our sample was more heterogeneous than theirs across certain demographics (i.e., age, education, economic status), yet more homogeneous than their sample in other ways (i.e., race/ethnicity). Additionally, sensitivity to sample size is a significant drawback to the chi-square statistic (Sue, 2005),

and it is possible that our sample size was large enough to magnify slight differences between the two populations sampled. This is, however, an unlikely difference between our samples given the closeness in sample size between our population and the original normative sample (N = 280; Cardaciotto et al., 2008).

Based purely on the numeric and predictive findings of our analyses, we could offer suggested adjustments to the established PHLMS model. At the same time, however, we find the face validity of the PHLMS items to be highly consistent with theoretical conceptualizations of awareness and acceptance used in the original model. In other words, we observe the underlying theory supporting the two-factor model to be sound. Because the equation modeling literature continues to be discrepant in establishing the criteria for a good fitting model, our analyses suggest a reasonable fit of the PHLMS model to the data which are based on how well these factors fit the underlying theory. Thus, we find that the two-factor model of the PHLMS demonstrates acceptable reliability and consistency when administered to a primary care population.

Findings related to our psychometric hypothesis play a role in the continuing growth of the PHLMS as a measure of mindfulness. First, the results of this study provide further information regarding the psychometrics of this measure. The PHLMS allows for the factors of mindfulness to be measured separately or in combination. Measuring awareness and acceptance separately allows us to question whether or not certain factors of mindfulness are more important than others in certain contexts. In the example of our findings, acceptance was found to play a stronger role in the relationship between mindfulness and stress than awareness in that relationship. Despite the differences in these factors, we also found that awareness and acceptance were

marginally correlated. This suggests that an individual cannot be accepting of internal and external events without awareness of those events. Nonjudgmental acceptance is a fundamental construct in current mindfulness approaches (Baer, 2003; Hayes et al., 1999; Hayes, 2004). Still, the importance of the inverse relationship between acceptance and stress demonstrated in our data was upheld when controlling awareness. The PHLMS is a unique and useful tool for measuring Acceptance because most other available mindfulness measures lack the ability to measure mindful acceptance, separate from other factors.

Our results uphold the significant role of acceptance in positive cognitive and mood states. In general, higher levels of acceptance were related to lower levels of stress. Participants with greater nonjudgmental acceptance reported significantly less depression, less anger, and less distorted thinking than participants with lesser acceptance. Our findings also suggest that acceptance is important in the relationship between physiological markers of stress. To elaborate, acceptance was significantly, negatively correlated with sympathetic arousal, cardiopulmonary arousal, muscle tension, neuro/gastrointestinal symptoms, and upper respiratory symptoms. We have already discussed how variability in the impact of awareness on health may be attributable to the relationship between awareness and an attitude of acceptance. However, our results demonstrate that increased acceptance was associated with decreased stress, and increased awareness was associated with increased stress.

The importance of acceptance which is demonstrated by these findings supports the existing literature on acceptance-based mindfulness approaches. Without acceptance, awareness of psychological events, particularly stressful and arousing thoughts, emotions,

and sensations, can give rise to experiential avoidance (Hayes et al., 1999). Experiential avoidance can play a critical role in the development and maintenance of psychological distress (Gross, 1998; Hayes et al., 2004). Tendencies to avoid or inhibit internal experiences (i.e., thoughts, feelings, sensations) are shown to increase the intensity and frequency of these unwanted experiences (Gold & Wegner, 1995; Gross, 1998). Hayes (2004) describes a cyclical and pathological relationship between experiential avoidance, stress, and rejection, in which increased evaluation and psychological rigidity feed into experiential avoidance, which then feeds into more stress, arousal, and then more evaluation and avoidance.

Some evidence demonstrates similar relationships between avoidant coping and negative health habits, particularly with physical inactivity and poor dietary habits (Byrne, Cooper, & Fairburn, 2003; Fassino et al., 2002). In ACT (Hayes et al., 1999; Hayes, 2004), acceptance is linked with cognitive defusion to lessen the impact or importance of mental activities and to increase cognitive flexibility, with the ultimate goal of helping patient to move in a valued, life-enhancing direction. Even though we did not find a relationship between acceptance or mindfulness and negative health habits, acceptance-based interventions may impact other factors, such as avoidance coping or cognitive flexibility, which then impact negative health habits. Further investigation into acceptance-based interventions is required to better understand the impact of acceptance on health behaviors.

Through this research, we hoped to identify mindfulness as a novel factor in the relationship between stress and negative health habits. Finding a moderating factor between stress and negative health habits relied on the assumption that stress and

negative health habits are strongly related. Instead, we unexpectedly found a significant, but extremely weak, relationship between stress and negative health habits. These findings contradict general assumptions about the relationship between stress and health behaviors. Previously, we reported on the demonstrated link between stress and excessive drinking (Erblich & Earleywine, 2003), smoking (Cohen et al., 2003), physical inactivity, and poor dietary habits (Faith & Thompson, 2003). Both laboratory and naturalistic studies suggest that stress can trigger poor dietary habits and that the urges to smoke increase in relation to the experience of stress (Niaura, Shadel, Britt, & Abrams, 2002; Oliver, Wardle, & Gibson, 2000). However, we found that stress predicted less than 2% of the variance in negative health habits. Our findings suggest that negative health habits are not always triggered by stress or are necessarily even related to stress.

Of course, positive and negative health habits are also related to a variety of lifestyle, cultural, and socioeconomic factors that may be unrelated to stress. For example, physical inactivity and dietary habits are impacted by variables unrelated to stress, including family, cultural, and personal beliefs, as well as income, current diet, and emotional status (Withall, Jago, & Cross, 2009). Furthermore, coping responses to stress can include avoidance or escape behaviors, which may indirectly impact health, but which, in themselves, are not negative health habits (Dantzer, 2000). As the result our findings, we do not suggest that the previously established link between stress and negative health habits is invalid or mistaken. Rather, our findings suggests that when primary care patients report problems with negative health habits, factors other than stress may be contributing to the initiation and maintenance of those risky health behaviors.

Although we did not find that mindfulness moderates the relationship between stress and health behaviors, we suggest further investigation into of the relationships between mindfulness, particularly mindful or nonjudgmental acceptance, and stress, as well as relationships between stress and health habits. Our research demonstrated a clear relationship between acceptance and stress. These findings are relevant to individuals within the primary care population who are vulnerable to the negative impact of stress, particularly individuals with chronic illnesses managed by primary care physicians. Further investigation into the usefulness of acceptance-based interventions with chronically stressed, primary care populations is warranted.

Limitations of the Current Study

Several limitations of the current study are identified. First, the generalization of our findings to general medical populations and even to general primary care medical populations is limited by the distinct characteristics of our sample. As previously discussed, our sample population is homogeneous across age and race/ethnicity characteristics. Trends in one primary care practice are not universally applicable to all primary care practices. However, our sample population shares a common trend within primary care toward older healthcare consumers (Bernstein et al., 2003). Because primary care services are more frequently utilized by older populations, the age trend in our sample towards older adults may somewhat enhance the ability to extrapolate the findings of this research to primary care populations in general.

Second, the design of this study limits the ability to generalize our findings to broader medical populations. Our findings rely on self-report data, which is characteristically "soft" data. We did not obtain multiple measures for each of our

interpreted variables, limiting discriminate or convergent validation (Podsakoff & Organ, 1986). Non-probability sampling is another limitation to our study design. Convenience sampling limits the generalizability of our findings in two notable ways. First, non-probability sampling limits the degree to which our sample is representative of the general primary care population. Second, voluntary participation may have biased our findings in obvious and yet unknown ways. Because all participants were volunteers, it is possible that these participants represented more extreme cases; some volunteers may have attempted to use the self-report measures as a vehicle for voicing, further, the issues that they utilized primary care services to address. It is equally possible that patient volunteers were less extreme cases who felt stable enough to complete the questionnaires without concern. Given these methodological limitations, our findings can describe only relationships between factors that may affect health and well being.

The measures selected for this study may also have limited our findings. We selected the C-SOSI to measure stress because the reliability and validity of this measure with medical populations was previously established (Carlson & Thomas, 2007). However, the C-SOSI was normed on a cancer population and not a primary care population. It is possible that differences between these two subsets of medical populations may limit the capacity to capture stress clearly in a primary care population. Based on the face validity of the C-SOSI items, however, this is an unlikely limitation, because the items that capture the factors of stress within this measure assess for general factors of stress and do not contain any medical jargon that would limit these items to particular medical populations.

Furthermore, the C-SOSI examines physiological and psychological symptoms of stress. The psychological and physiological symptoms of stress are internal experiences, and as internal experiences, these align with measuring awareness and acceptances, which are also internal experiences. Perhaps a measure of stress that also identified behavioral or external effects of stress would have found a stronger link than we reported between stress and negative health habits. A measure of stress that examined both the internal experience of stress and the external response to stress may have more easily linked negative health habits with stress. Therefore, the findings of this study may be limited due to the nature of the measures selected.

Future Directions

Implications. Our results demonstrated a limited relationship between stress and negative health habits. Based on these results, we therefore concluded that factors other than stress can contribute to the initiation and maintenance of risky health behaviors in primary care patients. This conclusion illustrates the complexity of the relationship between stress and health behaviors that health care providers face in addressing health habits. Health care providers face tremendous challenges in addressing negative health habits, and primary care providers have historically fallen short in addressing these issues. To define the precipitating and maintaining factors to negative health habits more completely, further investigation into the relationship between stress and negative health habits in primary care patients is recommended.

In more chronically stressed patients with more extreme negative health habits, the relationship between stress and health habits may be clearer. It is possible that stress has a stronger relationship with more extreme health habits than with those that we

examined in a general primary care population. As an example of how more extreme negative health habits may be better related to stress, Thomas et al. (2011) demonstrated in a RCT, that alcohol-dependent participants who were exposed to an acute psychosocial stressor were twice as likely as non stressed participants to drink as much beer as was available. As an example of how more extreme stress may be better related with negative health habits, Vicennati et al. (2009) suggested that the risk of maladaptive eating behaviors is increased and that reactive food intake may develop when individuals with chronic exposure to environmental stress experience rapid weight gain. Thus, research that highlights extremes in stress or extremes in negative health habits may demonstrate a clearer relationship between the two.

Our results have implications for health care providers. Our data suggest that stress is not a significantly contributing factor to negative health habits in certain individuals. Therefore, prevention and intervention strategies for negative health habits that focus only on stress may not be efficacious among primary care patients similar to those in our sample. This information can help health care providers understand the reasons why certain prevention and interventions strategies might be ineffective with certain patients. This knowledge can help tweak approaches to managing negative health habits. Overall, this information may be useful in directing targets of behavioral health interventions and stress management within primary care populations. However, the information gleaned from our findings is not enough to impact the daunting problem of health risk management with which primary care providers struggle. Still, we can suggest that matching specific precipitating factors to negative health habits and further

to specific patient characteristics may enhance the efficacy of prevention and intervention strategies.

Few authors have examined variations in mindfulness as an untrained or dispositional characteristic (Brown & Ryan, 2003). Our study set out to elaborate on the possible impact of natural variations of mindfulness on health behaviors. We found that dispositional, untrained mindfulness was not related to negative health habits. Given the recent successes of mindfulness-based interventions in managing health behaviors, it appears that trained mindfulness may be qualitatively different from dispositional mindfulness.

Recent findings demonstrate the efficacy of mindfulness training with smoking cessation. Bowen and Marlatt (2009) reported that even brief mindfulness-based instructions, including instructions to accept, nonjudgmentally, thoughts and feelings about smoking urges or cravings resulted in participants smoking fewer cigarettes over a one-week period. In perhaps the first RCT to examine mindfulness training as a discrete treatment condition for smoking cessation, Brewer et al. (2011) reported greater improvements in smoking cessation among participants who received mindfulness-training (MT) versus individuals who received standard smoking cessation treatment recommended by the American Lung Association. The MT used in this study was similarly based on awareness and nonjudgmental acceptance of feelings and cravings, drawing on Kabat-Zinn's (1982) theory.

Following an 8-week MBSR program for cancer patients, Carlson et al. (2004) reported improved quality of life and decreased symptoms of stress. In addition, these authors observed improvements in physical activity among MBSR participants, even

though physical activity was not the target of this intervention. These results suggest that by targeting stress symptoms, trained mindfulness may impact negative health habits. The results of these studies suggest that trained mindfulness has a different relationship with stress and with health behaviors than we found with dispositional mindfulness.

It is possible that mindfulness skills and techniques are more useful in addressing stress and health behaviors than a general attitude of mindfulness, or that a mindful perspective is better maintained because of trained skills, reinforcement, and repetition. There may also be some protective factors imbedded in training programs that can positively impact stress and health behaviors, such as therapeutic rapport and social support. Motivation to engage in a mindfulness-based attitude and motivation to change in general may contribute to the differences between trained and untrained mindfulness. A person who naturally trends towards a mindful attitude or perspective is not necessarily motivated to be mindful in every moment, particularly in moments of increased stress. Furthermore, just because a person is mindful does not mean that he or she is motivated to change his or her health habits. Mindfulness-based trainings and interventions with voluntary participation may inherently capitalize on motivation and willingness to change. In measuring negative health habits, we did not measure motivation or willingness to change health- related behavior. Stages of change and motivation to change may be a missing factor in our research that better describes the differences between trained and dispositional mindfulness.

In contrast, some evidence suggests that trained and untrained mindfulness may not be so qualitatively different. In an undergraduate university sample, Gilbert and Waltz (2010) recently demonstrated that higher dispositional mindfulness, as measured

by the FFMQ, was related to higher levels of physical activity and to more fruit and vegetable intake, as well as to higher levels of self-efficacy for positive health habits. These authors suggested that individuals who maintain a general attitude of mindfulness have a fundamentally different outlook on themselves and the world. This mindful outlook is less conducive to reactive, short-term health fixes, such as going on a diet, and is more compatible with a continuous, life-long shift away from negative health habits.

Future research. Our finding that particular items on the Awareness and Acceptance factors of the PHLMS dominate their respective factors has not been previously reported and therefore extends the literature on this measure. This study has identified these dominant items, but does not answer whether or not this finding is meaningful, numerically or predicatively. We cannot describe the extent to which answers for the dominant items are predictive of the direction of answers for other items in the factor. Based on the face validity of these items, it does not appear that the dominant items are worded in such a way that captures the core of these constructs anymore than the non-dominant items might. Future research that examines whether or not particular items on the PHLMS are strong enough to manipulate the respective factor is required to better understand this finding.

We recommend further investigation into the relationship between stress and negative health habits in primary care patients to define more clearly the precipitating and maintaining factors to negative health habits. Research focused on more extreme health habits or patient populations with more extreme stress-related issues (e.g., cardiac, diabetes, arthritis) may better explain the discrepancies in findings on the impact of stress on health behaviors. We also noted that the relationship between mindfulness and

negative health habits tends to be more clearly defined when looking at extreme negative health behaviors, such as addictions. Future investigation into acceptance-based interventions is recommended to continue to elaborate on the impact of acceptance on health behaviors, particularly with a focus on chronically stressed primary care populations and with populations who have extreme negative health behaviors.

Finally, we recommend research that elaborates further on the differences between trained and untrained mindfulness. There remains a sufficient lack of information regarding the impact of natural variations of mindfulness on well being as a whole, including how untrained mindfulness may impact health behaviors. In a general sense, it is not a huge leap to suggest that people who are naturally more mindful may lead more healthy lifestyles and therefore engage in fewer behaviors that negatively impact their physical and psychological well being. In terms of evidence, however, we continue to lack the research to substantiate these assumptions with credibility.
If mindfulness is more than a technique, then we need to continue to examine the experience of mindfulness, and not simply the application of mindfulness.

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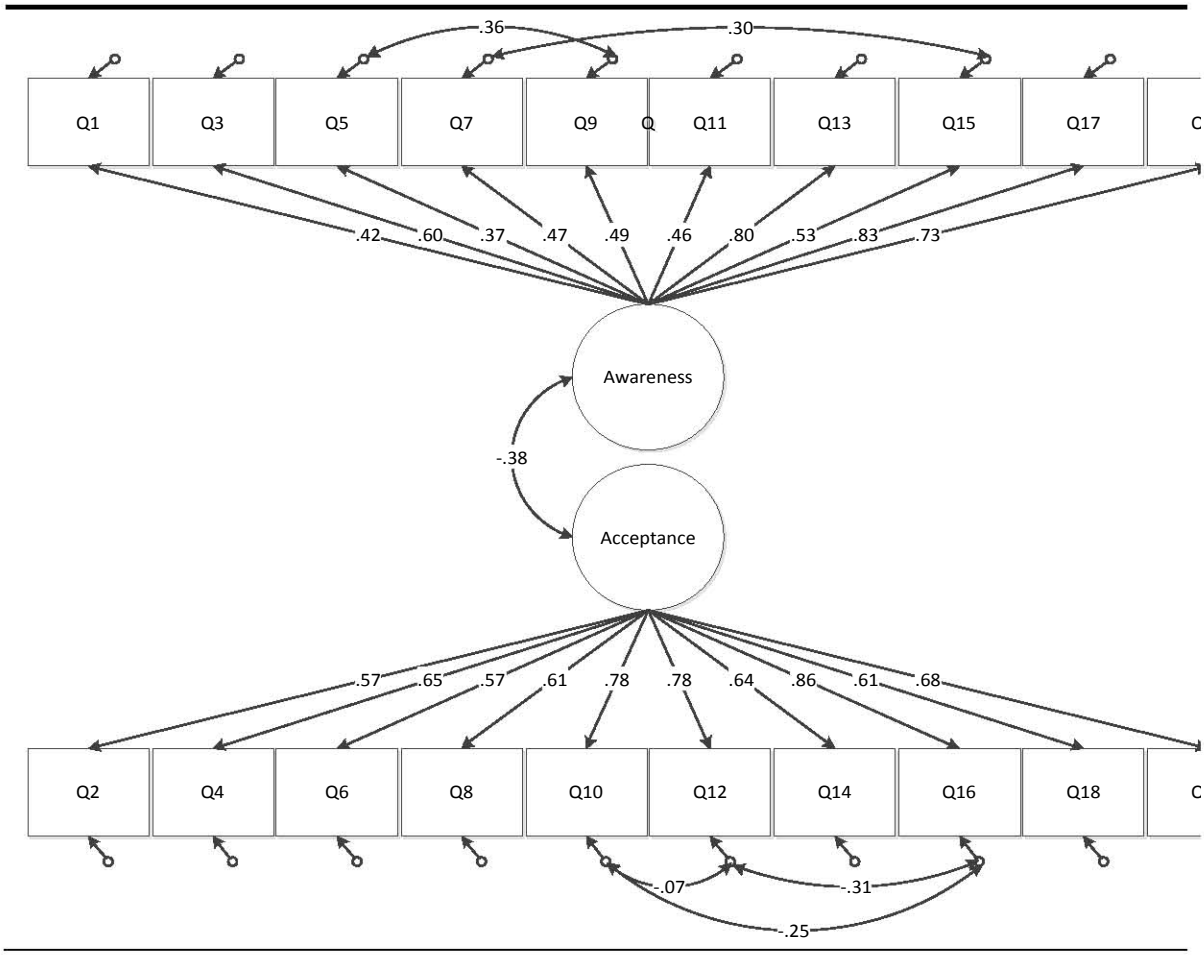
Appendix A: Figures

Figure 1

CFA Validation of Two-Factor Model of Mindfulness in the PHLMS (N = 198)



Appendix B: Tables

Table 1

Demographics of Patient Participants

Characteristic	*n*	%
Age in years		
18-35	10	5.1
26-40	27	13.6
41-55	39	19.7
56-89	122	61.6
Gender*		
Female	100	50.5
Male	97	49.2
Race/ethnicity		
Arab	2	1.0
Asian/Pacific Islander	1	.5
Black	3	1.5
Caucasian/White	184	92.9
Hispanic	5	2.5
Indigenous/Aboriginal	1	.5
Latino	1	.5
Multiracial	1	.5
Other	1	.5
Education		
Grammar school	8	4.0
High school/GED	79	39.9
Vocational/technical school	13	6.6
Some college	45	22.7
Bachelor’s degree	37	18.7
Master’s degree	14	7.1
Doctoral degree	2	1.0
Household income (per year)		
Under $10,000	12	6.1
$10 – 29,999	35	17.9
$30 – 49,999	48	24.2
$50 – 74,999	41	20.7

$75 – 99,999	27	13.6
$100 – 150,000	23	11.6
Over $150,000	10	5.1
Meditation		
Experience	62	31.3
No experience	136	68.7

NOTE: *N* = 198. *Missing demographic data was only found in the Gender category, 1 missing.

Table 2

Means and Standard Deviations for Subscales of Study Measures

Variable	Mean	Std. Dev.
Common Measures, Better Outcomes (COMBO)		
Current smoker	.18	.382
Heavy drinker	.11	.309
Less than recommended fruits and vegetables	.91	.281
Underactive	.56	.498
Total Health Habits	1.76	.77
Philadelphia Mindfulness Scale (PHLMS)		
Awaresness	35.53	6.64
Acceptance	30.28	7.45
Mindfulness	65.84	8.08
Calgary Symptoms of Stress Inventory (C-SOSI)		
Depression	6.80	6.59
Anger	7.77	5.68
Muscle Tension	8.90	7.45
Cardiopulmonary arousal	4.53	5.46
Sympathetic arousal	11.47	7.68
Neurological/GI	3.76	4.43
Cognitive disorganization	4.40	4.26
Upper respiratory symptoms	6.80	5.12
Stress Total	54.45	35.96

NOTE: Std. Dev. = Standard Deviation

Table 3

Summary of CFA Fit Indexes

Model	*df*	χ^2	CFI	TLI	RMSEA
	164	370.436	.87	.85	.08

NOTE: *df* = degrees of freedom; χ^2 = chi-square statistic; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation

Table 4

Findings from Lagrange Multiplier Tests

Acceptance	->	Q11
Acceptance	->	Q15
Q5	~~	Q7
Q13	~~	Q17
Q8	~~	Q10
Q16	~~	Q20
Q4	~~	Q12
Q5	~~	Q17

NOTE: -> = item load on latent variable; ~~ = items' errors allowed to correlate

Table 5

Factor Loadings of Awareness and Acceptance From CFA (N = 198)

Item	Estimate	Std.err	Z-value	Std.all
Latent Variable: Awareness				
Q1	1.00			.42
Q3	1.63	.32	5.16	.60
Q5	1.44	.36	3.98	.37
Q7	1.59	.35	4.57	.47
Q9	1.41	.30	4.69	.49
Q11	1.22	.27	4.53	.46
Q13	2.10	.37	5.71	.80*
Q15	1.67	.34	4.88	.53
Q17	2.19	.38	5.75	.83*
Q19	2.04	.37	5.55	.73
Latent Variable: Acceptance				
Q2	1.00			.57
Q4	1.26	.17	7.27	.65
Q6	1.21	.18	6.65	.57
Q8	1.25	.18	6.98	.61
Q10	1.55	.20	7.96	.78*
Q12	1.46	.18	7.98	.78*
Q14	1.29	.18	7.22	.64
Q16	1.77	.21	8.48	.86*
Q18	1.11	.16	6.97	.61
Q20	1.45	.19	7.55	.68

NOTE: *Std.err* = standard error of estimate; *Std.all* = standardized coefficients or beta coefficients

*items dominate the factor

Table 6

Pearson Correlations between Mindfulness, Stress, and Negative Health Habits

	Aw	Ac	M	D	An	MT	CPA	SA	N/GI	CD	URS	ST	NHH
Aw	1	-.340**	.503**	.228**	.227**	.381**	.237**	.198**	.226**	.117	.216**	.307**	-.058
Ac	-.340**	1	.637**	-.573**	-.483**	-.491**	-.388**	-.452**	-.379**	-.476**	-.208**	-.571**	-.087
M	.503**	.637**	1	-.349**	-.259**	-.148*	-.168**	-.262**	-.162*	-.338*	-.008	-.278**	-.127*
D	.228**	-.573**	-.349**	1	.634**	.640**	.626**	.578**	.662**	.604**	.315**	.832**	.189**
An	.227*	-.483**	-.259**	.634**	1	.585**	.447**	.444**	.487**	.564**	.330**	.732**	.092
MT	.381**	-.491**	-.148*	.640**	.585**	1	.554**	.587**	.632**	.485**	.471**	.829**	.058
CPA	.237**	-.388**	-.168**	.626**	.447**	.554**	1	.575**	.661**	.450**	.455**	.774**	.120*
SA	.198**	-.452**	-.262**	.578**	.444**	.587**	.575**	1	.661**	.450**	.455**	.795**	.124*
N/GI	.226**	-.379**	-.162**	.662**	.487**	.632**	.661**	.586**	1	.506**	.489**	.808**	.084
CD	.117	-.476**	-.388**	.604**	.564**	.485**	.450**	.541**	.506**	1	.401**	.722**	.063
URS	.216**	-.208**	-.008	.315**	.330**	.471**	.455**	.418**	.489**	.401**	1	.616**	.056
ST	.307**	-.571**	-.278**	.832**	.732**	.829**	.774**	.795**	.808**	.722**	.616**	1	.132*
NHH	-.058	-.087	-.127*	-.189**	.092	.058	.120*	.124*	.084	.063	.056	.132*	1

NOTE: Aw = Awareness; Ac = Acceptance; M = Mindfulness; D = Depression; An = Anger; MT = Muscle tension; CPA = Cardiopulmonary arousal; SA = Sympathetic arousal; N/GI = Neurological/GI; CD = Cognitive distortion; URS = Upper respiratory symptoms; ST = Stress total; NHH = Negative health habits