Validation of the Calgary Symptoms of Stress Inventory (C-SOSI) for Predicting Adherence to a Stress Reduction Technique

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ABSTRACT

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Stress is a ubiquitous aspect of modern life that has serious effects on mental and physical health. Many stress reduction techniques are currently available to help combat these effects but non-adherence to them is a significant barrier to their overall effectiveness. The aims of the current study were to: 1) validate the Calgary Symptoms of Stress Inventory (C-SOSI), an instrument that classifies one"s stress response profile, using traditional psychometric procedures as well as for predicting responses to a laboratory stress situation, and 2) explore the utility of this instrument for predicting adherence following training in a single stress reduction session using guided breathing. Seventy undergraduates (55 women, 15 men) participated in a laboratory study in which they reported their typical stress responses using the C-SOSI, and their actual cognitive, affective, and cardiovascular responses to two stressful tasks were assessed. Next, all participants were trained in and practiced a diaphragmatic breathing relaxation strategy. Adherence, efficacy, and enjoyment of daily practice of the relaxation strategy were measured during a two-week follow-up phase using a web-based recording system. Although internal consistency reliabilities were generally acceptable for the C-SOSI subscales (Cronbach alphas ranging from .78 to .94), the validity of the C-SOSI subscales for explaining variance in actual stress responses to laboratory stressors was not as expected. The C-SOSI Affect subscale explained a significant amount of variance in the cognitive response to stress in the laboratory ($R^2 = .21$, $p < .01$), and the C-SOSI Physiology subscale explained a significant amount of variance in both the affective and physiological responses to stress in the laboratory ($R^2 = .28$, $p < .01$, and $R^2 = .22$, $p < .01$, respectively). None of the C-SOSI subscales explained adherence to daily practice, efficacy, or enjoyment of the breathing relaxation strategy. Participants with both greater active coping and aggregated physiological responses to laboratory stress rated their practice of the relaxation strategy as being more enjoyable than participants with lower responses in both of these domains. In summary, although the C-SOSI Physiology subscale was shown to be associated with actual physiological and affective responses to laboratory stressors, the other subscales of the C-SOSI fared less well, and no C-SOSI subscale was associated with any measure of adherence to daily practice, efficacy, or enjoyment of the breathing relaxation strategy used in this study. Because this study was the first to attempt to demonstrate the validity of the C-SOSI, the instrument requires further attention in future empirical work on measuring the stress responses of healthy adults as well as individuals suffering with a range of medical diseases.

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IRB Acknowledgement

I verify that I obtained IRB approval prior to initiating data collection for this project. I also verify that my research was conducted in strict adherence to the approved protocol. No amendments to the protocol were required during data collection and appropriate continuing reviews were completed according to the standards established by the IRB.

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Stress has been viewed alternatively as a physiological reaction, a collection of environmental aggravations, a cognitive appraisal of threat, a stimulus-response interaction, or an imbalance between environmental demands and personal resources, among other things (e.g., Beck, 1993; Gadzella, 1994; Larkin, 2005; Matheny, Aycock, Curler, & Junkette, 2003). On one hand, when people refer to „work stress," „financial stress," or „interpersonal stress," the connotation appears to reflect external environmental stimuli that occur in daily life. On the other hand, when people refer to the discomfort that stress plays in their lives or when they feel „stressed out," stress appears to reflect internal responses to life situations. To complicate matters, stress also can be categorized by time frames of occurrence: acute, sequential, chronic but intermittent, and chronic (Cohen, 2000). For the purposes of the proposed project, stress will be conceptualized as a stimulus-response interaction that involves both environmental challenges people confront in their daily lives (i.e., stimuli) *and* the individualized patterns of response that follow. The term „stressor" will be used when referring to environmental stimuli that threaten or challenge organisms engaged in daily living, and the term „stress response" will be used when referring to the various types of reactions organisms exhibit in response to these environmental stimuli. The current paper focuses on the stress response, so it will be introduced first, with an emphasis on the physiological sequelae of exposure to environmental stressors. Next, methods of measuring the stress response will be described. Finally, as stress is a common reason for seeking help in healthcare settings, the application of the measurement of the stress response and its proposed importance in predicting outcomes to stress reduction programs will be considered.

The stress response

It is generally agreed that the stress response involves four broad domains of functioning: cognitive, behavioral, physiological, and emotional (e.g., Avero & Calvo, 1999; Cohen, 2000; Cohen & Rodriguez, 1995; Larkin, 2005). Affective responses to stressors may include such feelings as anxiety, depression, or anger, among other things. Behaviorally, individuals may exhibit any number of responses, among them forms of escape, increased substance use, or social withdrawal. Cognitive processes may be consumed by worry, rumination, or catastrophic thinking about the stressor. Physiological processes, which will be discussed more in depth, generally involve arousal of the autonomic nervous system, leading to a wide array of physiological changes in the body (Larkin, 2005). These different domains of the stress response are often difficult to tease apart, and there is some debate about the order in which they occur and whether individual differences exist in the sequence and patterning of these various domains of the stress response. For example, in their early work on this topic, Schwartz, Davidson, and Goleman (1978) highlighted three of these domains of the stress and anxiety response: cognitive, behavioral, and somatic (i.e., physiological). They hypothesized that stress management techniques might be more or less effective depending on which of these response domains were prominent within a particular person‟s stress response profile. In line with this theory, Cohen and Rodriguez (1995) proposed that emotionally upsetting events affected individuals via physiological, cognitive, behavioral, and social pathways. Accordingly, the emotional component took center stage, but immediate physiological reactions to stress were undeniable, as were cognitions. Similarly, in an examination of the James-Lange theory of emotion, physiological perception and emotional perception were found to be correlated (Pollatos, Kirsch, & Schandry, 2005), providing additional evidence that stress responses among these domains

were not orthogonal. Even when considering only affect, it is impossible to extricate a singular component using Folkman and Lazarus‟ (1991) definition of emotions as “psychophysiological reactions consisting of cognitive appraisals, action impulses and patterned somatic reactions” (p. 209). Beck (1993) suggested that individuals engage in the cognitive appraisal process first, before acting and experiencing emotions in response to a stressful situation. Folkman and colleagues (1986) build upon this assertion, noting that individuals base their coping responses upon their appraisals of threat. Integrating these multiple theories of stress and coping, there is convincing evidence that the varying domains of the stress response overlap and influence one another.

It must be acknowledged that stress is a part of everyday life, and while uncomfortable, has important evolutionary significance. Stress responses can be beneficial, and the body systems‟ reactions can be life-saving. Among human ancestors, failure to exhibit healthy stress responses to life-threatening stimuli more frequently resulted in death and/or serious injury than exhibiting less substantial stress responses. For example, human ancestors who reacted with strong fight-flight responses to animals that threatened their lives were more likely to survive than those who failed to respond to these sources of threat in their environments. Even in more contemporary times, it could be argued that exposure to some degree of stress facilitates job performance, motivation to achieve, and educational and occupational success.

Despite the life-sustaining and productive consequences of stress responses, there are many negative psychological and physical consequences of stress responses, mainly when they occur too frequently, too intensely, and last for substantial periods of time. One statistic suggests that a large number of annual deaths are partly attributable to stresses associated with the modern lifestyle (Cohen, 2000). Poor stress management has been linked with myriad complications for

both mental and physical health, among them cardiovascular disease, memory problems, inflammatory diseases, difficulties with problem solving, and emotional turmoil (e.g., Cohen & Rodriguez, 1995; Ellins et al., 2008; Lovallo, 1997; Patel, 1993; Steinhauser, Maier, & Hübner, 2007).

It is generally believed that stress exerts its negative effects on health through a cascade of physiological events including activation of the autonomic nervous system, secretion of stress hormones like cortisol and the catecholamines from the neuroendocrine system, and disruptions of the immunological system responsible for protecting the body from infections and other foreign substances. Cannon (1928) first described these effects as an organism"s attempts to maintain homeostasis in the face of stressors. In contrast to the regulatory process of homeostasis, which involves the body"s maintenance of equilibrium in a relatively static environment, McEwen (1998) labeled the process „allostasis," which refers to the body"s attempt to maintain stability of functioning in an unstable or changing environment. The constant struggle to maintain emotional and physiological stability as the organism confronts and responds to environmental threats and challenges produces a physiological strain in the body known as allostatic load.

The body"s endeavor to maintain allostasis most commonly involves activation of the hypothalamic-pituitary-adrenocortical (HPA) axis and the sympathetic adrenomedullary system (McEwen, 1998). These systems are involved in the response to acute stressors (in the fight-or-flight response) and often result in increased heart rate, respiration rate, and blood pressure; the body uses a similar response to defend against chronic stressors (Ader, Cohen, & Felten, 1995; Lovallo, 1997). Of course, the process must also involve inactivation when the stressor is no longer present. The inability of the body to inactivate the HPA axis response efficiently upon

termination of exposure to a stressor or frequent activation of the HPA axis response exposes the body to an overabundance of these stress hormones, leading to allostatic overload and the health-threatening physiological outcomes that occur with it (McEwen, 1998).

According to McEwen (1998), there are four ways in which allostatic load becomes problematic. First, frequent exposure to stressors causing repeated activation of the system can weaken the body and cause health problems. Second, if the body does not adapt to these repeated exposures to stress (i.e., failure to habituate), the same elevated physiological responses will be exhibited, leaving the body exposed to stress hormones for prolonged periods of time. Third, an inability of the system to be inactivated following exposure to stress (i.e., prolonged recovery) allows the stress hormones to circulate for a longer period of time than is necessary. In a final scenario, the body may fail to respond to stressors with one physiological system so another is activated to compensate. McEwen (1998) notes that when the HPA axis does not respond appropriately (in this case, a deficient level of activation), the immune system increases production of cytokines which can have an equally deleterious effect. Although the immune system is generally proficient at handling the body‟s demands, disruptions in normal functioning occur when individuals are exposed to prolonged stressors. For instance, the glucocorticoids (of which cortisol is the most prominent), have been shown to suppress the immune system and result in an increased production of proinflammatory cytokines (Ader et al., 1995). After initially conferring an enhanced immunologic state, the prolonged presence of these immune bodies maintains an inflammatory condition, leaving the body susceptible to infection and increased risk for autoimmune disease (Ader et al., 1995; McEwen, 1998). There is evidence that through practicing common stress management strategies, the physiological processes that define allostatic load can be modulated. For example, asthma patients practicing biofeedback-assisted

relaxation experienced decreased inflammation and better pulmonary function compared to controls (Kern-Buell, McGrady, Conran, & Nelson, 2000). Additionally, participants practicing progressive muscle relaxation produced less salivary cortisol than did controls in another study (Pawlow & Jones, 2005). These results indicate that it is possible to mitigate the physiological consequences of stress; this will be discussed in more detail in a later section of this dissertation.

Heart rate variability (HRV) has become an increasingly popular measure of physiological responding to stress. In its most basic terms, HRV is a change in the beat-to-beat activity of the heart over time. These changes are influenced by both sympathetic and parasympathetic innervation, making this process particularly interesting to researchers studying stress (Berntson et al., 1997). In general, greater HRV is associated with an enhanced ability to adapt to stress physiologically, and reduced HRV indicates an inability to adapt, which is often associated with a vulnerability to stress-related illnesses (Wheat & Larkin, 2010), similar to the model of allostatic load previously described. Recent research has indicated that HRV is tied to several biomarkers of systemic inflammation through anticholinergic activity of the vagus nerve, further implicating its importance in disease processes, particularly cardiovascular and kidney disease (Haensel, Mills, Nelesen, Ziegler, & Dimsdale, 2008). This association may be especially pronounced in depressed patients with heart disease (Frasure-Smith, Lesperance, Irwin, Talajic, & Pollock, 2009), but it is also evident in healthy adults (Thayer & Fischer, 2009; von Kanel, Nelesen, Mills, Ziegler, & Dimsdale, 2008).

To summarize, the stress response is a necessary reaction to help individuals cope with environmental demands. However, an exaggerated response, too frequent activation of the response, or a prolonged response sets in motion a chain of physiological events that, over time,

can disrupt the body‟s delicate balance and cause injury to the cardiovascular and immune systems, resulting in negative health outcomes for individuals.

Measurement of stress

As previously described, there are a variety of ways to conceptualize stress. One‟s conceptualization of stress will clearly influence the way in which measures of stress are devised and selected; thus, there are different scales to measure stress as a stimulus, as a response, or as an interaction between the two. For example, Selye (1956) depicted stress as a response in his description of the General Adaptation Syndrome. An important part of his model was the focus on the physiological response to stressors and the ensuing health outcomes that resulted from prolonged exposure to numerous types of stressors. It is not surprising then that Selye measured stress using direct measures of physiological disturbance, including presence of gastric ulcers in stressed animals. In contrast, Holmes and Rahe (1967) conceptualized stress as a series of environmental aggravations, and their measure (the Social Readjustment Rating Scale) is essentially a list of common environmental life stressors people encounter (e.g., death of a loved one, losing a job, purchasing a home, having a baby). The Daily Stress Inventory (DSI; Brantley, Cocke, Jones, & Goreczny, 1988), the Daily Inventory of Stressful Events (DISE; Almeida, Wethington, & Kessler, 2002), and the Student Life-Stress Inventory (Gadzella, 1994) assess both the stressors present in one‟s environment and how intensely an individual reacts to them, following a transactional stimulus-response model. The DSI and the DISE assess the perceived intensity (as well as prevalence) of multiple daily stressors. Although these methods attempt to measure an individual‟s reactions to stressors, they do not assess the patterning or sequence of specific responses, only the respondent‟s overall perceptions of stressfulness.

Clinically, it is generally thought to be more useful to know about a person‟s stress response rather than the types of particular environmental stressors he or she confronts. Although it is important to recognize the environmental precipitants of an exaggerated stress response, the therapist and client have more control over the latter part of the equation. Unfortunately, the aforementioned measures of stress, either lists of environmental stimuli or general perceptions of stressfulness, have not been all that useful in clinical settings. To develop a more useful assessment tool that provides a comprehensive measure of one‟s stress response profile, including domains of affective, cognitive, behavioral, and physiological responding, the Calgary Symptoms of Stress Inventory (C-SOSI) was developed. The purpose of this instrument was to examine the somatic, cognitive, and behavioral symptoms of stress that were altered following a mindfulness stress reduction treatment program (Carlson & Thomas, 2007). Although items were selected to measure these three specific response domains, a factor analysis of scale items did not yield a three factor solution. Factors on the C-SOSI that emerged included: Depression, Anger, Cognitive Disorganization, Muscle Tension, Cardiopulmonary Arousal, Sympathetic Arousal, Neurological/Gastrointestinal Symptoms, and Upper Respiratory Symptoms. As this scale was developed and used within the context of a psychooncology unit, it placed a significant emphasis on somatic manifestations of stress; it is thus unclear if the factors identified would be similar in a population of individuals without a major medical concern. However, the sub-scales that were identified appeared to be strong, as internal consistency alphas were .80 or above for all factor-derived subscales and for the total score.

Koh, Park, Kim, and Cho (2001) also attempted to develop an inventory grounded in the four factor theory of stress responding (i.e., emotional, cognitive, behavioral, and physiological). They found that, although these four general domains were evident among the items devised, the

specific factors observed did not support a four-factor solution. A factor analysis revealed that their Stress Response Inventory was composed of seven factors which were named Tension, Aggression, Somatization, Anger, Depression, Fatigue, and Frustration. This scale is unique in that it was developed using a Korean population, using the experiences of Korean psychiatrists and psychologists to develop some of the items. It has not yet been validated for use in Western, English-speaking nations. The instrument shows promise, however, as various estimates of reliability indicated that the SRI consistently measured robust factor constructs.

Gadzella (1994) was more successful in uncovering a four factor solution on the stress response portion of the Student-Life Stress Inventory. However, a weakness of the scale is that the cognitive component was measured by only two items and the emotional component only by four items. The behavioral and physiological subscales were comprised of more items, suggesting that the factors observed may not represent the full range of potential stress responses. Additionally, Cronbach"s alphas varied for the measurement of stressful situations, with some trending toward the unacceptable range (e.g., .52 for Frustration), bringing into question the reliability of this measure of stress. The factor analytic methods used in the development of the scale were not reported, also leading to some questions about the factor structure of the instrument.

Although several studies (Carlson & Thomas, 2007; Gadzella, 1994; Koh et al., 2001) have attempted to measure the stress response profile comprehensively with the aim of developing a more clinically useful tool for appraising the pattern and sequence of the stress response, they all have some weaknesses and require further validation. For example, none of these instruments have been validated to determine whether participant responses on them are associated with the actual cognitive, behavioral, affective, or physiological responses observed

during exposure to a stressful situation, nor have they been tested for usefulness in selecting a treatment modality.

Stress management

As previously noted, knowledge about the stress response could have important clinical applications for stress reduction. None of the reviewed instruments has been used in a study attempting to predict an individual‟s response to a particular stress management intervention. In this regard, if a measure of stress response is not associated with treatment outcomes, such an instrument, though informative, may not be useful clinically.

Given the numerous negative psychological and physical consequences of stress, it is imperative that individuals learn to cope or manage the stress in their lives. Lazarus and Folkman (1984) defined coping as "constantly changing cognitive and behavioral efforts to manage specific external and internal demands that are appraised as taxing or exceeding the resources of the person" (p. 141), which mirrors the conceptualization of stress and the stress response previously described. Coping can be conceptualized in various ways, though among the most common distinctions are approach vs. avoidant coping and emotion-focused vs. problem-focused coping. Approach coping involves actively addressing stressful stimuli, whereas avoidant coping relies on strategies to distract oneself from the stressor. Similarly, problem-focused and emotion-focused coping represent attempts to manipulate some part of the stressful transaction (the stimulus in the former and the emotional response in the latter). Lazarus and Folkman (1984) note that no strategy is inherently good or bad; rather, the usefulness of the strategy employed is judged by the outcomes it induces. This dynamic process has been referred to as goodness-of-fit, as effective coping strategies are selected based upon the demands of the stressful situation, specifically how controllable it is. The goodness-of-fit hypothesis has received some empirical

support, indicating that individuals generally do match their coping strategy of choice (problem-focused or emotion-focused) with the controllability of the stressor, and this attempt often results in less distress. Accordingly, problem-focused coping appears to be more beneficial in response to stressors for which respondents exert some control (e.g., one can reduce risk of heart disease by stopping smoking) and that emotion-focused coping appears to be more beneficial in situations in which respondents confront uncontrollable outcomes (e.g., praying for comfort while dying from an incurable disease). Findings supporting the goodness-of-fit hypothesis, however, have been equivocal, with some studies indicating greater distress when there is a mismatch between appraisals and coping responses; however, other studies have not supported this association and instead found main effects for overall coping effectiveness, regardless of specific type (Forsythe & Compas, 1987; Park, Folkman, & Bostrom, 2001; Zakowski, Hall, Klein, & Baum, 2001).

Stress management in its myriad forms could be viewed as a type of emotion-focused coping, as its aim is to regulate the emotional response to stress, thereby decreasing the physiological effects of stress. The use of complementary medicine, which includes stress management and relaxation techniques, has risen in recent years, and deep breathing exercises are among the most widely used strategies (Barnes, Bloom, & Nahin, 2008). In early studies of relaxation techniques, Benson (1975) proposed that their apparent effectiveness stems from their ability to reduce autonomic arousal and offset the damages produced by repeated physiological arousal. Among the beneficial physical changes of various stress management techniques, he lists decreased oxygen consumption, respiratory rate, heart rate, blood pressure, and muscle tension, and increased production of alpha waves, which are all part of the relaxation response.

Repeated elicitation of the relaxation response is thought to decrease blood pressure and alleviate other stress-related illnesses.

Although there are several unique stress management techniques that are commonly practiced, Benson (1975) states they all have in common certain characteristics that are integral to the practice and to bringing about the relaxation response. The four basic components are a quiet environment in which to practice, mental focus, a passive attitude, and a sitting position that minimizes muscle tension. However, the practice of stress management itself may not be so basic, as each of the strategies requires a significant commitment on the part of the learner to engage in regular practice to acquire, strengthen, and maintain his or her skill with the chosen technique. Given the length of time required to learn and master these skills, it is important to select a strategy that will be both acceptable to the client and result in positive health outcomes. Engaging in regular practice of a stress management technique that does not ameliorate the negative aspects of one‟s stress response profile is problematic, as is selecting a technique that works for the client, but is one he or she is not interested in practicing. In this regard, it is important to optimize the match between a specific stress management strategy chosen and the effect it has upon one‟s stress response profile.

Although most stress management techniques have been shown to result in changes in the autonomic, somatic, and central nervous systems, specific strategies have been hypothesized to influence these physiological processes differentially. For example, meditation is generally thought to influence the stress response via central nervous system de-activation, while progressive muscle relaxation is thought to influence the stress response via reductions in somatic nervous system activity (Lehrer, Schoickett, Carrington, & Woolfolk, 1980). Using this conceptualization, it could be suggested that stress management techniques are differentially

efficacious for individuals exhibiting differing types of stress reactivity profiles. With the practice of yoga, for example, there are different paths one develops with continuing practice: a physical path, a cognitive path, a behavioral path, and a devotional path. Though they are not isolated, the labeling of these different paths points to an acceptance of the four domains in which stress reduction may be most pertinent (Patel, 1993).

As the domains of stress reactions overlap, so do the effects of various stress reduction strategies. It is not likely that someone practicing a particular stress management technique would see improvements in only their cognitive processes and another person practicing a different technique would experience an alleviation of only affective symptoms. Nevertheless, a „specificity" hypothesis has been proposed that states that when efforts are made to match one"s stress response profile with a specific stress management intervention, outcomes will be optimized (Schwartz et al., 1978). This specificity hypothesis closely resembles the goodness-of-fit hypothesis proposed in the coping literature (Lazarus & Folkman, 1984). Accordingly, people who respond to stress with exaggerated somatic nervous system responses (e.g., muscle tension) will exhibit the greatest reduction in stress when practicing a strategy aimed at reducing somatic tension (e.g., progressive muscle relaxation). Congruently, people who respond to stress with exaggerated cognitive responses (e.g., catastrophic attributions) will exhibit the greatest reduction in stress when practicing a strategy aimed at reducing cognitive stress responses (e.g., cognitive restructuring). There was some early support for this theory, with one study showing that individuals engaging in aerobic exercise for stress reduction experienced less somatic and more cognitive anxiety following training than individuals using meditation (Schwartz et al., 1978). In contrast, individuals engaging in meditation experienced less cognitive anxiety and more somatic anxiety following training than the exercise trainees. In another study comparing

PMR and meditation, individuals engaging in either technique experienced a greater reduction in state anxiety than did individuals in a control group after exposure to a brief stressor, but those engaging in PMR saw greater decreases in somatic anxiety than did the other two groups; no such interactions were observed for cognitive anxiety (Rausch, Gramling, & Auerbach, 2006). Meditation also has been reported to have less of an effect on hypertension than PMR (Lehrer & Woolfolk, 1993). These studies appear to suggest that different stress reduction techniques (in this case PMR and meditation) effect different outcomes on one"s stress response profile. However, this "specific effects" model has not been well-supported by all studies. In fact, results from multiple studies comparing the relative effectiveness of various stress reduction techniques have been mixed (Lehrer & Woolfolk, 1993; Rausch, Gramling & Auerbach, 2006). It is now believed that some additional specific effects may be seen within the context of a more general "relaxation response" (Lehrer & Woolfolk, 1993). In support of this modified specificity hypothesis, Carrington (1993) listed positive gains from a regular meditation practice across all four domains, counting among the benefits increased mood and productivity, reduced anxiety and irritability, fewer illnesses, a heightened sense of self-awareness, and improved decision making skills. Although beneficial influences are evident across domains, those that occur in the area in which an individual feels the effects of stress most acutely (i.e. the domain in which he or she most intensely reacts to a stressor) may be detected most easily by the learner.

Adherence to stress management

Various stress reduction techniques have been used successfully in the treatment of hypertension, migraine headache, insomnia, anxiety disorders, and other ailments (Lehrer & Woolfolk, 1993; Patel, 1993). Of course, in order for one to experience the benefits of a stress management program, one must actively engage in it and practice it on a daily basis. Adherence

is not guaranteed; in fact, many health professionals struggle with motivating their clients to adhere to any treatment recommendations, including those related to stress management (Lehrer & Woolfolk, 1993). In a review of published studies regarding adherence to stress management programs, Lehrer and Woolfolk (1993) found that roughly 50 percent of individuals who had begun meditating stopped after three or six months of practice. Given the difficulties with continuity of treatment, much empirical focus has been set on adherence to clinical recommendations, with a variety of theories being explored.

Early research suggested many possible reasons why patients may not regularly practice stress reduction techniques, including unrealistic expectations for the results of practice, beliefs that practice will not influence risk for disease (e.g., external health locus of control), unpleasant or unfamiliar physiological sensations that accompany the practice, and other intervening variables, such as presence of depression or other psychiatric disorders (Lehrer & Woolfolk, 1993). More recently, engagement in specific health behaviors has been examined as a factor that influences adherence to regular practice. For example, active coping has been associated with better adherence to medication regimens among patients with HIV, whereas avoidant coping was related to missing doses (Vyavaharkar et al., 2007; Weaver et al., 2005). Cognitive and affective reactions to a behavior also may be important in the adoption of a behavior; individuals who rated a variety of health promoting behaviors to be more enjoyable and more beneficial reported higher intentions to engage in those behaviors (Lawton, Conner, & McEachan, 2009).

More recently, psychology has integrated concepts from behavioral economics to study health behaviors, including adherence to treatment recommendations. Delay discounting of reinforcement is one such area of focus that may provide a context for understanding preventive health behaviors. Delay discounting of reinforcement is a phenomenon that involves choosing an

immediate but small reward instead of a more substantial reward later. For example, an individual with a lesser propensity for delay discounting may choose to forgo a fattening dessert at a meal in favor of the long-term health benefits of maintaining a healthy diet. In contrast, an individual who prefers more immediate rewards (engages in more discounting of delayed rewards) may be less likely to engage in current health behaviors, including adhering to medication regimens and other treatment recommendations. Consistent with this theory, patients may engage in a cost-benefits analysis of engaging in a particular stress management program, in which the cost (e.g., time committed to daily practice) is contrasted with the perceived long term health benefits of daily practice. Often, the harmful health effects of stress are not immediately recognizable and the beneficial health effects of stress management are not easily detected, whereas the direct and indirect costs associated with acquisition and maintenance of the stress management practice are relatively noticeable; this renders the decision to follow professional advice regarding stress management tenuous at best (Lamiruad & Geoffard, 2007; Patel, 1993). Even if the practice of stress management prolongs life and results in reduced risk for chronic diseases, these results will not be realized if persons do not adhere to their regular practice. Finding ways to keep patients engaged in stress management programs has become increasingly important among clinicians as they deal with more and more patients suffering from the effects of chronic stress. The area of health behavior economics must be advanced to further illuminate the reasoning behind patients‟ health decisions, as results of studies in this line of inquiry are mixed, indicating that the theory may not yet be fully developed (Chapman et al., 2001).

Another factor that may be important in predicting adherence pertains to the type of stress management method selected and how well it matches with the client‟s stress response profile. There is a large body of research examining attempts to match psychological treatments to client