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**Stress, Health, and Mindfulness:
Exploring Relationships and Mechanisms
Using Self-Report Measures**

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Abstract

The relationship between stress and physical health has been well established in the medical and psychological literature. Mindfulness meditation is a practice that has been successfully used to reduce stress in several populations, and the construct itself has recently begun to be measured as a naturally occurring characteristic. A recent study demonstrating the significant relationships between mindfulness, stress, and physical health prompted the investigation in the present study of the possible mechanisms underlying these relationships. It was hypothesised that the relationship between mindfulness and physical health would be largely mediated by stress, and that in addition, mindfulness would explain a significant proportion of the variance in health after stress had been accounted for. Participants were 129 undergraduate students who completed a battery of self-report questionnaires including the Perceived Stress Scale, the Short-Form 36 Health Survey, and two recently developed measures of mindfulness; the Mindful Attention and Awareness Scale and the Kentucky Inventory of Mindfulness Skills. Perceived stress was shown to account for a large proportion of the relationship between mindfulness and health, and mindfulness was also shown to explain a significant proportion of the variance in physical health after stress had been controlled for. An additional finding was that acceptance demonstrated stronger relationships with both physical and mental health than any of the other components of mindfulness studied. Potential mechanisms of mindfulness that may help explain these findings are discussed.

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Introduction

A vast number of studies over several different disciplines have been conducted with the aim of understanding more about stress and how it affects human beings. Many negative effects have been demonstrated by stress, and numerous treatment approaches have been developed in an attempt to reduce or prevent these ill effects. One approach to have emerged in psychology relatively recently with promising initial results is mindfulness meditation, a practice involving the non-judgemental observation of what is occurring in the present moment. The present study aims to explore the relationships between stress, health, and general level of mindfulness, and further investigate the validity of two recently developed psychometric measures of mindfulness.

Stress

Hans Selye (1956) describes stress as essentially the process by which the body responds to external demands (“stressors”). Some of the internal changes that can occur are signs of damage as the body attempts to respond to the stressors, while others are evidence of the body’s adaptive reactions to the demands (Selye, 1956). In order to explain the body’s response to sustained and unrelenting stress, Selye introduced a three phase model called “general adaptation syndrome” (GAS). During phase one of the GAS model (the alarm reaction) the autonomic nervous system is activated by the stress. If the stress is too powerful for the system to adapt to, gastrointestinal ulcers form, the adrenal glands become enlarged, and the thymus begins wasting away. Phase two (the resistance phase), is characterised by either the occurrence of damage, or the organism’s adaptation

to the stress. The last phase is that of exhaustion, where the organism either dies or suffers irreversible damage as a result of the ongoing stress (see Figure 1).

Phase 1	Phase 2	Phase 3
The Alarm Reaction	Resistance	Exhaustion
<i>ANS activated by stress</i>	<i>Damage occurs or organism adapts to stress</i>	<i>Organism dies or suffers irreversible damage</i>

Figure 1. Three phase model of stress (“General Adaptation Syndrome”) developed by Hans Selye, (1956).

Selye proposed that the stress response evolved as an adaptive process, but that severe or prolonged stress could lead to tissue damage or disease. McEwen (1998) used the term “allostatic load” to describe this process, and defined allostatic load as the effect of excessive exposure to the physiological stress response (McEwen, 1998). Selye’s consideration of stress as a *response* to environmental conditions was not universally accepted by researchers in the field of stress however, as criteria for stressful conditions were not able to be clearly defined. Using this conceptualisation, any event that could cause a physiological response in the form of a stress reaction would be defined as a stressor, although several events that would not be considered stressful (e.g. anticipating a pleasurable event) can cause these same responses. As a result, several theorists began to look upon stress as a *stimulus*, and identified it with a variety of

objective events or environmental conditions (e.g. electric shock, catastrophic life events, uncontrollable stimuli, sleep deprivation, and daily hassles). Psychometric instruments made up of lists of such events (Social Readjustment Rating Scale, Holmes & Rahe, 1967; Assessment of Daily Experience, Stone & Neale, 1982) began to enter the psychological literature as measures of stress. Problems are also evident with the definition of stress as a stimulus however, as research has since demonstrated that not all individuals exposed to the same “stressful” events experienced negative effects of stress (Wheaton, 1990).

According to Lazarus (1966) the way an individual cognitively appraises an environmental situation determines whether or not they will show a physiological stress response. Lazarus theorised that a person experiences the effects of stress when they perceive the demands of a situation to be beyond their perceived resources (Lazarus, 1966). Several psychological studies have been conducted investigating this relationship, and the majority have found that perceived stress is a better predictor of poorer health outcomes than exposure to particular stressors (Brosschot, Godaert, Benschop, Olf, Ballieux, & Heijen, 1998, Lazarus & Folkman, 1984).

Assessment of Stress

In response to the need for a measure that investigated an individual’s perceived level of stress, Cohen, Karmarck, & Mermelstein, (1983) developed the Perceived Stress Scale (PSS). Unique in that it is the only measure of perceived stress developed for use with a general population, the PSS is now a widely used and well-validated measure that is used to obtain a subjective report of an individual’s experience of feelings and

behaviours related to stress over the past four weeks. A 14 item test with answers rated on a 5-point Likert scale, the PSS has good psychometric properties, with the authors reporting coefficient alpha reliabilities of .84, .85, and .86 in each of three samples. Concurrent and predictive validity has also been shown with studies demonstrating significant positive relationships between the PSS scores and number and impact of life events, depressive symptoms, and social anxiety, and prediction of the utilisation of health services (Cohen et al., 1983).

Stress and Health

The work by both Selye and Lazarus demonstrate the major mechanisms by which stress can affect physical health. Selye established that a series of non-specific negative physiological effects can arise when an organism is placed under severe or sustained stress, and Lazarus demonstrated how an individual's appraisal of an environmental condition as stressful or not determines whether a stressor is present. The specific effects of stress on health have been a major topic of research for several years now, and as a result the effects of stress on physical health are well known and accepted in medical and psychological literature (see Schneiderman, Ironson, & Siegel, 2005; and Dougall & Baum, 2001, for reviews). Such effects have been shown to include reduced immunity, (Cohen, Doyle, Skoner, Frank, Rabin, & Gwaltney, 1998; Cohen, Tyrell, & Smith, 1991; Cobb & Steptoe, 1996) increases in atherosclerosis (a precursor to cardiovascular disease) in animals (Kaplan et al. 1982), and increased risk of cardiovascular disease, (Yusuf, Hawken, & Ounpuu, 2004; Black, 2003) and hypertension (Ironson, 1992) in humans, increased insulin resistance, (Black, 2003) and increased likelihood of

headaches (De Benedittis, Lorenzetti, 1992) and other forms of chronic pain (Bomholt, Harbuz, Blackburn-Munro, Blackburn-Munro, 2004). Chronic diseases are now a major cause of death and disability in developed countries (World Health Organization, 2005) and many such illnesses are exacerbated by stress (Leserman, Pettito, Golden, Gaynes, Gu, & Perkins, 2000; Lutgendorf, Antoni, Ironson, Fletcher, Penedo, Van Riel, 1995; Mohr, Hart, Julian, Cox, Pelletier, 2004).

Stressful conditions and circumstances are also associated with higher rates of behaviours that often contribute to poorer health outcomes, such as smoking, substance use, and disordered eating. Populations who live in environments characterised by higher levels of stress have higher rates of smoking than the general population, and increased mortality from lung cancer and chronic obstructive pulmonary disorder (Colby, Linsky, & Straus, 1994). A longitudinal study that examined this phenomenon more specifically showed that Navy seamen from the United States smoked more cigarettes on days of high stress (Conway, Vickers, Ward, & Rahe, 1981). Stressful life events and chronically stressful life conditions have also been linked to the onset of bulimia (Welch, Doll, & Fairburn, 1997), and higher consumption of alcohol (Linsky, Strauss, & Colby, 1985), and it has been proposed that alcohol may be used as self-medication by people experiencing stress-related disorders such as anxiety (Zimmerman Wittchen, Hofler, Pfister, Kessler, & Lieb, 2003). An illustrative prospective community study by Zimmerman et al. (2003) of over 3000 adolescents and young adults showed that those with certain anxiety disorders (social phobia and panic attacks) were more likely to go on to develop problems of abuse or dependence on alcohol or other substances over a four year follow-up period. Together, these studies illustrate numerous

pathways by which stress can lead to negative effects on the human body and reduce overall health.

Assessment of Health

Although current health status in most western societies is usually determined by objective testing, self-report instruments are widely used to assess current health status in the general population for clinical and research purposes. Subjective measures such as questionnaires on health perceptions have demonstrated predictive validity of morbidity and mortality rates (Idler & Angel, 1990; Idler & Kasl, 1991; Wolinsky & Johnson, 1992), and changes in disability (Ferrero, Farmer, & Wybraniec, 1997; Idler & Kasl, 1995, Wilcox, Kasl, & Idler, 1996) and are thus perceived and used as valid measures of generic health status. One widely used health assessment tool that has been normed on several populations, including New Zealanders, is the Short-Form 36 Health Survey (SF-36) (Ware, & Sherbourne, 1992; Scott, Tobias, Sarfati, & Haslett, 1999). It is a 36-item instrument including eight different subscales designed to measure four facets each of physical and mental health (general health, physical functioning, bodily pain, role limitations due to physical health problems; and vitality, emotional well-being, social functioning, and role limitations due to personal or emotional problems). Each subscale contributes to a compound score of either physical or mental health, and these scores are combined to create a score reflecting overall health.

Studies examining the psychometric properties of the SF-36 indicate good reliability, with the authors reporting Cronbach's alpha coefficients of over .8 for all scales of the SF-36 apart from social functioning, which was .76 (Jenkinson, Coulter, & Wright,

1993). Studies have found the SF-36 is also more sensitive to lower levels of dysfunction and disability than other commonly used measures, making it more suitable for use with general non-medical populations (Ware & Sherbourne, 1992). Several research articles on the validity of the SF-36 have been published, and independent researchers report that content validity compares favourably with other widely used generic health surveys (McDowell & Newell, 1996). Scott et al. (1999) report that the SF-36 demonstrates satisfactory psychometric performance in a New Zealand population, including appropriate factorial structure in which the two factor orthogonal solution (physical and mental health subgroups) explained 67% of the variance in the data. The pattern of factor loadings was also reported as similar to that of US (Ware, Kosinski, & Keller, 1994) and Western European (Ware, Kosinski, & Gandek, 1998) population samples. The SF-36 also reflected the New Zealand population subgroup disparities seen in objective measures of health, though to a lesser degree, adding to the validity of this instrument as a measure of general health in this population (Scott et al., 1999).

Meditation and Stress Reduction

The serious consequences of stress on health described above emphasise the need to develop effective ways to reduce the impact of stress on individuals, and unsurprisingly many methods within the field of psychology and other disciplines have been developed to realise this aim. One particular method, meditation, has been used for many years for this purpose (Miller, Fletcher, & Kabat-Zinn, 1995). One particular type of meditation, Mindfulness, has emerged in the medical and psychological literature as an effective

treatment for psychological and physiological symptoms of stress (see Grossman, Niemann, Schmidt, & Walach, 2004; and Smith, Richardson, Hoffman, & Pilkington, 2004, for reviews).

Mindfulness has been described as the act of “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 1994, p. 68) and “bringing one’s complete attention to the present experience on a moment-to-moment basis” (Marlatt & Kristeller, 1999, p. 4.). As a practice, mindfulness involves cultivating conscious awareness of internal and external phenomena through sustained attention to observable internal and external events (e.g. thoughts, symptoms of physiological arousal, tactile sensations). The roots of mindfulness lie in Eastern contemplative traditions, particularly Buddhism. Although it has been called the “heart” of Buddhist meditation (Kabat-Zinn, 2003; Thera, 1962), mindfulness is not a fundamentally esoteric or religious concept (Grossman et al, 2003). It is potentially available and applicable to all people (Kabat-Zinn, 2003).

Although mindfulness has existed for many centuries in contemplative traditions, this practice was incorporated into the field of psychology relatively recently. An intervention originally developed by Jon Kabat-Zinn (1982) for use with chronic pain patients, Mindfulness-Based Stress Reduction (MBSR), attracted considerable attention after several treatment outcome studies demonstrated the efficacy of the approach for this population (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987). The Mindfulness-Based Stress Reduction program is an 8-10 week group therapy course that focuses on gradually increasing participant’s ability to sustain mindful awareness, or mindfulness, in everyday life. Participants in

groups of about 30 meet weekly for 2-2.5 hours where they receive instructions in and the opportunity to practice mindfulness meditation skills, as well as discussion on stress and coping, and homework assignments. Mindfulness is taught using several different exercises. A 45-minute body scan exercise is used in which participants lie down with their eyes closed and direct their attention to each part of the body in turn, carefully observing the physical sensations occurring there at that time. Participants also engage in a sitting meditation, in which they sit up in a wakeful posture and attend to the sensations of their breathing. Hatha yoga postures are also used to teach mindfulness of bodily sensations during gentle movements and stretching. Participants are also encouraged to practice mindfulness during ordinary activities such as walking, standing, and eating. Groups in MBSR programs are also instructed to practice these skills outside group meetings for at least 45 minutes a day, six days a week. After about six weeks, an intensive 7-8 hour mindfulness session is held where participants spend an entire day engaging in the practice.

Since initial studies of the effectiveness of MBSR that suffered from methodological problems such as lack of control group, MBSR has been evaluated more rigorously in randomised controlled trials, and is associated with substantial reductions in psychological morbidity associated with medical illness (Reibel, Greenson, Brainard, & Rosenzweig, 2001; Speca, Carlson, Goodey, & Angen, 2000; Carlson, Ursuliak, Goodey, Angen, & Speca, 2001). Mindfulness-based approaches have also been successfully used in the treatment of behavioural and emotional disorders of which distress is often a component, including borderline personality (Linehan, Armstrong, Saurez, Allmon, & Heard, 1991), generalised anxiety (Roemer & Orsillo, 2002; Wells,

1999), and post-traumatic stress disorder (Wolfsdorf & Zlotnick, 2001). Treatment approaches incorporating mindfulness have also been introduced and used successfully for other psychological difficulties including recurrent depression (Teasdale, Segal, Williams, Rudestam, & Lau, 2000), substance abuse (Marlat, 2002), and eating disorders (Kristeller & Hallett, 1999; Telch, Agras, & Linehan, 2001).

Mindfulness and Physical Health

The use of mindfulness in medical populations has focused mainly on reducing the symptoms of psychological stress and morbidity that often occur alongside serious medical conditions, however recent findings suggest that mindfulness practice may potentially influence physical health. Physical differences observed after training and practice in mindfulness include reduced cardiopulmonary and gastrointestinal symptoms in individuals receiving conventional treatment for cancer (Specia, Carlson, Goodey, & Angen, 2000), increased clearing of skin during phototherapy and photochemotherapy in psoriasis patients (Kabat-Zinn, Wheeler, Light, Skillings, Scharf, Cropley, et al., 1998; Bernhard, Kristeller, & Kabat-Zinn, 1988), and decreased ratings of pain in chronic pain patients (Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn, Lipworth, Burney & Sellers, 1987). The impact of mindfulness meditation on immunity has also recently begun to be measured, and has shown some promising effects; including increased antibody titers in response to influenza vaccinations (Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller, Santorelli, et al., 2003), decreases in the suppressive influence of strenuous physical activity on the immune system (Solberg, Halvorsen, Sundgot-Borgen, Ingjer, & Holen, 1995), and changes in lymphocyte and cytokine cells

in individuals diagnosed with depression to an immune profile less consistent with that of a depressed person (Carlson, Speca, Patel, & Goodey, 2003). Such findings suggest that mindfulness interventions may have a wider applicability to well-being than originally believed, and have been followed with literature theorising the mechanisms of action underlying mindfulness-based interventions (Shapiro, Carlson, Astin & Freedman, 2006).

Mechanisms of Mindfulness

Bishop, Lau, Shapiro, Carlson, Anderson, & Carmody, et al. (2004) proposed an operational definition of mindfulness comprising two components reflected in generally accepted definitions – self-regulation of attention, and an orientation to experience characterised by curiosity, openness, and acceptance. Shapiro, et al. (2006) further separate these components into three elements; intention, attention, and attitude, which they believe encapsulate the moment-to-moment process that is mindfulness. Shapiro et al. (2006) propose that from these three elements (or “axioms”) a fundamental shift in perspective arises, which they term “reperceiving”. Reperceiving is defined as the ability to disidentify from the content of one’s consciousness (e.g. thoughts and emotions) and thereby perceive one’s moment to moment experience with a greater degree of clarity and objectivity. This is contrasted with detachment, which is described as distancing from one’s experience to the point of numbness or apathy. Shapiro et al. (2006) explain that the process of reperceiving simply allows a person to “deeply experience each event of the mind and body without identifying with it or clinging to it”. From this shift in perspective, Shapiro et al. (2006) highlight four additional mechanisms that may

contribute to positive outcomes in mindfulness practice: 1) self-regulation and self-management, 2) emotional, cognitive, and behavioural flexibility, 3) values clarification and 4) exposure.

Mindfulness Mechanisms and Stress Reduction. As outlined above, mindfulness has been used extensively as a method of stress reduction, and several of the above mechanisms relate directly to stress. Exposure to distressing observable internal and external can stimuli serve to create tolerance through desensitisation to such stimuli, decreasing the level of stress associated with them (Baer, 2003). Increases in self-regulation and emotional, cognitive, and behavioural flexibility allow for more adaptive responses to stressful situations/stimuli as habitual responses to stress are interrupted, and access to a wider range of coping responses is created (Shapiro et al. 2006). Lazarus and Folkman (1984) define coping as “constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus and Folkman, 1984, p. 141). Mindfulness may therefore aid in coping by facilitating more flexible and adaptive responses to environmental demands, through increasing one’s ability to see the present situations as they are in this moment and “to respond accordingly, instead of with reactionary thoughts, emotions, and behaviours triggered by prior habit, conditioning, and experience” (Shapiro et al. 2006, p. 381).

Mindfulness Mechanisms and Health. As the relationship between stress and health has been well established, and mindfulness interventions have demonstrated

effectiveness in reducing health, a strong argument for the effects of mindfulness on health is through the reduction in stress. Another mechanism has been proposed by which mindfulness may affect health in a more direct way (Shapiro & Schwartz, 1999, 2000). The relationship of mindfulness to self-regulation and self management occurs through the capacity of active mindful awareness to increase an individual's ability to attend to bodily and environmental processes, and adjust their behaviour as is required to maintain optimal health (Shapiro et al., 2006). Self-regulation is described as the process by which systems maintain functioning through monitoring and feedback loops, the information from which is used to facilitate successful adaptation to change (Shapiro and Schwartz, 1999, 2000). According to Shapiro and Schwartz, intention and attention serve to enhance these feedback loops and generate better health:

intention → attention → connection → regulation → order → health

Figure 2. Self-regulation mechanism of mindfulness as described by Shapiro and Schwarz, (1999).

Intentionally cultivating non-judgemental awareness through attention creates connection with the body, which in turn leads to self-regulation, and ultimately to greater order and health (Shapiro and Schwartz, 1999, 2000). According to this model increased attentiveness to one's physical sensations allows a connection to take place, in which an individual becomes consciously aware of all of their physical experiences, however subtle these may be. As a result of the increased information gained through

this conscious awareness, an individual is better equipped to respond in a self-regulatory manner that restores order to their physical system. This basic idea has been explained in terms of the effects of mindfulness on chronic pain patient's experiences and responses to pain. As Kabat-Zinn (1990) describes, increased ability to recognise the early signals of pain allows a person to use that information to choose to behave in ways that are less likely to make the pain worse, or more likely to decrease it. The application of mindfulness to binge-eating disordered populations further illustrates this point. Clinical studies exploring the effects of a mindfulness-based intervention for individuals diagnosed with binge eating disorder showed that by learning to bring mindful awareness to their everyday experiences, including eating, this population was less likely to engage in as many binge eating episodes, and ingested a reduced quantity of food when they did overeat (Kristellar & Hallet, 1999; Telch, Agras, & Linehan, 2001). Although different populations with alternative treatment goals, what these applications demonstrate is the self-regulatory effect that can arise when full attention is given to bodily sensations (pain, hunger/satiation) and the behaviours associated with those sensations. Such attention theoretically improves an individual's ability to maintain order and health by increasing their capacity to self-regulate, a hypothesis that has received initial empirical support in a study examining the relationship between mindfulness and self-regulated emotion and behaviour (Brown & Ryan, 2003).

Assessment of Mindfulness

Although mindfulness has largely been studied as an intervention, recent studies have emerged examining mindfulness as a naturally occurring characteristic (Brown & Ryan,

2003; Baer, Smith, & Allen, 2004). This initial research has shown that individual differences in general tendency to be mindful do exist, and that self-report questionnaires appear to be a useful way to measure this construct (Brown & Ryan, 2003; Baer et al., 2004).

In the past five years, several such mindfulness measures have been developed and included in the psychological literature (Brown & Ryan, 2003; Buchheld, Grossman, & Walach, 2001; Baer et al., 2004). To date, these measures have been mainly examined in terms of their correlations with measures of psychological wellbeing (Brown & Ryan, 2003; Baer Smith, Hopkins, Krietmeyer, & Toney, 2006). Mindfulness measures have been found to be positively related to several measures of psychological wellbeing including openness to experience, emotional intelligence, self-compassion, self-esteem, positive affect, life satisfaction, vitality, competence, and relatedness, and negatively related to scales measuring anxiety, angry hostility, depression, self-consciousness, impulsiveness, vulnerability, neuroticism, and negative affect (Brown & Ryan, 2003; Baer et al, 2006). With significant correlations in expected directions ranging from .15 (MAAS with NEO-Personality Inventory Openness to Experience scale; Costa & McRae, 1992) to .74, (Describe subscale of the KIMS with the Toronto Alexithymia Scale; Bagby, Parker, & Taylor, 1993; Bagby, Taylor, & Parker, 1993) and averaging .29 (average of the correlations with psychological constructs reported in Baer et al., 2004 and Brown & Ryan, 2003). This is a similar pattern to the outcomes of studies using mindfulness as a stress-reduction treatment, as individuals receiving mindfulness treatment have shown significantly lower scores on total mood disturbance, depression,

anxiety, anger, and confusion, and less emotional irritability and cognitive disorganisation (Speca, Carlson, Goodey, & Angen, 2000).

Several different instruments for the measurement of mindfulness have recently become available. The major differences between them lie in the populations they were designed for (those with prior experience of meditation and those without), and the information they seek. The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), the Cognitive and Affective Mindfulness Scale (CAMS; Feldman, Hayes, Kumar, & Greeson, 2004) and the Freiberg Mindfulness Inventory (FMI; Buchheld et al., 2001) were all designed to measure general level of mindfulness. The fifth available instrument is the Mindfulness Questionnaire (MQ; Chadwick, Hember, Mead, Lilley, & Dagnan, 2005), which was designed to assess a mindful approach to distressing thoughts or images.

Of the scales that were developed to measure an individual's general level of mindfulness, three have been designed for use with a population with no previous experience in mindfulness; the MAAS, the KIMS and the CAMS. An important difference exists between these measures in the conceptualisation of the mindfulness construct they operate from. The KIMS and the CAMS both conceptualise mindfulness as a multifaceted construct, and contain subscales on all of the aspects of mindfulness listed in generally accepted definitions in the psychological literature. The KIMS was particularly influenced by the literature by Linehan, as her writings have included the most behaviourally based descriptions of mindfulness (Linehan, 1993a, 1993b; Dimidjian & Linehan, 2003). The subscales drawn from the various definitions are

generally reflective of these, and include acceptance, observation, describing, non-judging, and non-reacting (Baer et al., 2004; Feldman et al., 2004). These aspects are either measured individually (as in the KIMS) or grouped together to yield a single total score (as in the CAMS). In contrast, the Mindful Attention and Awareness Scale conceptualises mindfulness as a uni-dimensional construct, in which the degree to which a person acts with awareness in their daily life is seen as the most accurate measure of their general level of mindfulness (Brown & Ryan, 2003).

There has been some disagreement in the literature about the usefulness of measuring mindfulness as a uni or multi-dimensional construct. Brown and Ryan (2004) do not dispute that mindfulness contains elements such as acceptance, but they argue that acceptance is subsumed within a person's ability to live in the present moment, as it is impossible to be present and act with awareness in a given situation and at the same time fail to accept it (Brown & Ryan, 2004). Baer et al. (2004) on the other hand have emphasised Smith, Fischer & Fister's (2003) point that the validity of the assessment of multifaceted constructs is improved when each facet is identified and measured separately.

Kentucky Inventory of Mindfulness Skills. The KIMS is a 39-item measure of mindfulness with four scales measuring different aspects of the construct; Observing, Describing, Acting with Awareness (the aspect that the MAAS measures exclusively), and Accepting with Judgement. Example items include "I notice when my moods begin to change" (observe), "I'm good at finding words to describe my feelings" (describe), "When I do things, my mind wanders off and I'm easily distracted" (acting with awareness) and "I tell myself I shouldn't be feeling the way I'm feeling" (accepting

without judgement). The items in the KIMS were assessed almost solely by mindfulness therapists with a background in Dialectical Behaviour Therapy (Linehan, 1993a). These practitioners categorised and rated each item in terms of its fit into each particular subscale, and only those items with very high inter-rater agreement of quality and good fit were retained. Internal consistency testing was then conducted, and alpha coefficients for Observe, Describe, Act with Awareness, and Accept without Judgement were .85-.91, .84-.86, .76-.83, and .87 respectively. Intercorrelations between the KIMS subscales have demonstrated that although most of the scales are correlated positively in the expected direction, the Observe and Acceptance subscales were significantly negatively correlated. A principal components factor analysis specifying that four factors be identified was carried out during development after an initial exploratory analysis yielded nine factors with eigenvalues over 1, accounting for 63% of the variance. The second analysis was reported to clearly support the four factor structure, and the four principal components identified explained 43% of the variance in data.

Mindful Attention and Awareness Scale. The Mindful Attention and Awareness Scale is a 15-item measure of attention to and awareness of present-moment experiences in daily life. Items are framed so as to capture experiences that are the opposite of mindfulness, which are then reverse scored, so that higher scores reflect higher levels of mindfulness. Examples of questions include: 'I rush through activities without being really attentive to them' 'I drive places on "automatic pilot" and then wonder why I went there' and are rated on a 6-point Likert scale from almost always to almost never.

The MAAS has demonstrated good reliability, with Cronbach's alpha coefficients reported at .82 and .86 in separate studies (Brown & Ryan, 2003; Baer et al., 2006 respectively) and test-retest reliability of .81 reported by the authors. Evidence for criterion validity of the MAAS has emerged through studies conducted by the authors in which scores on the mindfulness measure were compared between a sample of Zen meditators and a sample of people from the general population. Those who had been actively practicing mindful awareness scored significantly higher on the MAAS than those from the general population (Brown & Ryan, 2003). Construct validity of the MAAS has been evidenced by expected significant positive and negative relationships with a variety of psychological constructs measured by well validated psychometric scales, and related significantly positively to scales measuring openness to experience, clarity, attention, and repair of mood, flexibility, novelty seeking, and engagement, internal state awareness, and negatively to scales measuring public self-consciousness, social anxiety, rumination, and absorption, (Brown & Ryan, 2003). Particularly relevant to this study is that the MAAS has also been shown to have a significant negative relationship with stress (Brown & Ryan, 2003). The Symptoms of Stress Inventory (SOSI; Leckie & Thompson, 1979) was used as a measure of psychological stress in a study in which Brown and Ryan (2003) found a significant negative correlation of .46 between this measure and the MAAS.

The MAAS is also the only measure of mindfulness that has been studied in relation to physical health. The authors found that higher mindfulness scores using the MAAS were associated with lower levels of somatisation, fewer physical symptoms, and fewer visits to medical practitioners in the preceding 21 days. This important finding provides

preliminary support for the hypothesis that health should be positively related to mindfulness. The central aim of this study is to explore this relationship in more detail, and determine to what degree it may be mediated by stress.

Summary

The relationship between stress and physical health is well established and widely accepted in both the medical and psychological communities. The negative effects of the former on the latter have been researched in a variety of ways, and resulting findings indicate that the reduction of stressful states is advantageous for the healthy physical functioning of individuals. Mindfulness meditation is an approach to the reduction of stress that has been increasingly used in recent years to successfully reduce stress and distress in a variety of populations. A state of being that involves sustained non-judgmental awareness of internal and external observable phenomena, recent studies have demonstrated that individuals differ in their general tendency to be mindful in everyday life. Psychometric instruments have recently been developed to measure this construct, and such tests have been shown to be positively correlated with several measures of psychological wellbeing. One study conducted during development of the Mindful Attention and Awareness Scale has shown that mindfulness relates significantly and negatively to both stress and measures of poor physical wellbeing including reported physical and somatic symptoms, and recent visits to medical practitioners.

Initial hypotheses of this study then are that mindfulness measures will be negatively correlated with stress (as measured by the Perceived Stress Scale) and positively correlated with physical health (as measured by the Total Physical Health score on the

SF-36). Provided the expected relationships have been established, the first main aim of this study is to determine to what degree this relationship is mediated by stress. As higher levels of stress have been associated with poorer health outcomes, and mindfulness has been used as a treatment primarily to reduce stress and distress, it is expected that a significant proportion of the relationship between general level of mindfulness and physical health will be mediated by stress.

The second main hypothesis of this study is that mindfulness will explain a significant proportion of the variance in physical health after stress has been accounted for. The aim of this investigation is to determine whether there is any evidence that there may be another mechanism of mindfulness (besides stress reduction) partially responsible for the mindfulness-health relationship. Self-regulation is one such mechanism, and is the only one of those proposed to date that appears to have the potential to relate directly to physical health. This study is not designed to determine whether self-regulation is in fact the mechanism besides stress that explains the relationship to health (if in fact there is one). Rather the aim is to simply determine whether stress-reduction is the main mechanism responsible for the relationship, and explore the possibility that there may be more than one mechanism of mindfulness partially responsible for this relationship.

By using the only multi-dimensional measure of mindfulness to date that yields separate scores for each facet of the construct (the Kentucky Inventory of Mindfulness Skills), particular aspects of mindfulness will be able to be examined for their degree of correlation with measures of physical health. It is expected that as the only facet of mindfulness to date that has been studied directly in relation to health (the Act with

Awareness subscale of the KIMS), will be significantly positively correlated with physical health. As components of the same mindfulness construct, it is expected that the other subscales will also show positive correlations with physical health. The Mindful Attention and Awareness Scale will also be included in this study in an attempt to replicate and expand upon earlier findings by MAAS developers, and determine which of the mindfulness measures demonstrate the highest correlations with physical health. The two primary aims of this study rest on assumptions that two other hypotheses be initially met; that findings for both scales replicate earlier findings by the MAAS developers in which mindfulness level was shown to be negatively related to stress, and positively related to physical health. These relationships have not been demonstrated using the KIMS to date, and so hypotheses follow from findings expected for the MAAS. Although the KIMS has not yet been examined in terms of its relationship to measures of stress, one particular aspect of mindfulness included as one of its subscales, acceptance, has recently begun to be studied in relation to stress. Several laboratory experiments investigating the effects of acceptance vs. suppression methods of coping with various stressors (for example cold pressor task, upsetting film clips) have demonstrated that the use of acceptance methods leads to increased tolerance of stressful stimuli (Feldner, Zvolensky, Eifert, & Spira, 2003; Hayes, Bissett, Korn, Zettle, Rosenfarb, Cooper et al., 1999; Levitt, Brown, Orsillo, & Barlow, 2004). The Acceptance subscale of the KIMS is therefore expected to be particularly negatively related to stress.

Another aim of the present study is to attempt to address the debate in the literature about whether or not to explicitly include items on acceptance in measures of

mindfulness. As a uni-dimensional measure, the MAAS includes only questions related to acting with awareness (one of the subscales of the KIMS). Original developers of the MAAS state that it is unnecessary to include separate acceptance items in a mindfulness measure such as the MAAS, as acceptance is subsumed within the construct. To test this, the Acceptance subscale of the KIMS will be entered into a regression equation predicting mental health after the Mindful Attention and Awareness Scale to determine whether acceptance explains any more of the variance in mental health than the MAAS alone. Mental health is the selected variable because to date most of the research involving mindfulness measures has been related to mental health (or psychological wellbeing) and not to physical health.

One final aim of this study is to further explore the reliability and validity of the two recently developed mindfulness measures by attempting to replicate findings by the authors during development. Specifically, it is expected that mindfulness measures will be significantly positively correlated with the mental health subscales of the SF-36, and will relate to one another in similar ways to those already reported. In particular the MAAS is expected to correlate more highly with the Act with Awareness subscale of the KIMS than any of the others.

Summary of Hypotheses

Initial Hypotheses

The two mindfulness measures will be negatively related to stress and positively related to physical health

Main Hypotheses

The expected relationship between mindfulness and physical health will be mainly accounted for by stress

Mindfulness will explain a significant proportion of the variance in health after stress has been controlled for

Secondary Hypotheses

Earlier findings by MAAS and KIMS developers will be replicated in that:

These measures will be significantly correlated with one another, particularly the Act with Awareness subscale of the KIMS and the MAAS total score

Both measures will be positively correlated with mental health

Method

Participants

Participants in this study were 129 undergraduate students enrolled in first year psychology papers at the University of Waikato. Of these, 19 students were male (15%) and 110 were female (85%), and participant's ages ranged from 18 to 47, with a mean age of 23.5. Sixteen of the participants in this study identified themselves as NZ Maori, 75 identified as NZ European or Pakeha, 12 reported Asian origin, three reported Pacific Island descent, four identified European descent, 10 described their ethnicity as New Zealander or New Zealand Kiwi, five identified with other ethnic groups, and four did not report an ethnicity.

Materials and Scoring

Participants completed a battery of psychometric measures comprising four self-report inventories and a demographic questionnaire. The Mindful Attention and Awareness Scale or MAAS (Brown & Ryan, 2003) was one of two measures used to assess participants' general level of mindfulness (see Appendix C, and pp 16-17 of this study's Introduction for further discussion of the MAAS). It contains 15 statements that participants are asked to rate on a 6-point Likert-scale (*Almost Always* to *Almost Never*) the extent to which they act with awareness in everyday activities. None of the items on the MAAS are reversed, and the scores on individual items are simply added together to yield a total score of general level of mindfulness.

Baer et al's (2004) Kentucky Inventory of Mindfulness Skills (KIMS) was the second scale used to measure general level of mindfulness (see Appendix D, and pp 17-18 of the present study's Introduction for further discussion of the KIMS). The KIMS contains 39 items measuring various facets of mindfulness (observing, describing, acting with awareness, acceptance) and participants are required to rate to what degree they feel the statements reflect their experience on a 5-point Likert scale (*Never or very rarely true – Very often or always true*). Scores are obtained by reversing negatively worded items and then summing the individual items that make up each of the four subscales. Totals from each of the subscales are then added together to yield an overall score of general level of mindfulness.

The Perceived Stress Scale (PSS; Cohen, 1983) was used to assess general level of stress (see Appendix E, or pp 3 of Introduction for more detailed discussion of the PSS). This 14 item scale asks participants to rate the extent to they have experienced stress-related thoughts and behaviours over the past four weeks on a 5-point Likert scale (*Never to Very Often*). Scores are obtained by reversing negatively worded items and adding together all resulting numbers to give a single total score of perceived level of stress.

The Short Form-36 Health Survey or SF-36 (Ware & Sherbourne, 1992) is a 36 item measure of general health comprising of eight scales designed to assess different aspects of physical and mental health (see Appendix F). The eight subscales include physical functioning, role limitations due to physical problems, bodily pain, general health, mental health, vitality, role limitations due to emotional problems, and social functioning (see pages 6-7 of the present study for further discussion of the SF-36). As

some of the eight subscales are rated on different scales than others, (for example the physical functioning questions are rated on a 3-point scale and the mental health scale questions are rated from 1-6) in order to make comparisons scores are first converted to percentages. From these, percentage scores are derived for subscale totals, compound subscale totals (physical and mental health), and a total score of overall health. Scores for all dimensions are expressed on a scale of 0-100, where higher scores indicate better health and wellbeing. The authors provide online access to the SF-36 manual, and also provide an online scoring option at www.sf-36.com. Using the online scoring option, data is entered into a spreadsheet, and is then converted by the program into individual item percentages and scale and subscale totals. A brief demographic questionnaire also included in the questionnaire package asked participants to specify their sex, age and ethnicity, for the purposes of describing the sample. Data were recorded, stored and analysed in SPSS version 13.0 for Windows.

Procedure

The proposed research was initially approved by the Ethics Committee for Human Research of the University of Waikato Psychology Department. Students enrolled in first year psychology courses were invited to participate in the study through advertisements (see Appendix A) posted on both online and physical psychology research notice boards. The project was described as a study on “Health and Dealing with Life” and participants were offered a 1% contribution to their overall grade for the paper they were enrolled in on completion of a short battery of questionnaires. Students

were assured the information they contributed would remain confidential, and were given instructions on where to obtain and submit questionnaires.

Questionnaire packages were collected from the Psychology Department office, and completed measures were returned to a separate box in the same location. In order to obtain the 1% credit toward their grade, participants were required to complete a course credit form containing their name, which was detached from the questionnaire and submitted separately. Consent was not explicitly sought on a separate consent form, however it was stated on an introductory information page that consent would be assumed on return of the questionnaire.

The four different instruments used were arranged in varying order so that each measure was presented first, second, third, and fourth an equal number of times and not always before or after the same measure. A cover letter (see Appendix B) was included giving a brief overview of the study area instructions for participation.

Data was collected over a period of four months, and all raw data collected was entered into SPSS version 13.0 for Windows. This programme was then used to calculate scores on the PSS and MAAS according to instructions published by the authors (Cohen et al., 1983; Brown & Ryan, 2003), and the KIMS according to written instructions obtained from the author (R. Baer, 2006, University of Kentucky). The SF-36 was scored using the online programme provided by the authors (www.sf-36.com). Missing data from the MAAS, the KIMS, and the PSS were calculated using an average of the total scores for each respective scale, and data from those participants who failed to answer all items of the SF-36 were omitted entirely as the online scoring programme did not allow for missing values.

Results

Two participants omitted items from the SF-36 questionnaire, and were subsequently removed from all analyses. On the remaining three questionnaires, 27 participants omitted at least one question from the PSS, the MAAS or the KIMS, and missing values for these were calculated through averaging the scores on the rest of the items. Data from participants who had failed to answer three or more questions from any one entire scale were deleted from the study for validity reasons, leaving a total of 119 individual data sets for analysis. All analyses using this data set were conducted using the statistics program SPSS Version 13.0 for Windows. The SPSS program was then used to calculate participants' scores on each of the measures to create summary data, consisting of single total scores on the MAAS and PSS, four KIMS subscale and total scores, and the eight SF-36 subscales, two compound subscale totals (physical and mental health), and overall total score. The total distributions of scores on each measure were then tested for normality and internal consistency (reported on Tables 1 and 2), and scale intercorrelations were obtained and a factor analysis performed on the KIMS data. Results for each individual measure are outlined in the following paragraphs.

Perceived Stress Scale

The Kolmogorov-Smirnov statistic was used to test normality for all of the measures, with an alpha level of .05 used as the criterion for determining whether a population was normally or non-normally distributed. Scores for the PSS were found to be normally

Table 1

Descriptive Statistics for the General Health Measures

Measure	Mean \pm SD	Range (Min – Max)	Possible Range	Internal Reliability (Cronbach's Alpha)
Perceived Stress Scale	25.39 \pm 7.44	5 - 41	0 - 56	0.809
SF-36 Total	68.62 \pm 17.58	23 - 96	0 - 100	0.925
Total Physical Health	71.42 \pm 16.36	27 - 96	0 - 100	0.888
General Health	86.91 \pm 17.09	15 - 100	0 - 100	0.807
Physical Functioning	79.29 \pm 30.22	0 - 100	0 - 100	0.869
Role Physical	71.17 \pm 25.98	0 - 100	0 - 100	0.794
Bodily Pain	70.43 \pm 23.63	13 - 100	0 - 100	0.812
Total Mental Health	62.26 \pm 19.89	20 - 93	0 - 100	0.893
Role Emotional	63.42 \pm 27.22	0 - 100	0 - 100	0.776
Social Functioning	55.03 \pm 20.67	10 - 100	0 - 100	0.685
Vitality	57.05 \pm 38.38	0 - 100	0 - 100	0.851
Mental Health	65.17 \pm 19.27	16 - 96	0 - 100	0.838

distributed, and mean and standard deviations are reported in Table 1 along with internal reliability coefficient Cronbach's alpha. Nunnally (1978) recommends a Cronbach's alpha level of .8 or greater as an indication of good internal consistency. Cronbach's alpha for the PSS was .8. The mean PSS score in this sample was 25.4, and the range obtained was fairly close to the possible minimum and maximum scores.

Short Form-36 Health Survey

Means, standard deviations, range obtained and possible range for each subscale and total SF-36 score are reported in Table 1, along with the Cronbach's alpha internal reliability coefficient for each. As can be seen in Table 1, mean scores obtained for the mental health subscales were lower than those obtained for the physical health subscales, which were all skewed toward the more positive end of the range of scores. Minimum and maximum scores for each subscale were very close to those possible.

The Kolmogorov-Smirnov statistic showed that all of the subscales of the SF-36 related to physical health were significantly skewed towards higher levels of health. Due to this finding, the non-parametric equivalent of the Pearson's correlation coefficient (Spearman's rho) was also used in the correlational analysis of data from those SF-36 scales related to physical health (general health, physical functioning, role physical, bodily pain, and the total physical health score). The correlations found using Spearman's rho were almost no different from those found using the parametric coefficient Pearson's r. In particular, correlations that were statistically significant with the Spearman's were also significant with the Pearson's r, and those that were non-significant with the non-parametric test were also non-significant with the parametric

one, with a single exception; the correlation between the Observe subscale of the KIMS and the General Health subscale of the SF-36. The Spearman's rho showed that the positive correlation between the two was non-significant, whereas the Pearson's showed this positive relationship to be significant. For this reason the correlation between these two scales will be accepted as non-significant. With the exception of this one result, findings indicated that the parametric correlation coefficient used here (the Pearson's r) was generally robust against departures from normality, and so only the statistically more powerful Pearson's correlations will be reported here.

As numerous studies have demonstrated the factorial validity of the SF-36, and the measure has been found to be acceptable for use with a New Zealand population, (Scott et al., 1999) a factor analysis was not performed on the SF-36.

Mindful Attention and Awareness Scale

Data for the MAAS were found to be normally distributed ($K-S = .073$). The average total score for the sample was 57.6, and the standard deviation 11.8 (as reported in Table 2). Reliability testing showed a Cronbach's alpha coefficient of .87 for the MAAS, demonstrating a very good level of internal consistency. The range of scores obtained was close to the minimum and maximum possible scores for this scale.

Kentucky Inventory of Mindfulness Scale

All four subscales of the KIMS as well as total score were found to be normally distributed. Descriptive statistics and internal reliability for the subscales and total KIMS score are listed in Table 2. Internal consistency of the KIMS was generally high, with all

but one of the subscales (Act with Awareness) showing Cronbach's alpha levels of .8 or above. The Act with Awareness subscale had an internal reliability alpha of .742. As can be seen on examination of the minimum and maximum total possible scores and those actually obtained, participants scored within a significantly restricted range on the KIMS questionnaire. Scores obtained on the Observe, Describe, and Act with Awareness subscales in particular showed high minimum obtained scores, and the Act with Awareness subscale a low maximum obtained score.

Table 2

Descriptive Statistics for Measures of Mindfulness

Scale	Mean \pm SD	Range (Min – Max)	Possible Range	Internal Reliability (Cronbach's Alpha)
MAAS	57.10 \pm 11.77	19 - 83	15 - 90	.866
KIMS Total	121.40 \pm 13.79	91 - 155	39 - 195	.806
Observe	37.45 \pm 7.10	17 - 57	12 - 60	.804
Describe	27.33 \pm 5.76	15 - 40	8 - 40	.855
ActAware	28.30 \pm 5.17	18 - 40	10 - 50	.742
Acceptance	28.31 \pm 6.76	11 - 43	9 - 45	.871

Note. MAAS = Mindful Attention and Awareness Scale; KIMS = Kentucky Inventory of Mindfulness Skills; *N* for total sample = 119.

Intercorrelations between the KIMS subscales are given in Table 3. As the correlation matrix shows, the subscales Observe and Acceptance were significantly negatively correlated ($r = -.287$ $p < .01$). All other correlations between the subscales were in the expected positive direction, with the Describe and Act with Awareness subscales correlating most highly at .289 ($p < .01$).

Table 3

Correlations Between Mindfulness Measures (Pearson's r)

Scale	Observe	Describe	ActAware	Acceptance
MAAS	.090	.389**	.526**	.321**
Observe		.175*	.104	-.287**
Describe			.289**	.165*
ActAware				.140

Note. MAAS = Mindful Attention and Awareness Scale; ActAware = Acting with Awareness; ** = $p < .01$; * = $p < .05$

Although the sample size in this study is smaller than generally accepted criteria for factor analytic study (Comrey & Lee, 1992) the factorial validity of the KIMS has yet to be explored in a New Zealand sample. For this reason, principal axis factoring was used to explore the factorial validity of the KIMS, with oblique rotation used to allow for correlations between the subscales (see Table 4). This method was used to allow for comparisons between the factor loadings generated in the present study with those generated by Baer et al. (2004) during development of the scale (see Appendix G for factor analysis obtained by Baer et al., 2004).

Ten factors with eigenvalues over one were extracted during the initial analysis, accounting for 65% of the total variance; however observation of the scree plot clearly indicated a four factor solution. Following from Baer et al. (2004) a second factor analysis was conducted specifying that four factors be extracted, again using principal axis factoring with oblique rotation.

Table 4

Items and Factor Loadings for a Principal Components Analysis of the Kentucky Inventory of Mindfulness Skills (KIMS)

Item	Factor 1	Factor 2	Factor 3	Factor 4
Accept without Judgement Items				
4 'criticise self for irrational/inappropriate emotions'	.708			
8 'evaluate whether my perceptions are right or wrong'	.189	-.367		
12 'tell self I shouldn't be feeling the way I'm feeling'	.739			.117
16 'believe some of my thoughts are abnormal/bad'	.660		.185	
20 'judge whether my thoughts are good or bad'	.578	-.355		
24 'judge how worthwhile/less my experiences are'	.559	-.144	.186	.100
28 'tell self shouldn't be thinking the way I'm thinking'	.781	-.123		
32 'think some of my emotions are bad/inappropriate'	.789	-.143	.194	
36 'disapprove of self when I have inappropriate ideas'	.657	-.135		
Observe items				
1 'notice changes in my body'		.523	.134	
5 'attend to whether muscles are tense or relaxed'		.531		
9 'notice sensations of body moving'	-.192	.515		
13 'stay alert to water sensations when showering'	-.116	.491		
17 'notice how substances affect thought/body/emotions'		.374	-.141	
21 'attend to sensations, e.g. wind in hair or sun on face'		.611	.217	
25 'attend to sounds, e.g. clocks, birds, or cars'	-.175	.398		.195
29 'notice smells and aromas of things'		.475		
30 'intentionally stay aware of my feelings'		.677	.112	
33 'notice visual elements in art or nature'		.271		
37 'attend to how emotions affect thoughts/behaviour'		.585		-.134
39 'notice when my moods begin to change'		.579		
Describe items				
2 'good at describing my feelings'	.118		.718	
6 'easily puts beliefs/opinions/expectations into words'		.203	.594	.281
10 'can express my perceptions, e.g. taste/smell/sound'		.330	.525	.176
14 'hard to describe how I'm feeling'	.224		.723	.190
18 'have trouble expressing how I feel about things'	.312		.647	
22 'difficult to describe sensations in my body'	.143		.651	.172
26 'even if upset, can still put it into words'			.743	
34 'natural tendency is to put my experiences into words'	-.196	.302	.499	
Act with Awareness items				
3 'easily distracted'	.264		.149	.559
7 'only focused on what I'm doing'	.305		.138	.271
11 'drive on "automatic pilot"'				.717
15 'focus all of my attention when reading'		.163		.613
19 'get totally wrapped up in things'	-.353		-.177	.286
23 'don't attend to tasks because daydreaming/worrying/distracted'	.357		.283	.502
27 'daydream when doing chores'				.301
31 'do several things at once'	-.154			.282
35 'part of mind occupied w/other topics when working on something'	.227		.133	.602
38 'get completely absorbed in what I'm doing'	-.253			.609

Note. N = 119

This analysis yielded a clear four-factor solution that accounted for 38% of the variance after factor extraction. Thirty-four of the 39 items in the scale loaded at .3 or higher on the factors for which they were intended, and loadings were much higher than this for most of the items (see Table 4). Of those five that did not load at least .3 on the factors for which they were intended, two items, 33 from the Observe subscale; “I notice visual elements in art or nature, such as colours, shapes, textures, or patterns of light and shadow” and 31 from the Act with Awareness subscale; “I tend to do several things at once rather than focusing on one thing at a time” still loaded notably more highly on their respective factors than any other (.271 and .282, respectively). The three other items (two from the Act with Awareness subscale and one from the Accept without Judgement subscale) loaded more highly on factors other than those for which they were intended. Item 8 from the Accept without Judgement subscale: “I tend to evaluate whether my perceptions are right or wrong” loaded more highly on the Observe factor (.367) than on the Acceptance factor (.189). Items 11 and 19 from the Act with Awareness subscale: “I drive on automatic pilot without paying attention to what I’m doing” and “When I do things, I get totally wrapped up in them and don’t think about anything else” both loaded more highly on the Accept without Judgement factor (.305 and .353 respectively) than on the Act with Awareness factor for which they were intended (.271 and .286 respectively).

Correlations Between Mindfulness Measures

Correlations between the Mindful Attention and Awareness Scale and the Kentucky Inventory of Mindfulness were carried out in order to assess the degree to which these

scales demonstrated a pattern of convergent and discriminant validity with one another (see Table 3). The MAAS correlated relatively highly in a positive direction with the KIMS total ($r = .563, p < .01$) and differentially with each of the KIMS subscales. All correlations were in the expected positive direction, and of particular note were both the non-significant correlation between the MAAS and the Observe subscale and the high correlation between the Act with Awareness subscale of the KIMS.

Correlations Between Mindfulness Measures and Health

One of the hypotheses of this study was that mindfulness would be negatively related to perceived stress and positively related to mental health. In order to test this, correlations (Pearson's r) between the mindfulness measures, the Perceived Stress Scale, and mental health subscales of the SF-36 were calculated and are given in Table 5. Correlations between the PSS and the mindfulness measures were all significantly negative at the .01 alpha level. The total KIMS score yielded the strongest correlation with perceived stress, at $-.483$, followed by the Describe subscale of the KIMS at $-.363$. All mental health subscales of the SF-36 (Vitality, Mental Health, Role Emotional, Social Functioning, Total Mental Health) were significantly positively related to all of the mindfulness scales, with the exception of the Observe subscale. All correlations between this subscale of the KIMS and the mental health scales (although positive), did not approach significance and demonstrated no apparent relationship. The

Table 5

Correlations Between Mindfulness and Mental Health Measures (Pearson's r)

Measure	MAAS	Observe	Describe	ActAware	Accept	KIMS Total
Perceived Stress Scale	-.333**	-.118**	-.363**	-.289**	-.331**	-.483**
SF-36 Total	.427**	.024	.315**	.278**	.453**	.470**
Mental Health						
Mental Health	.374**	.066	.296**	.270**	.405**	.389**
Social Functioning	.300**	.042	.222**	.267**	.315**	.369**
Role Emotional	.243**	-.008	.212**	.176*	.253**	.274**
Vitality	.346**	.067	.228**	.170*	.367**	.374**

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

Acceptance subscale of the KIMS however showed higher correlations with all of the measures of mental health than every other mindfulness measure including the MAAS.

In order to test the hypothesis that mindfulness would be positively related to *physical*, health the correlations between the mindfulness measures and the physical health subscales of the SF-36 were obtained (see Table 6). All of the mindfulness measures besides the Observe subscale of the KIMS correlated positively with the physical health subscales of the SF-36, and most of these correlations were significant. Most of the correlations between the Observe subscale and the physical health scales were negative, however none of these reached the level of significance. The Acceptance subscale was most strongly related to all of the SF-36 measures of physical health, relating to almost all of the measures more highly than the total KIMS score.

Table 6

Correlations Between Mindfulness and Physical Health Measures

Variable	MAAS	Observe	Describe	ActAware	Accept	KIMS Total
SF-36 Total	.401**	-.035	.261**	.227**	.456**	.399**
SF-36 Total Physical Health	.325**	-.063	.164*	.180*	.397**	.298**
Physical Functioning	.187*	-.078	.054	.098	.191*	.113
Role Physical	.173*	-.117	.055	-.054	.294**	.068
Bodily Pain	.324**	.041	.267**	.226**	.409**	.418**
General Health	.203**	-.163*	.127	.177*	.343**	.204*

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

Regression

In order to explore the relationships between mindfulness measures and physical health, both linear and multiple regression methods were employed. As all physical health subscales were significantly negatively skewed, data from this group were transformed to a reflected log of the original form prior to regression analysis in order to obtain normality in distribution of scores.

Linear regression was first used with each individual mindfulness scale and the PSS to determine the magnitude at which each explains the variance in health (see Table 7). As can be seen in Table 7, separate linear regressions showed that four individual measures predicted the variance in health at the .000 significance level. The PSS explained the largest amount of the variance in physical health (29.6%), followed by the Acceptance scale of the KIMS (18%), the KIMS total score (11.6%), and the MAAS (10.8%).

Table 7

Predictions of SF-36 Total Physical Health by Stress and Mindfulness Measures

Subscale	B	SE B	β	Adj. R ²
PSS	.019	.003	.549**	.296**
MAAS	-.007	.002	-.340**	.108**
Observe	.001	.003	.021	-.008
Describe	-.008	.004	-.189*	.028*
Act with Awareness	-.009	.004	-.184*	.026*
Acceptance	-.016	.003	-.436**	.183**
KIMS Total	-.006	.002	-.351**	.116**

Note. * $p < .05$ ** $p < .001$

A series of sequential regression equations were carried out using PSS scores and scores on individual mindfulness measures to predict physical health. These analyses were performed in order to address two main hypotheses: 1) that most of the relationship between mindfulness and physical health would be accounted for by stress level, and 2) that mindfulness would explain a significant proportion of the variance in health after stress had been accounted for. The three mindfulness measures that had explained a significant proportion of the variance in health at the $p < .001$ level (total MAAS score, total KIMS score, Acceptance subscale) were used in this analysis. Each of the three regression equations performed contained both the PSS and one measure of mindfulness entered separately. Hierarchical regression was used with the PSS score entered first, because the relationship between stress and health had already been well established and the correlations between stress and health in the present study were stronger than those between mindfulness and health. Results are presented in Table 8.

Table 8

Summary of Heirarchical Regression Analysis for Variables Predicting Physical Health

Variable	B	SE B	β	R	R ²	Adj. R ²	R ² change
Step 1 (All Equations)							
Perceived Stress	.019	.003	.549**	.549	.302	.296	
Step 2 (Equation A)							
Perceived Stress	.017	.003	.495**	.549	.302	.296	
KIMS Total	-.002	.002	-.111	.558	.311	.299	.010
Step 2 (Equation B)							
Perceived Stress	.017	.003	.490**	.549	.302	.296	
Mindful Attention and Awareness Scale	-.004	.002	-.177*	.574	.329	.318	.028
Step 2 (Equation C)							
Perceived Stress	.015	.003	.455**	.549	.302	.296	
Acceptance	-.011	.003	-.285**	.612	.374	.364	.073

Note. ** $p < .001$; * $p < .05$

As can be seen from this table, perceived stress explained a high proportion of the variance in (log of) physical health in the regression equations. After step 1, with the total PSS score in the equation, $\underline{R}^2 = .302$ (adj. $\underline{R}^2 = .296$), $\underline{F} = 50.983$, $p < .001$. In the first equation, addition of the KIMS did not reliably improve \underline{R}^2 (adj. $\underline{R}^2 = .299$, F change = 1.618, $p = .206$), however, addition of the MAAS to the PSS in the second equation resulted in an adj. \underline{R}^2 of .318, (F change = 13.569, $p < .001$) demonstrating that the MAAS predicted a significant proportion of the variance in physical health after stress was accounted for. Finally the third equation in which perceived stress and acceptance were entered to explore their prediction in the variance of physical health demonstrated that, in addition to reliably improving \underline{R}^2 after accounting for stress level,

acceptance explained more of the variance in (log of) physical health after accounting for this factor than either of the two complete mindfulness measures. Together, perceived stress and acceptance explained 36% of the variance in (log of) physical health as measured by the SF-36.

One final aim was to explore whether there was any evidence to support that acceptance as a facet of mindfulness needed to be explicitly included in psychometric measures of the construct. In order to investigate this, hierarchical regression was performed using the variables total MAAS score and the Acceptance subscale of the KIMS to predict the dependent variable mental health. Variables were entered in this order because acceptance is an integral part of mindfulness, and so theoretically acceptance should not significantly add to the variance explained by a complete mindfulness measure. As can be seen in Table 9, acceptance was found to significantly raise the variance of mental health explained by the MAAS from 17% to 28%.

Table 9

Summary of Hierarchical Regression Analysis for Variables MAAS and Acceptance Predicting Mental Health

Variable	B	SE B	β	R	Adj R ²	R ² change
Model 1						
MAAS	.722	.141	.427	.427	.176**	.182
Model 2						
MAAS	.530	.139	.314	.427	.176**	.182
Acceptance	1.036	.241	.352	.542	.282**	.111

Note. ** p < .001;

Discussion

The main aim of this study was to explore the relationship between mindfulness and physical health, and determine to what degree this relationship was mediated by stress. Findings clearly supported both the initial and first main hypotheses; that mindfulness and health would be significantly positively correlated, and that this relationship would be mediated to a large degree by perceived stress level. Results of this study partially supported the other key hypothesis that mindfulness would explain a significant portion of the variance in physical health after stress was accounted for. With regard to this latter finding, both the Mindful Attention and Awareness Scale and the Acceptance subscale of the KIMS were individually shown to predict health at a significant level after stress had been accounted for, but the total KIMS score was not.

The first main hypothesis; that any correlation between general mindfulness level and physical health would be mainly mediated by stress, was driven largely by the studies demonstrating the successfulness of mindfulness as a stress reduction intervention. In light of this increasingly wide body of research, this finding is not particularly surprising. What these results do indicate however is that there may be support for the mechanisms of mindfulness proposed by Shapiro et al., (2006), a significant proportion of which can be considered to directly relate to stress reduction (enhanced coping through increased cognitive, emotional, and behavioural flexibility; increased tolerance of stressful stimuli through exposure). Although further research is needed to test the possible influence of these elements in more detail, findings from this study may

potentially indicate that the mechanisms proposed by Shapiro et al., (2006), may indeed hold some promise in explaining how mindfulness may work.

That this expected result was obtained using two different measures of mindfulness also adds to the validity of these newly developed scales. The fact that the correlations between physical health and the MAAS and KIMS were shown to be primarily mediated by stress level demonstrates good criterion-related validity for both these scales, as they performed exactly as was expected from the literature on both the use of Mindfulness-Based Stress Reduction in medical populations and the mechanisms of mindfulness proposed.

The other main finding of this study was that two mindfulness measures (the MAAS and the Acceptance subscale of the KIMS) were shown to significantly predict variance in physical health after accounting for stress. This hypothesis was motivated by another main mechanism of mindfulness proposed by Shapiro et al., (2006), that of self-regulation. As the only proposed mindfulness mechanism to date that appears to have the potential to directly relate to physical health (and one that has already been demonstrated to be associated with mindfulness, Brown & Ryan, 2003), it was argued that self-regulation could potentially explain this possible finding. The present study did not explicitly explore whether this was indeed the mechanism responsible for this finding. What the results of this study do demonstrate however is that other mechanisms besides stress reduction may play a role in the relationship between mindfulness and health, and detailed investigation into the possible explanations for this relationship is an important direction for future research.

One interesting finding from this study was the clear result that the acceptance component of mindfulness was the one related most strongly to almost all of the measures of physical and mental health. Earlier findings by Baer et al., (2004) showed that the Accept without Judgement subscale was generally no more highly correlated with measures of specific positive and negative psychological constructs than the other subscales in the KIMS, and was in fact usually less highly correlated. The difference between these psychological measures and those used in this study is that the SF-36 mental health subscales measure general mental health, as opposed to particular positive or negative constructs related to mental wellbeing. What these findings may indicate then is that individuals who score more highly on measures of ability to accept their thoughts, feelings, and emotions without judgement may have better general mental health than those who score lower. This idea is itself not entirely new to the psychological literature; the cultivation of the acceptance of thoughts and emotions without judgement as a treatment for psychological disorders is increasingly being recognised, with Hayes, Strosahl, & Wilson's (1999) Acceptance and Commitment Therapy, and Linehan's (1993a) Dialectical Behavior Therapy (a major component of which is the acceptance and change dialectic underlying treatment) being increasingly adapted and applied to new clinical populations. These results show that this relationship (between mental health and ability to accept one's thoughts and emotions) is able to be demonstrated using relatively objective measures. This also adds to the validity of the Accept without Judgement scale as a psychometric instrument, and could potentially mean that there may be clinical utility for this scale in the measurement of change in ability to accept internal phenomena when this is the primary treatment goal.

The other part of this significant finding regarding acceptance was that acceptance also related most strongly to physical health, again almost without exception correlating more highly with every measure of physical health on the SF-36 subscale than every other measure of mindfulness. Prior to this study, the correlations between acceptance and general physical health had not been reported in the psychological literature, and so these findings highlight a potential area for the focus of future research. To date there have been very few studies investigating the possible physiological effects of acceptance, although as mentioned earlier higher rates of acceptance vs. suppression have been shown to predict higher tolerance (in the form of lower physiological responses) of stressful stimuli (Feldner et al., 2003; Hayes et al., 1999; Levitt et al., 2004). These findings may demonstrate that the relatively high correlations between acceptance and physical health are reflective of the same explanation proposed for the relationship between physical health and mindfulness generally- namely that of a relationship largely mediated by stress.

One aspect of the correlation between acceptance and physical health that cannot be explained by stress however is the finding that acceptance predicted a significant proportion of the variance in health after stress had been accounted for. The explanation proposed when this finding was demonstrated by the MAAS was that of the only mindfulness mechanism to date that appears to relate directly to physical health; self-regulation. It is possible that this theory may also apply to the findings for the Acceptance subscale of the KIMS. As an overarching axiom of mindfulness, acceptance plays the vital role of *intention* in the intention → attention → connection → regulation → order → health process. Without the non-judgemental attitudinal stance comprising

the first element of the self-regulation process (*intention*) the successive steps of attention, connection, etc. could not take place. Acceptance may therefore be seen as the key facet of mindfulness needed to begin the process of self-regulation, which would explain why acceptance was the only facet of mindfulness shown to predict variance in physical health after stress had been controlled for.

Although the MAAS and the Acceptance subscale of the KIMS explained more of the variance in health than stress alone, as mentioned earlier the total KIMS score did not. One key possibility for this finding may be the effect of the relationships between the different subscales and the resulting impact of this on the overall mindfulness score. Findings for correlations between the subscales, (including the significantly negative correlation between the Observe and Acceptance subscales) generally reflected earlier results reported by Baer et al., (2004), except that the significant negative correlation was notably larger in this study. As the Accept without Judgement scale was the one KIMS subscale to predict the variance in health after controlling for stress, the significant negative correlation between the Observe and Acceptance scales may have considerably reduced the likelihood that the total KIMS score would show a similar result. Indeed, the magnitude of the negative correlation between these two subscales raises concerns about the validity of using the total KIMS score as an accurate measure of general mindfulness level.

Measures of Mindfulness

As mentioned, measures of mindfulness were found to be significantly correlated with measures of both stress and physical health. Findings reflected the results of

previous investigations into these relationships by Brown and Ryan (2003) during the development of their scale the MAAS, and add to the robustness of these earlier findings by demonstrating similar patterns of relationships between these constructs using different measures of both stress and physical health than those employed in the original study. In addition, as the KIMS had not previously been studied in relation to either stress or physical health, significant positive correlations between these measures and the KIMS add new information about this scale to the psychological literature. These findings add to the construct validity of the KIMS by demonstrating significant relationships with expected other measures, and yielding results similar to those seen for the other mindfulness scale (the MAAS) in both the present study and Brown and Ryan (2003).

Mindfulness measures were evaluated in several other ways for their validity internal reliability, and generally performed well, although there were findings that indicated that both these measures may be in need of some further evaluation before they can be accepted as robust and valid measures of mindfulness. Results of internal reliability testing (Cronbach's alpha) were good for all scales and subscales, and reflected earlier findings by the authors of both the KIMS and the MAAS. The total scores for each scale correlated well with one another, demonstrating convergent validity. As hypothesised, the two scales designed to measure the degree to which individuals act with awareness in their daily life (the MAAS and the Act with Awareness subscale of the KIMS), correlated most highly with one another than any of the other mindfulness measures, replicating Baer et al's., (2004) earlier findings. Both these scales also showed a very similar pattern of correlations with the other subscales of the KIMS, providing more

evidence that these two scales may indeed be measuring the same facet of the mindfulness construct. As mentioned earlier, scale intercorrelations of the KIMS also revealed a significantly negative correlation between the Observe and Acceptance subscales.

Another finding with regard to the KIMS was that the range of scores obtained for the total KIMS score was markedly restricted. This was particularly obvious when this range was compared with the ranges obtained for the other three measures used, all of which were much closer to the maximum and minimum scores possible. Such a finding could indicate that the KIMS may be less sensitive than the MAAS at picking up extreme high and low levels of mindfulness. Interestingly this restricted range finding was not demonstrated on the Accept without Judgement subscale, indicating that the measurement of this particular facet of mindfulness within the KIMS is much more sensitive to detecting high and low levels of the component.

Another investigation into the validity of the KIMS for use in a New Zealand population was the principal components factor analysis performed in the same fashion as Baer et al., (2004) during development of the scale. Although the sample size was small, the factor analysis performed on the KIMS items yielded similar results overall to the one carried during development of the scale (Baer et al., 2004). There were some differences however. During Baer et al's., (2004) initial study, three items from the Observe subscale; items 30 "I intentionally stay aware of my feelings", 37 "I pay attention to how my emotions affect my thoughts and behaviour", and 39 "I notice when my moods begin to change" showed loadings on the Acceptance factor similar in magnitude to those on their expected factor. This result was not found in the present

study. All three items loaded highly on the Observe factor, (more highly than they had in the Baer et al., 2004 study) and did not load at all on the Acceptance factor. This finding provides support for the decision by Baer et al. (2004) to retain these three items in order to adequately cover the observation facet of mindfulness.

The vast majority of items loaded on the factors for which they were intended, many very highly, although there were some exceptions to this. One item (8) from the Accept without Judgement subscale, “I tend to evaluate whether my perceptions are right or wrong” loaded notably more highly on the Observe subscale. A possible reason for this could be cultural differences between the United States and New Zealand populations in the understanding and everyday use of the word “perception”. Perception may have been understood by this first year psychology sample to refer to the information coming in from their senses, rather than their cognitive viewpoint. Indeed, when consulting a commonly used thesaurus such as the one on the Microsoft Word computer program (set to the English language as it is used in New Zealand), on the word ‘perception’, one of the synonyms provided is ‘observation’. This finding tentatively indicates that it may be desirable to remove this item from the Accept without Judgement subscale when using the KIMS in a New Zealand population, as it does not appear to be measuring acceptance. Replication of this finding in a New Zealand population using a more suitable sample size would be necessary before drawing this conclusion.

Items 11 “I drive on “automatic pilot” without paying attention to what I’m doing”, and 19 “When I do things, I get totally wrapped up in them and don’t think about anything else” from the ActAware subscale loaded more highly on the Acceptance subscale than their own. This finding was not shown in the Baer et al. (2004) study. In

order to explain this finding, items on the Accept without Judgement scale were carefully observed, and it was found that they appear to reflect a process that may also be occurring in the other two items. An overwhelming theme in the Acceptance items appears to be a mental commentary on thoughts, feelings, and emotions (32 “I think some of my emotions are bad/inappropriate”, 28 “I tell myself I shouldn’t be thinking the way I’m thinking”/”feeling the way I’m feeling”-12, 4 “I criticise myself for irrational/inappropriate emotions”, 20 “I judge whether my thoughts are good or bad” etc). When item 11 (driving on automatic pilot) is considered in terms of what it means in practice, a person who is not aware of what they are doing at the present moment (driving) is usually unaware because they are thinking about something else. What this item may have in common with the items on the Acceptance subscale then is that it quite possibly simply refers to a process of ongoing mental commentary that may be occurring in each.

The other item that loaded more highly on the Acceptance subscale than its own, 19 – “When I do things, I get totally wrapped up in them and don’t think about anything else” may be problematic for a different reason. This item, as well as another item on the ActAware subscale, 38 “I get completely absorbed in what I’m doing, so that all my attention is focused on it” appear to refer to another trait that has been measured for its relationship to mindfulness- absorption. Absorption has been referred to as the tendency to enter trancelike states of consciousness, in which a person is “out of touch” with reality (Tellegen, 1982, cited in Brown & Ryan, 2003). In their development of the MAAS scale Brown and Ryan, (2003) hypothesised that mindfulness would be unrelated to the trait of absorption, and indeed found a weak but significantly negative correlation

between the two constructs. This raises concerns about the validity of including such items on a scale of mindfulness. Although they are worded so as to attempt to refer to the focusing of attention, these two items may be more closely related to absorption than they are to mindfulness, and therefore need to be evaluated carefully for their worth on a scale such as this.

Although it may appear from these results that the KIMS may face more challenges to its validity as a mindfulness measure than the MAAS, it must be remembered that the KIMS was designed to measure mindfulness as completely as possible. By virtue of containing separate scales for the different proposed facets of mindfulness, the KIMS measure may reveal significantly more information about the construct as a whole, adding a great deal to the potential usefulness of this instrument.

One of the final aims of this study was to address debate in the literature about whether the acceptance component of mindfulness needed to be explicitly included in scales measuring this construct. As a uni-dimensional measure, the assumption underlying the MAAS is that mindfulness can be captured simply as the tendency to act with awareness during daily life. Developers have argued that acceptance is subsumed within the ability to be attentive and aware during the present moment, and that questions on acceptance should not therefore obtain any more information on mindfulness than those measuring the tendency to act with awareness. Results showed that acceptance did in fact add significantly to the explanation of the variance in mental health, demonstrating that it is possible this component may not be adequately captured within the Mindful Attention and Awareness Scale as it is currently written.

Measures of General Health

Although descriptive statistics and internal reliability coefficients for the two well-validated health measures employed in this study (the PSS and the SF-36) were largely similar to those previously published (Cohen, 1983; Scott et al., 1999), one notable difference was found. In the present sample, the mean scores on all of the mental health subscales were slightly lower than those scores obtained as New Zealand norms in the Scott et al. (1999) study. It is unclear why exactly this is, although the sample used here was not random sample from the general public as was the above study. It is possible that some of the characteristics of the sample used here that differed from the above population may have played a role in the differences obtained. One major possible factor could be the large number of females in this study compared with males. Community and epidemiological studies have shown that several common psychological disorders are more prevalent in women than men (American Psychiatric Association, 2000). Two of the most common of these, Major Depression and Generalised Anxiety Disorder, have been found at rates two to three times higher in women than men (American Psychiatric Association, 2000). The fact that the vast majority of participants were completing their first year of study in a tertiary institution (often a situation that requires a considerable amount of adaptation) may also have contributed to the lower mental health scores seen here as participants adjusted to university life.

Limitations of this Study

One main limitation of this study was the reliance on self-report measures to explore the relationships between health, stress, and mindfulness. Self-report measures are

subject to bias in perception of respondents, and this may be particularly important regarding the measurement of physical health, as this is very much an objective phenomenon. Self-report measures are also subject to social desirability, which was not controlled for in this study.

The use of an undergraduate psychology sample is also a limitation of this study, as it is of many psychological studies, because this group is a very specific subsample of the population. Ideally, findings such as those generated in this study are able to be readily generalised to the wider public, however this is not possible from such a limited sample. This limitation is particularly relevant to this study as this sample was shown to have responses different from the general New Zealand population in measures of mental health.

A third possible limitation was the (unavoidable) reliance on newly developed measures of mindfulness that have yet to be rigorously tested and widely accepted as reliable and valid measures of the construct. Evaluating mindfulness level with measures other than those used here may have yielded different results, meaning that findings reported here must be considered preliminary. It is also possible that these measures themselves may still undergo changes before they are finalised and begin to be widely used.

Conclusions and Future Directions

In spite of these limitations, results from this study do add to what is known about mindfulness as a naturally occurring characteristic and its relationships with other constructs. Further research involving the manipulation of the variables measured in this

study would help to determine whether these have the potential to influence one another in ways that would be expected. The previously demonstrated finding that mindfulness level and physical health would be positively related was able to be explored in more detail however, and (very) preliminary evidence obtained about the possible mechanisms of mindfulness that may be in part responsible for these relationships. The finding that mindfulness, (and in particular the component acceptance) predict some of the variance in health after stress has been accounted for highlights an important area for future research. Further research into the possible explanations for this finding will help confirm or deny whether there is evidence for the mindfulness mechanisms proposed by Shapiro et al., (2006) with regard to physical wellbeing.

The possibility that self-regulation may account for some of the variance in physical health explained by mindfulness is a particular area of study that warrants a great deal of attention. One possibility that has emerged from this study that needs to be explored is whether the cultivation of mindfulness (and a key component of this construct – acceptance), could serve to both reduce the incidence of stress-related health difficulties and increase the ability of individuals to regulate their physical system. In the Introduction to this study it was stated that chronic diseases were now the leading cause of death and disability in developed countries (World Health Organization, 2005). Many such illnesses are able to be prevented by human behaviour, and indeed self-regulation and self-management programs for the ongoing management of chronic diseases are becoming increasingly common in Primary Health Organisations in this country (following a trend internationally) to reduce resource strain on the health system (V. Pickers, personal communication, October 17 2006). A teachable “way of being” that

holds the potential to increase our ability to attend to the needs of our physical system and allow us to maintain optimal order and functioning could potentially provide immeasurable support for efforts to reduce the impact of the multitude of preventable physical disorders and diseases.

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Appendix A: Research Advertisement

This appendix contains the research advertisement for this study.

PARTICIPANTS NEEDED

for a study on

HEALTH and

DEALING WITH LIFE

This study is exploring whether how people cope with life has any significant effect on their physical health.

The questionnaire takes about 20 minutes to complete, and participants from 103 will get 1% course credit. All others interested are welcome! All results are kept confidential, and questionnaires can be picked up and dropped off from the blue boxes at the psych office– K.1.26 at the end of the corridor.

Researcher:

My name is Kristal Foster and I am in my second year of the clinical programme. My main areas of interest within psychology are centred around wellbeing and the maintenance of good health, physical and psychological.

Contact details: kcf1@waikato.ac.nz

Supervisors: Mary Foster and Nicola Starkey

Appendix B: Cover Letter

This appendix contains the cover letter to the questionnaire package used.

Health and Ways of Coping with Life

This is a study on the relationship between people's physical health and the way they cope with everyday life. I am interested in your responses to the following questionnaire to help answer this question, and really grateful for your participation.

The questionnaire is designed to be completely anonymous, so there is no need to include your name in the form. If you are a 102 student, the 1% course credit form can be detached from the end of this questionnaire and placed in the box for completed questionnaires and course credit forms.

Results of this study will be posted on the psychology research noticeboard in K.1. Please also feel free to email if you would like a summary of the results emailed to you.

It is assumed that your consent will be given by the return of the questionnaire, but if you feel for any reason that you no longer wish to participate in the study, please don't feel pressured to return it.

Thank you so much for your participation, and I wish you all the best in dealing with your life!

Kristal Foster

Appendix C: Mindful Attention and Awareness Scale

This appendix contains Brown and Ryan's (2003) Mindful Attention and Awareness Scale (MAAS).

Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be.

	Almost Always 1	Very frequently 2	Somewhat frequently 3	Somewhat infrequently 4	Very infrequently 5	Almost never 6
1.						
	I could be experiencing some emotion and not be conscious of it until later	1	2	3	4	5 6
2.	I break or spill things because of carelessness, not paying attention, or thinking of something else	1	2	3	4	5 6
3.	I find it difficult to stay focused on what's happening in the present	1	2	3	4	5 6
4.	I tend to walk quickly to get where I'm going without paying attention to what I experience along the way	1	2	3	4	5 6
5.	I tend not to notice feelings of physical tension or discomfort until they really grab my attention	1	2	3	4	5 6
6.	I forget a person's name almost as soon as I've been told it for the first time	1	2	3	4	5 6
7.	It seems I am "running on automatic" without much awareness of what I'm doing	1	2	3	4	5 6
8.	I rush through activities without being really attentive to them	1	2	3	4	5 6
9.	I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there	1	2	3	4	5 6
10.	I do jobs or tasks automatically, without being aware of what I'm doing	1	2	3	4	5 6
11.	I find myself listening to someone with one ear, doing something else at the same time	1	2	3	4	5 6
12.	I drive places on "automatic pilot" and then wonder why I went there	1	2	3	4	5 6
13.	I find myself preoccupied with the future or the past	1	2	3	4	5 6
14.	I find myself doing things without paying attention	1	2	3	4	5 6
15.	I snack without being aware that I'm eating	1	2	3	4	5 6

Appendix D: Kentucky Inventory of Mindfulness Skills

This appendix contains Baer, Smith, and Allen's (2004) Kentucky Inventory of Mindfulness Skills (KIMS)

Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

	Never or very rarely true 1	Rarely true 2	Sometimes true 3	Often true 4	Very often or always true 5	
1.	I notice changes in my body, such as whether my breathing slows down or speeds up	1	2	3	4	5
2.	I'm good at finding the words to describe my feelings	1	2	3	4	5
3.	When I do things, my mind wanders off and I'm easily distracted	1	2	3	4	5
4.	I criticise myself for having irrational or inappropriate emotions	1	2	3	4	5
5.	I pay attention to whether my muscles are tense or relaxed	1	2	3	4	5
6.	I can easily put my beliefs, opinions, and expectations into words	1	2	3	4	5
7.	When I'm doing something, I'm only focused on what I'm doing, nothing else	1	2	3	4	5
8.	I tend to evaluate whether my perceptions are right or wrong	1	2	3	4	5
9.	When I'm walking, I deliberately notice the sensations of my body moving	1	2	3	4	5
10.	I'm good at thinking of words to express my perceptions, such as how things taste, smell, or sound	1	2	3	4	5
11.	I drive on "automatic pilot" without paying attention to what I'm doing	1	2	3	4	5
12.	I tell myself that I shouldn't be feeling the way I'm feeling	1	2	3	4	5
13.	When I take a shower or bath, I stay alert to the sensations of water on my body	1	2	3	4	5
14.	It's hard for me to find words to describe how I'm feeling	1	2	3	4	5
15.	When I'm reading, I focus all of my attention on what I'm reading	1	2	3	4	5
16.	I believe some of my thoughts are abnormal or bad and I shouldn't think that way	1	2	3	4	5
17.	I notice how foods and drinks affect my thoughts, bodily sensations, and emotions	1	2	3	4	5
18.	I have trouble thinking of the right words to express how I feel about things	1	2	3	4	5
19.	When I do things, I get totally wrapped up in them and don't think about anything else	1	2	3	4	5
20.	I make judgements about whether my thoughts are good or bad	1	2	3	4	5
21.	I pay attention to sensations, such as the wind in my hair or the sun in my face	1	2	3	4	5

Never or very rarely true	Rarely true	Sometimes true	Often true	Very often or always true					
1	2	3	4	5					
22.	When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words				1	2	3	4	5
23.	I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted				1	2	3	4	5
24.	I tend to make judgements about how worthwhile or worthless my experiences are				1	2	3	4	5
25.	I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing				1	2	3	4	5
26.	Even when I'm feeling terribly upset, I can still find a way to put it into words				1	2	3	4	5
27.	When I'm doing chores, such as cleaning or laundry, I tend to daydream or think of other things				1	2	3	4	5
28.	I tell myself that I shouldn't be thinking the way I'm thinking				1	2	3	4	5
29.	I notice the smells and aromas of things				1	2	3	4	5
30.	I intentionally stay aware of my feelings				1	2	3	4	5
31.	I tend to do several things at once rather than focusing on one thing at a time				1	2	3	4	5
32.	I think some of my emotions are bad or inappropriate and I shouldn't feel them				1	2	3	4	5
33.	I notice visual elements in art or nature, such as colours, shapes, textures, or patterns of light and shadow				1	2	3	4	5
34.	My natural tendency is to put my experiences into words				1	2	3	4	5
35.	When I'm working on something, part of my mind is occupied with other topics, such as what I'll be doing later, or things I'd rather be doing				1	2	3	4	5
36.	I disapprove of myself when I have irrational ideas				1	2	3	4	5
37.	I pay attention to how my emotions affect my thoughts and behaviour				1	2	3	4	5
38.	I get completely absorbed in what I'm doing, so that all my attention is focused on it				1	2	3	4	5
39.	I notice when my moods begin to change				1	2	3	4	5

Appendix E: Perceived Stress Scale

This appendix contains Cohen, Karmarck, and Mermelstein's (1983) Perceived Stress Scale.

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you have felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

0. Never
1. Almost never
2. Sometimes
3. Fairly often
4. Very often

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 1. | In the last month, how often have you been upset because of something that happened unexpectedly? | 0 | 1 | 2 | 3 | 4 |
| 2. | In the last month, how often have you felt that you were able to control the important things in your life? | 0 | 1 | 2 | 3 | 4 |
| 3. | In the last month, how often have you felt nervous and "stressed"? | 0 | 1 | 2 | 3 | 4 |
| 4. | In the last month, how often have you dealt successfully with irritating life hassles? | 0 | 1 | 2 | 3 | 4 |
| 5. | In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life? | 0 | 1 | 2 | 3 | 4 |
| 6. | In the last month, how often have you felt confident about your ability to handle your personal problems? | 0 | 1 | 2 | 3 | 4 |
| 7. | In the last month, how often have you felt that things were going your way? | 0 | 1 | 2 | 3 | 4 |
| 8. | In the last month, how often have you found that you could not cope with all the things that you had to do? | 0 | 1 | 2 | 3 | 4 |
| 9. | In the last month, how often have you been able to control irritations in your life? | 0 | 1 | 2 | 3 | 4 |
| 10. | In the last month, how often have you felt that you were on top of things? | 0 | 1 | 2 | 3 | 4 |
| 11. | In the last month, how often have you been angered because of things that happened that were outside of your control? | 0 | 1 | 2 | 3 | 4 |
| 12. | In the last month, how often have you found yourself thinking about things that you have to accomplish? | 0 | 1 | 2 | 3 | 4 |
| 13. | In the last month, how often have you been able to control the way you spend your time? | 0 | 1 | 2 | 3 | 4 |
| 14. | In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? | 0 | 1 | 2 | 3 | 4 |

Appendix F: Short-Form 36 Health Survey

This appendix contains Ware and Sherbourne's (1992) Short-Form 36 Health Survey (SF-36).

This survey asks you for your views about your health. This information will keep track of how you feel and how well you are able to do your usual activities.

Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

1. In general, would you say your health is: (Circle one)
- | | |
|-----------|---|
| Excellent | 1 |
| Very Good | 2 |
| Good | 3 |
| Fair | 4 |
| Poor | 5 |
2. *Compared to one year ago*, how would you rate your health in general *now*? (Circle one)
- | | |
|---------------------------------------|---|
| Much better now than one year ago | 1 |
| Somewhat better now than one year ago | 2 |
| About the same now as one year ago | 3 |
| Somewhat worse now than one year ago | 4 |
| Much worse now than one year ago | 5 |
3. The following items are about activities you might do during a typical day. Does your *health* now limit you in these activities? If so, how much?

Activities	Yes, Limited A Lot	Yes, Limited A Little	No, Not Limited At All
Vigorous activities , such as running, lifting heavy objects, participating in strenuous sports	1	2	3
Moderate activities , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?	1	2	3
Lifting or carrying groceries	1	2	3
Climbing several flights of stairs	1	2	3
Climbing one flight of stairs	1	2	3
Bending, kneeling, or stooping	1	2	3
Walking more than a mile	1	2	3

Walking several blocks	1	2	3
Walking one block	1	2	3
Bathing or dressing yourself	1	2	3

4. During the *past 4 weeks*, have you had any of the following problems with your work or other regular daily activities *as a result of your physical health*? (Circle one number on each line)

	Yes	No
Cut down on the amount of time you spent on work or other activities	1	2
Accomplished less than you would like	1	2
Were limited in the kind of work or other activities	1	2
Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

5. During the past 4 weeks, have you had any of the following problems with your work or other regular activities as a result of any *emotional problems* (such as feeling depressed or anxious)?
(Circle one number on each line)

	Yes	No
Cut down on the amount of time you spent on work or other activities	1	2
Accomplished less than you would like	1	2
Didn't do work or other activities as carefully as usual	1	2

6. During the *past 4 weeks*, to what extent has your *physical health* or *emotional problems* interfered with your normal social activities with family, friends, neighbours, or groups?
(Circle one)

Not at all	1
Slightly	2
Moderately	3
Quite a bit	4
Extremely	5

7. How much *bodily* pain have you had during the *past 4 weeks*? (Circle one)

None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very severe	6

8. During the *past 4 weeks*, how much did *pain* interfere with your normal work (including both work outside the home and housework)? (Circle one)

Not at all	1
A little bit	2
Moderately	3
Quite a bit	4
Extremely	5

9. These questions are about how you feel and how things have been with you *during the past 4 weeks*. For each question, please give one answer that comes closest to the way you have been feeling. How much of the time during the *past 4 weeks* – (Circle one number on each line)

	All of the Time	Most of the Time	A Good bit of the Time	Some of the Time	A Little of the Time	None of the Time
Did you feel full of pep?	1	2	3	4	5	6
Have you been a very nervous person?	1	2	3	4	5	6
Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
Have you felt calm and peaceful?	1	2	3	4	5	6
Did you have a lot of energy?	1	2	3	4	5	6
Have you felt downhearted and blue?	1	2	3	4	5	6

Did you feel worn out?	1	2	3	4	5	6
Have you been a happy person?	1	2	3	4	5	6
Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your *physical health* or *emotional problems* interfered with your social activities (like visiting friends, relatives, etc.)? (Circle one)

- All of the time 1
- Most of the time 2
- Some of the time 3
- A little of the time 4
- None of the time 5

11. How TRUE or FALSE is each of the following statements for you?(Circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
I seem to get sick a little easier than other people	1	2	3	4	5
I am as healthy as anybody I know	1	2	3	4	5
I expect my health to get worse	1	2	3	4	5
My health is excellent	1	2	3	4	5

Appendix G: Factor Analysis for Kentucky Inventory of Mindfulness Skills

This appendix contains the factor analysis for Kentucky Inventory of Mindfulness Skills conducted by Baer, Smith, and Allen, (2004)

Items and Factor Loadings for a Principal Components Analysis of the Kentucky Inventory of Mindfulness Skills (KIMS) In a Study Conducted by Baer et al. (2004)

Item	Factor 1	Factor 2	Factor 3	Factor 4
Accept without Judgement Items				
4 'criticise self for irrational/inappropriate emotions'	.76	.17	.12	
8 'evaluate whether my perceptions are right or wrong'	.56	-.12	-.16	
12 'tell self I shouldn't be feeling the way I'm feeling'	.67		.14	
16 'believe some of my thoughts are abnormal/bad'	.61		.24	
20 'judge whether my thoughts are good or bad'	.71			
24 'judge how worthwhile/less my experiences are'	.49	-.15		
28 'tell self shouldn't be thinking the way I'm thinking'	.78	.13	.10	
32 'think some of my emotions are bad/inappropriate'	.71	.11	.18	
36 'disapprove of self when I have inappropriate ideas'	.65			
Observe items				
1 'notice changes in my body'		.49	-.02	
5 'attend to whether muscles are tense or relaxed'		.53		
9 'notice sensations of body moving'		.59		
13 'stay alert to water sensations when showering'		.59		
17 'notice how substances affect thought/body/emotions'		.59		
21 'attend to sensations, e.g. wind in hair or sun on face'		.60		
25 'attend to sounds, e.g. clocks, birds, or cars'	.10	.59		-.12
29 'notice smells and aromas of things'		.62		
30 'intentionally stay aware of my feelings'	-.25	.42	.20	
33 'notice visual elements in art or nature'	.16	.60		
37 'attend to how emotions affect thoughts/behaviour'	-.35	.41	.14	
39 'notice when my moods begin to change'	-.39	.35	.11	
Describe items				
2 'good at describing my feelings'			.86	
6 'easily puts beliefs/opinions/expectations into words'			.79	
10 'can express my perceptions, e.g. taste/smell/sound'			.65	.16
14 'hard to describe how I'm feeling'	.18	-.11	.69	
18 'have trouble expressing how I feel about things'	.20	-.12	.74	
22 'difficult to describe sensations in my body'	.22		.66	
26 'even if upset, can still put it into words'			.66	
34 'natural tendency is to put my experiences into words'	-.15		.76	
Act with Awareness items				
3 'easily distracted'			.14	.60
7 'only focused on what I'm doing'				.60
11 'drive on "automatic pilot"'			.12	.43
15 'focus all of my attention when reading'			.11	.45
19 'get totally wrapped up in things'		.16		.54
23 'don't attend to tasks because daydreaming/worrying/distracted'		-.22	.14	.71
27 'daydream when doing chores'			-.17	.47
31 'do several things at once'		-.12	-.11	.54
35 'part of mind occupied w/other topics when working on something'				.75
38 'get completely absorbed in what I'm doing'		.14		.63

Note. N = 205