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The Effect of Varying Levels of Depressive Symptoms on Mindfulness Acquisition: An Exploratory Study

By

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Submitted to the graduate degree program in Clinical Psychology and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.

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Abstract

Research and clinical theory increasingly suggest that mindfulness may be an effective clinical intervention for a myriad of mental illnesses. However, there is debate in the field as to whether or not mindfulness-based programs may be beneficial for treatment of active depression. Those cautioning against the use of mindfulness-based programs suggest that the cognitive demands of a meditation practice may be too difficult for those with acute depressive symptoms. The purpose of this study is to investigate whether differences exist between individuals with varying levels of depressive symptoms in the ability to acquire mindfulness skills. Data come from a two-week, longitudinal study in which undergraduates, with a range of depressive symptoms, engaged in a breath-focused mindfulness exercise every other day. Self-reported trait mindfulness, state mindfulness, depressive symptoms, rumination, and sleep quality were measured at various time points over the two-week study period. Multilevel modeling was used for main analyses. Results suggest individuals with more acute, depressive symptoms may be able to successfully acquire trait mindfulness skills, as well as receive an adjunctive benefit such as a reduction in depressive symptoms over time, and reduced rumination and increased sleep quality. Limitations and future directions are addressed.

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In the past decade, research interest in mindfulness has dramatically increased (Baer, 2003; Chiesa and Serretti, 2010), and there has been a particular focus on investigating mindfulness as a form of a clinical intervention (Keng et. al, 2011). As of 2006 there were more than 600 mindfulness-related manuscripts published (Brown, Ryan, & Creswell, 2007), and in 2012, based on a PsycInfo database search, there were over 2,900 various publication types (peer-reviewed journal articles, books, and various chapters) related to "mindfulness".

Adopted in the West from a Buddhist perspective, mindfulness can be thought of as a form of conscious "meta-attention," or awareness of our own attention. When we are mindful, our attention will attend to the present moment, rather than drifting with whatever captures it. Alternatively, non-mindfulness can be thought of as living in the past or future, through specific thoughts or worries, but not the present. Non-mindfulness is common, and can be seen in our daily lives through examples such as "driving on auto-pilot"; during routine drives our minds can become so focused on past and future worries, problems and thoughts that when we finally reach our destination we may not consciously remember stopping at all of the stoplights or making all of the appropriate turns. Mindfulness is a perspective of living life with a greater attentional awareness than comes naturally for most people.

Numerous studies have portrayed the association between mindfulness and positive psychological functioning. These studies have examined mindfulness as a psychological construct in various populations including various community samples (Brown & Ryan, 2003; Chadwick et. al, 2008), college undergraduates (Baer et. al, 2006; Brown & Ryan, 2003), and clinical populations (Baer et. al, 2004). A meta-analysis from 2011 by Keng, Smoski & Robins reports that trait mindfulness (level of one's mindfulness in daily life) has been associated with many different aspects of well-being including higher levels of life satisfaction (Brown & Ryan,

2003), agreeableness (Thompson & Waltz, 2007), conscientiousness (Giluk, 2009; Thomspson and Waltz, 2007), vitality (Brown & Ryan, 2003), self-esteem (Brown and Ryan, 2003; Rasmussen and Pidgeon, 2011), empathy (Dekeyser, et. al., 2008), sense of autonomy, competence, optimism, and pleasant affect (Brown & Ryan, 2003).

Additionally, trait mindfulness has been found to have significant negative correlations, based on self-reports, between mindfulness and neuroticism (Dekeyser et. al, 2008; Giluk, 2009), absent-mindedness (Herndon, 2008), dissociation (Baer et. al, 2006), rumination (Raes & Williams, 2010), cognitive reactivity (Raes, Dewulf, Van Heeringen & Williams, 2009), social anxiety (Brown & Ryan, 2003; Dekeyser et. al, 2008), difficulties in emotion regulation (Baer et. al, 2006), experiential avoidance (Baer et. al, 2004), alexithymia (Baer et. al, 2004), intensity of delusional experience in the context of psychosis (Chadwick et. al, 2008), and general psychological symptoms (Baer et. al, 2006). There are also known associations between mindfulness and sustained attention (Schmertz, Anderson & Robins, 2009), persistence (Evans, Baer & Segerstrom, 2009), and lower frequency of negative automatic thoughts and ability to let go of those thoughts (Frewen, Evans, Maraj, Dozois and Partridge, 2008).

Due to the benefits of being mindful in everyday life, there are mindfulness exercises that have been developed in order to cultivate the practice of mindfulness. These exercises and techniques can be thought of as mindfulness meditation (MM). One of the most popular definitions of MM, in the Western world, is “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn, 1994) including bodily sensations, feelings, thoughts, and external stimuli from the environment (e.g. Baer, 2003; Grossman, Niemann, Schmidt, & Walach, 2004). It is the fostering of a conscious attention on a moment-to-moment basis and is characterized by an open and receptive attitude (Marlatt & Kristeller,

1999). Similarly, it has also been described as “the nonjudgmental observation of the ongoing stream of internal and external stimuli as they arise” (Baer, 2003).

One MM technique, guided imagery, can be conceptualized as directed thoughts and suggestions that guide one’s imagination toward a more relaxed and focused state. One example would be an instruction such as the following: “visualize your thoughts, feelings, and sensations as if they are clouds passing by in the sky”. This allows one to notice their thought occurring, but not attach any emotion or judgment to it, and let it pass, so that they can remain present to observe the next thought that passes by without getting lost in their past cognitions. Another technique used is instructing people to consciously bring more awareness to daily activities (from eating to washing the dishes to walking the dog). For example, if one were given a raisin and instructed to “eat mindfully” they may be asked to fully notice the sensations as they eat including texture, flavor, and density of the raisin. Another popular technique is “focused breathing” in which one practices sustaining attention on one’s breath. Instructions include simply focusing on the sensations of one’s inhalations and exhalations; as extraneous thoughts occur (e.g., worries about work or school) they are instructed to notice the thought, but let it pass, without judgment, and return focus to the breath.

Evidence in health research suggests that mindfulness exercises may be useful in physical disorders (Chiesa & Seretti, 2010). Grossman and colleagues conducted a meta-analysis investigating the health benefits of MM on physical disorders, and found an effect size of 0.53. Mindfulness training was examined in studies among medical patients including the following diagnoses: Fibromyalgia, various cancer diagnoses, coronary artery diseases, chronic pain, and obesity (Grossman, 2004). Based on the strong effect size they reported mindfulness training may enhance general features of coping with distress and disability in everyday life, including

serious disorders or distress. Baer and colleagues also found similar benefits for health parameters of physical well-being including sensory pain, physical impairment and functional quality of life estimates (Grossman, 2004; Baer, 2003).

In addition to data from self-report studies, there have been many neuroimaging studies which indicate that MM practices may promote positive psychological benefits through activation of specific brain areas (Chiesa & Seretti, 2010). Neurobiological findings suggest an activation of multiple areas such as the prefrontal cortex (PFC) and the anterior cingulate cortex (ACC), and an increase in alpha and theta electroencephalogram (EEG) activity, a pattern usually associated with both meditation and relaxation (Cahn & Polich, 2006). Additionally, more expert meditators exhibit increased theta activity which may indicate that greater experience could be related to higher ability of self-induced deep relaxation (Chiesa & Seretti, 2010).

Studies investigating the long-term effects of MM suggest that mindful attention is related to voluntary regulation of PFC activity and could be an important element in overall reorganization of brain activity. Voluntary sustained attention reduces excessive emotional reactivity, hence bringing the mind-body interaction into equilibrium which may relate to positive clinical outcomes (Chiesa & Seretti, 2010).

There have also been neurobiological findings that suggest mindfulness is negatively correlated with resting activity in the amygdala and in medial prefrontal and parietal brain areas whereas these areas are positively correlated with resting activity in patients (Way, Creswell, Eisenberger & Lieberman, 2010). These findings further add strength to the association between mindfulness and greater self-reported ability to let go of negative thoughts about the self (Frewen et. al, 2008).

Due to the vast amount of benefits seen through research in health and psychological functioning there have been several major therapies that have been developed to integrate MM and the acquisition of mindfulness skills into therapeutic interventions. These more popular therapies include Mindfulness Based Stress Reduction (MBSR), Dialectical Behavior Therapy (DBT), Acceptance and Commitment Therapy (ACT) and Mindfulness Based Cognitive Therapy (MBCT). These mindfulness-oriented interventions have been associated with an astounding number of positive impacts on psychological symptoms and disorders.

MBSR is an eight-to-ten week course of two-and-a-half hours per week of mindfulness meditation instruction and training (Kabat-Zinn, 1990), as well as at-home mindfulness exercises and an all-day mindfulness retreat. Research indicates that this intervention enhances general features of coping with distress and disability in everyday life, as well as with more specific disorders such as depression and anxiety (Grossman et. al, 2004). Additionally, MBSR has been associated with reductions in self-reported anger (Anderson et al., 2007), perceived stress (Oman et al., 2008), post-traumatic avoidance symptoms (Bränström et al., 2010), and medical symptoms (Williams et al., 2001). It has also been found in both clinical and non-clinical populations that MBSR may improve empathy, self-compassion (Shapiro et al., 2005), forgiveness (Oman et al., 2008), and overall quality of life (Grossman et al., 2010; Shapiro et al., 2005).

DBT includes four modes of treatment: individual therapy, group skills training, telephone consultation between patient and therapist, and consultation team meetings for therapists. Mindfulness is taught during the skills training as a way to help patients increase self-acceptance and reduce avoidance of difficult emotions (Linehan, 1993b). DBT is primarily known for its efficacy rates in the population with borderline personality disorder (Linehan,

1993) and has been associated with decreases in parasuicidal behavior, number of psychiatric inpatient days, and anger (Linehan et. al, 1991). Other findings include decreases in depression (Turner, 2000) drug use (Linehan et. al, 1999), suicidal ideation (Turner, 2000), hopelessness (Koons et. al, 2001) and binging episodes (Telch et. al, 2001).

ACT includes six core treatment processes: acceptance, defusion, contact with the present moment, self as context, values and committed action (Hayes, Luoma, Bond, Masuda & Lillis, 2006). ACT does not specifically include mindfulness meditation exercises, but it focuses on helping patients cultivate present-centered awareness and acceptance which is consistent with other mindfulness-oriented interventions (Baer, 2003). ACT has been found to be effective in comparison to no treatment for lowering levels of depressive and anxiety symptoms and poor mental health outcomes. In addition, it also seems to be effective in reducing substance use and dependence among nicotine-dependent (Gifford et. al, 2004) and poly-substance abusing individuals (Hayes et. al, 2004). Preliminary evidence even suggests it may be helpful in treatment of trichotillomania (Woods et. al, 2006).

One of the most widely disseminated mindfulness-oriented interventions is MBCT, which has been shown to have a clinically significant impact on depressive symptoms (Anderson et. al, 2007; Grossman et. al, 2010; Koszycki et. al, 2007). Studies also report an improvement in a range of symptomatic and psychosocial outcomes among remitted depressed patients including overall quality of life (Godfrin and van Heeringen, 2010; Kuyken et. al, 2008). More specifically, improvements are seen in residual symptoms associated with major depressive disorder (MDD) including, but not limited to, mood disturbance (Britton et. al, 2010), rumination (Michalak, Holz & Teisman, 2011), and sleep problems (Yook et. al, 2008).

After "recovering" from an MDE it is common for patients to experience residual symptoms of depression (Kennedy, Abbot & Paykel, 2004), which frequently result in relapse (Judd et al., 1998). For instance, increased insomnia has been associated with greater levels of depression (Taylor et. al, 2005). Sleep problems may lead to higher rates of relapse in people with recurrent depression. Research suggests individuals who have recurrent MDE exhibit higher levels of sleep disturbance several weeks prior to a recurrent episode and that sleep complaints may precede the series of symptoms that make up the syndrome of major depression (Perlis et. al, 1997). Additionally, rumination has also been found to prolong and increase depressed mood (Thomsen, 2006) and influence the onset of clinically significant depressive episodes (Nolen-Hoeksema, Stice, & Bohon, 2007).

Without ongoing treatment, people with a history of MDD have been found to experience relapse at rates as high as 80% (Kupfer et. al, 1992). Each additional MDE increases the risk of worsening the course of the disease (Kessing et. al, 2004).

Even though rumination, negative mood, and sleep quality seem to be independently associated with one another, they are likely to occur in interaction; "the negative moods giving the thoughts a negative taint detrimental to sleep and the negative thoughts amplifying negative mood, thus initiating a vicious circle" (Thomsen et. al, 2003). Further research suggests that ruminative thought may predict delayed sleep onset for those with a propensity for rumination (Zoccolo et. al, 2009). The connection between these two distinct residual symptoms may exacerbate one another and propel a subsequent MDE. Due to these residual symptoms of sleep and rumination playing a role in relapse of depression it has become increasingly more important to find treatments that may target these symptoms for relapse prevention.

MBCT was initially designed for those with a chronic, unremitting depressive history and to prevent relapse among those in remission from depression (Segal, et al. 2002). It incorporates mindfulness training as developed by Kabat-Zinn and his colleagues at the University of Massachusetts Medical Center (Kabat-Zinn, 1990), and adds various components of cognitive behavior therapy for depression (Beck, Rush, Shaw & Emery, 1979). The MBCT model specifies that previously depressed persons are characterized by greater cognitive vulnerability to states of low mood that may reactivate patterns of ruminative thinking: thus causing depression to be re-established (Segal,Williams, Teasdale, & Gemar, 1996; Teasdale, 1988; Teasdale, Segal, &Williams, 1995). MBCT teaches individuals to observe their thoughts and feelings through the repeated practice of intentionally returning attention to a neutral object, such as their breath or bodily sensations, in the present moment (Kenny & Williams, 2007). Patients are taught to accept intense bodily sensations and emotional discomfort, to detach or "de-center" from the content of negative thoughts, and to disengage from these processes by redirecting attention to experiences as they flux and change moment by moment (Piet & Hougaard, 2011).

During the first three sessions participants learn intentional attention through using a range of mindfulness practices such as the body scan, mindful movement, and mindfulness of breath. These early sessions also highlight habitual patterns of reactivity that arise during meditation (e.g., intrusive negative thoughts) and the associated aversion and judgment –which are thought to fuel depressive episodes (Kuyken et. al, 2010). Theory posits that mindfulness skills play a role in allowing one to respond to these negative thoughts with self-compassion and less judgment and aversion. This new way of responding to negative thoughts may cut back on rumination. Through closely observing the contents of consciousness, those practicing

mindfulness begin to realize their thoughts are in constant change. This mindful observation of thought creates a detachment, or de-centering, from the contents of consciousness (Holzel, 2011); thus helping to step out of the harmful habitual patterns of negative thinking (Feldman, Kuyken in press).

It is hypothesized that mindfulness skills induce change when a current experience is fully known and accepted rather than confronted with avoidance or resistance (Siegel 2010), like so often happens when negative thoughts arise. Learning how to step back from reactions rather than becoming "lost in them" is thought to have therapeutic effects. There are few compelling studies indicating how MBCT works, but in one recent, randomized control trial conducted by Kuyken and colleagues MBCT was compared with maintenance anti-depressants (mADM). Findings reported that greater reactivity predicted worse outcome in mADM participants, but not for those in the MBCT group. This study suggests that MBCT's effects are mediated by "enhancement of mindfulness" along with a decoupling of the relationship between reactivity of depressive thinking and poor outcome (Kuyken et. al, 2010). Recent studies highlight that the effect of MBCT may be facilitated or mediated by increased mindfulness and self-compassion (Kuyken et al., 2010); decreased rumination (Shahar, Britton, Sbarra, Figueredo, & Bootzin, 2010); and a balanced pattern of emotion related brain reactivity (Barnhofer et al., 2007). Two other studies found increased mindfulness and reduced rumination during MBCT and showed that post treatment levels of mindfulness and rumination significantly predicted MDD relapse over a 12 month follow-up period, even after controlling for residual depressive symptoms and number of previous episodes (Michalak, Heidenreich, Meibert, & Schulte, 2008; Michalak, Hölz, & Teismann, 2010).

Additionally, recent research indicates there is a neural plasticity component involved with mindfulness skill training. Through skill exercises, individuals are taught to attend to aspects of their subjective experience which has the power to change their minds, resulting in changes of the brain's neural patterns (Siegel, 2010). Thus, one's brain may become "re-wired" to be less "reactive and automatic" (Siegel, 2010). Further research suggests that the practice of mindfulness may cultivate neuroplastic changes "in the anterior cingulate cortex, insula, temporo-parietal junction, fronto-limbic network, and default mode network structures" (Holzel et. al, 2011). Holzel and colleagues suggest that these neural changes work synergistically, establishing a process of enhanced self-regulation.

Findings between MBCT treatment and depression include fewer relapse rates among patients with three or more episodes of depression (Ma and Teasdale, 2004; Teasdale et. al, 2000) or prolonged time to relapse (Bondolfi et al., 2010). Also, preliminary evidence suggests that MBCT may be more effective than treatment as usual (TAU) in reducing depressive symptoms among currently depressed patients (Barnhofer et. al, 2009; Hepburn et. al, 2009). Piet and Hougaard conducted a meta-analysis in 2011 which included 6 studies that investigated MBCT for prevention of relapse or recurrence in recurrent MDD. Out of 5 of the studies (408 participants), the range for the risk ratio for relapse recurrence in MBCT versus control groups is 0.44 to 0.93 with a highly significant average of 0.66. This corresponds to a relative risk reduction of 34% in favor of MBCT (58% relapse in control group and 38% relapse in MBCT group). This meta-analysis also indicates MBCT (added to treatment as usual) is an effective intervention for relapse prevention in recurrent MDD in remission.

Additionally, two of the included studies compared MBCT to maintenance anti-depressant medications (m-ADM). In one of these studies, 123 participants were randomized

into a MBCT+ADM tapering or ADM group, and 75% of participants in the MBCT group had completely discontinued their ADM at 6 month follow-up (Kuyken et. al, 2008). The results from the second study reported, for those participants in need of continued intervention, that MBCT and M-ADM were equally effective (Segal et. al, 2010).

These findings indicate mindfulness training seem to have some significant psychological benefits over other forms of treatment. First, while psychotropic medications may be used for some individuals, it is not always the preferred option for all patients or may not be recommended for all patients (e.g., patients with emergent clinical issues, such as pregnancy or drug interactions; Fava et. al, 2005; Pederson et. al, 2009; Solomon et. al, 2005). Second, national self-report surveys have found alternative medicine techniques being used by 41% to 54% of people with depression; indicating a large demand for complementary therapies (Eisenberg et. al, 1998; Kessler et. al, 2001). Also, MBCT is cost-effective, requiring only 3 to 5 therapist contact hours per patient (Teasdale et. al, 2000) and training can then continue through compact discs and manuals (Eisendrath et. al, 2011). As a side note, mindfulness training gives an individual certain skills that can be employed, virtually, in any environment, at any time, and in most situations. This may lead to increased feelings of self-efficacy, and control, which is also known to have therapeutic benefits (as seen in the theory of locus of control; Rotter, 1954).

Although MBCT has been shown to be helpful in remission from depression, many of the studies that investigate MBCT in remitted patients do not give a clear description of the level of remission: whether it is full (not experiencing any depressive symptoms), or partial (still have some residual depressive symptoms; sub-syndromal). Furthermore, other studies that specify that participants are in partial remission do not give a clear portrayal of how many symptoms the individual is experiencing or the severity of individuals' symptom.

Also, it is unclear as to whether or not MBCT may have a wider role to play in treating chronic mood disorders during their active phase, which is when patients tend to seek help from primary care (Finucane & Mercer, 2006). It has been cautioned against using MBCT as treatment for acute depression (or active depression) "where factors such as difficulty in concentrating and the intensity of negative thinking may preclude acquisition of the attentional control skills central to the programme" (Teasdale et. al, 2000). Yet, there have been studies showing preliminary evidence of efficacy in helping depressive symptoms in those with active, acute depression (Eisendrath et. al, 2008; Kenny & Williams, 2007; Finucane & Mercer, 2006; Kingston et. al, 2007; Manicavasgar et. al, 2011). Additionally, other research has found no evidence that more severely depressed patients had difficulty learning MBCT (Eisendrath et. al, 2008).

With these conflicting views it is difficult to determine exactly how much depression is too much for individuals to benefit from MBCT, or more specifically, to successfully acquire mindfulness skills. Research has been found that the documented benefits of mindfulness intervention programs, such as MBSR and MBCT, are often attributed to the cultivation of mindfulness (as cited in Shapiro et. al, 2008). Therefore, it would be beneficial to develop a better understanding of which individuals are able to successfully acquire mindfulness skills in order to receive the positive benefits from the MBCT program, or, more broadly, other mindfulness-oriented interventions.

Although there are many advantages to MBCT, because we do not have a better idea of a "depression threshold" for mindfulness acquisition, it may be an ineffective use of patients' time and money, in therapy, trying to teach mindfulness skills if they are not receiving any benefit. What is it about those in partial remission, with sub-syndromal symptoms, that allow them to

acquire mindfulness skills more successfully than those who have active depression? Can those with higher levels of depression, even if not acquiring the mindfulness skills as "successfully" as those with less severe depressive symptoms, still receive some adjunctive benefit from learning these skills, such as better sleep quality or less rumination?

To our knowledge, no studies have used a dimensional approach in asking the question: "How much depression is too much for impeding the learning of mindfulness skills?" We want to investigate whether or not there is a certain threshold, or limit, in depression symptom severity that would inhibit the acquisition of mindfulness skills. Also, to our knowledge, no studies have looked at the interaction between mindfulness and both rumination and sleep quality in varying levels of depression.

There are three main hypotheses in this study. Based on the literature, hypotheses are the following: (a) "healthy" participants with no or minimal depressive symptoms will acquire more mindfulness skills than participants with a mild to moderate level of depressive symptoms, (b) the group of participants with more depressive symptoms will still acquire some mindfulness skills and, (c) the group of participants with elevated depressive symptoms will have a within group reduction in depressive symptoms, rumination and/or increased sleep quality. The purpose of this study is to investigate whether or not there is a difference in the ability to acquire mindfulness skills in varying levels of depressive symptoms to better inform the growing body of knowledge in mindfulness research and treatment outcome.

Because this was an exploratory study, the participants may have had a past MDE, have a current MDE, or have never had a fully syndromal MDE. The data from this study may have implications in expanding the type of patients that can be treated with MBCT, and other mindfulness-oriented interventions.

Methods

Participants

Participants used in these data analyses were 87 students (63% female) over the age of 18 (M=19.13, SD = 2.66, range = 18 – 34), primarily White (85%), and enrolled in an introductory psychology course at a large university in the Midwestern U.S. The four following groups of participants were intended to be recruited based on initial BDI-II score: healthy control, and three experimental groups (one with minimal, mild and moderate symptoms). However, due to limited number of students with clinically significant levels of depression that participated in SONA, the mild and moderate depressive groups were collapsed into one experimental depressive group. Therefore, after group structure was revised, participants were a part of one of the three following groups, based on their initial BDI-II score: 33 participants in the *healthy control* (HC) group (M=4.12, SD =3.389), 33 participants in the *healthy experimental* (HE) group (M=5.73, 4.453), 21 participants in the *depressive experimental* (DE) group (M=18.67, 4.993). (Baseline characteristics of the individual three groups are given in Table 1.) It is noteworthy that a BDI-II score of 18 or greater is usually indicative of an active major depressive episode (MDE) based on the Diagnostic Statistical Manual IV (DSM-IV) (Steer, Brown, Beck, & Sanderson, 2001). Therefore, the DE group may represent a sample similar in many respects to a sample of individuals with syndromal depression.

Interested individuals underwent a pre-screen through an online screening system, and were excluded based on the following criteria: (a) current or past bipolar disorder diagnosis; (b) increased or decreased dosage of any psychotropic medications within the previous four weeks; (c) problems with sustaining attention on a 10-minute mindfulness audio clip; (d) previous

training in MM (i.e., no one with a consistent, weekly meditation or yoga practice); (e) active suicidal ideation.

Two individuals were excluded after they arrived to the in-person baseline assessment. One had a score of greater than 28 on the BDI-II, and one responded with active suicidal ideation to Item 9 of the BDI-II questionnaire. Both individuals were provided with appropriate clinical referrals.

Measures

Self-Report Measures

***Beck Depression Inventory II (BDI-II)*:** (Beck et.al., 1996)—a 21-item, self-report measure assessing the severity of depression symptoms, during the past 2 weeks, on a 0 to 3 scale. The BDI-II has high internal consistency (α=0.91) and good convergent validity with the BDI-I (0.93) (Dozois et. al, 1998). This questionnaire was used during screening procedures to measure initial level of depressive symptom severity and place participants in the appropriate depressive symptom severity group. BDI-II scores were also assessed at day seven and day 14.

Ruminative Response Scale (RRS): (Nolen-Hoeksema & Morrow, 1991) is a 22-item scale adapted from the larger Ruminative Style Questionnaire. This smaller subscale assesses ruminative coping responses to depressed mood which concentrates on the meaning of rumination, feelings, symptoms and possible causes and consequences of mood. Items are rated on a 1 (“almost never”) to 4 (“almost always”) Likert scale. The RRS has good internal consistency (a=.89, Nolen-Hoeksema, Morrow & Fredrickson, 1993). Individual’s responses to this scale correlate significantly (.62) with their use of ruminative responses to depressed mood in a 30-day diary study (Nolen-Hoeksema, Morrow, Fredrickson, 1993 cited in Goerig & Papageorgiou, 2008). Higher scores on this measure indicate an increased tendency to ruminate.

This questionnaire was used measure rumination at baseline, day seven and day 14.

Five Facet Mindfulness Questionnaire (FFMQ): This 39-item instrument is intended to measure level of mindfulness in daily life (trait mindfulness). It is based on a factor analytic study of five independently developed mindfulness questionnaires (Baer et. al, 2006). The analysis yielded five factors that appear to represent elements of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience. All five facets show adequate to good internal consistency with alpha coefficients ranging from .75 to .91 (Baer et. al, 2006) and good construct validity (Baer et. al, 2008). Items are rated on a 5-point Likert-type scale ranging from 1 (*never* or *very rarely true*) to 5 (*very often* or *always true*). Examples of questions include the following: "In difficult situations, I can pause without immediately reacting" and "I rush through activities without being really attentive to them". This measure was given at baseline, day seven and day 14.

Toronto Mindfulness Scale (TMS): This self-report measure consists of 13 items and is intended to measure an individuals' "capacity to invoke a mindful state" (Lau et. al, 2006), or the state of "mindful self-regulation of attention and approach to experience" (Feldman et. al, 2007). Responses are collected immediately *after* they engage in a mindfulness meditation exercise. This measure poses statements such as, "I experienced myself as separate from my changing thoughts and feelings" and participants respond using a Likert-type ranging from 0 (*Not at all*) to 4 (*Very much*). The TMS has been found to be a "reliable and valid measure of mindfulness" with good internal consistency and has been found to be "distinct from anxiously preoccupied and ruminative states of self-focused attention" (Lau, Bishop, Segal et. al, 2006). This measure was given to experimental groups (HE and DE) after completion of the mindfulness meditation at baseline, day three, five, seven, nine, 11 and 13.

Daily Sleep Diary (DSD): This measure was filled out each morning, over the fourteen day study period, and assessed participants' sleep behaviors from the night before. Question number 12 measures an individuals' subjective sleep quality from the previous night. Sleep quality is measured on a 1-10 scale (1=poor sleep quality and 10=exceptional sleep quality). The estimates from the DSD have been found to be reliable and valid in adults with insomnia. (Bootzin & Engle-Friedman, 1981). Also, there are typically high correlations between sleep diaries and polysomnography (r = .63-.87), and sleep diaries have been found to be better than single-point retrospective estimates of sleep (Coursey et. al, 1980).

Focused breathing

The recorded instructions for the study's focused breathing induction have been adapted from the sitting MM exercise (Segal et al., 2002) in the Mindfulness Based Cognitive Therapy (MBCT) program in the form of a recorded audio clip 10 minutes in length. The goal of this exercise is to have participants focus their awareness on sensations they are experiencing in the present moment, with particular attention on the experience of breathing. First, participants are asked to become more aware of the sensations of their abdomen as they breathe: "Now bring your attention to the changing physical sensations in your lower abdomen as the breath moves in and out of your body". Then, participants are guided in how to focus on their breath. For example, the tape will ask participants to "be aware of your experience in each moment, as best you can, using the breath as an anchor to gently reconnect with the here and now…When you notice that your awareness is no longer on the breath, acknowledge gently and briefly where the mind has been. Then, gently bring your awareness back to the changing physical sensations in the lower abdomen, renewing your intention to pay attention to the breath coming in and breath going out." After these instructions there is a longer pause, allowing the participants to practice

this on their own. Finally, participants are instructed to continue focusing on their breath while allowing their attention to expand to their whole "body, posture, facial expression, and other parts of [their] body". Experimental groups (HE and DE) were instructed to listen to this meditation at baseline, day three, five, seven, nine, 11 and 13.

Procedure

Once exclusion criteria were assessed, eligible individuals were individually emailed with a password and invited to participate in the online screening portion of the study. Once prospective participants indicated interest in the study, they were allowed to sign up through the online screening system, and arrived, in person at an office in the university's Psychology building. Upon arrival, potential participants were verbally consented and given the consent form to sign. Once consented, participants filled out a BDI-II questionnaire. If their score was in the "healthy" range (BDI-II score of 0-13) they were randomly assigned to the control or experimental group (assignment alternated equally between each individual in the "healthy" range). If their BDI score was in the 14-28 range they were automatically assigned to the experimental group.

After being assigned to a group they were then directed to the Qualtrics online survey in which they completed in the KU laboratory. This baseline assessment was made up of the RRS, FFMQ, and DSD. Additionally, if they were assigned to the experimental condition then they also listened to the 10-minute MM and completed the TMS. If they were assigned to the experimental group. After which they were told they would be emailed a daily link to the appropriate Qualtrics survey each day for the remaining thirteen days of the study.

Participants were then informed they would be emailed a daily link to the appropriate Qualtrics survey each day for the remaining thirteen days of the study.

Qualtrics surveys for all participants included the BDI-II, RRS, and FFMQ questionnaires at baseline, day seven and day 14. All participants also filled out the DSD each morning. Participants in the experimental groups (HE and DE) also received the 10-minute audio mindfulness clip and the TMS at baseline and on all odd-numbered days over the course of the 2-week study.

Plan of Analysis

Statistical analyses were conducted using IBM SPSS Statistics 20 and Lisrel version 8.80. Multilevel Modeling (MLM) was used due to its ability to allow for repeated measures and multiple levels of nested data. It also accounts for the natural correlation of scores of each patient over time. Individual change in mindfulness skills, depression symptoms, rumination and sleep quality was evaluated across and between treatment conditions. As discussed in the Measures section above, questionnaires administered were at varying time points.

One specific benefit of MLM for this particular dataset is that it did not require assessments to occur at the same time points (Atkins, 2005). This was beneficial because participants were assessed using different questionnaires on different days throughout the course of the fourteen day study.

Additionally, due to the inherent nature of this study being longitudinal there is missing data for participants, and MLM does not require complete data from all participants (Atkins, 2005).

In the first set of multilevel models, the effect of depressive symptoms on acquisition of trait mindfulness was analyzed in two ways: through group status (categorical) and through depressive symptom level (continuous). All three groups (Healthy Control, Healthy Experimental, Depressive Experimental) were examined in these models. Groups were dummy-

coded and HE acted as the comparison group. Two separate models were conducted to test group status (determined by the combination of depressive symptom level based on BDI initial score and experimental condition) and depressive symptom level (determined by BDI score) on trait mindfulness acquisition (FFMQ total score). These multilevel models were conducted treating repeated FFMQ scores and associated subscales (Act with Awareness, Observe, Describe, Nonjudge, Nonreact) as dependent variables.

A second set of multilevel models was conducted to test the effect of depressive symptoms on acquisition of state mindfulness (as measured by adherence to the mindfulness audio clip). Analyses were conducted in two ways: group status (categorical) and depressive symptom level (continuous). Groups remained dummy-coded and only experimental groups (HE and DE) were examined in these models. Two separate models were conducted to test group status (determined by the combination of depressive symptom level and experimental condition) and depressive symptom level (determined by BDI score) on state mindfulness acquisition (TMS total score).

A third set of multilevel models was conducted to investigate whether group status, trait mindfulness acquisition, and time in treatment provided participants with an adjunctive benefit of decreased depressive symptoms, increased sleep quality and/or decreased rumination. Groups remained dummy-coded and all three groups (HC, HE, DE) were examined in these models. Three separate models were conducted to test group status on depressive symptoms (total BDI-II score), sleep quality (DSD question #12) and rumination level (total RRS score).

Results

The BDI, FFMQ, and RRS were administered at three time points (baseline, day seven, and day fourteen). The TMS was administered at seven time points, or every other day across

fourteen days. The DSD was administered every day across fourteen days. Due to the exploratory nature of the study, total scores were examined on the FFMQ, as well its five subscales (Act with Awareness, Observe, Describe, Nonjudge, Nonreact).

These measures were nested within 87 participants, and then further stratified into the following groups based on their initial BDI score: healthy control (n=33), healthy experimental (n=33), depressive experimental (n=21).

A deviance test, which examined whether a random-effect slope was justified by the data was used to assess the necessity of inclusion of random effects components. The deviance test was not significant which implies that slopes across individuals are similar and including a term to model the variability is unwarranted (Atkins, 2005).

Pre and post means within the DE group were examined for each of the indices (FFMQ, BDI, TMS, RRS, Sleep Quality) and are reported in Table 12.

The statistical significance level for all analyses was set at $\alpha=.05$.

Trait Mindfulness Acquisition by Group Status (categorical variable)

The effect of group status (determined by the combination of depressive symptom level and experimental condition) on trait mindfulness was examined through dummy coding participants based on the three groups (HC, HE and DE). The effect of group status on trait mindfulness acquisition was examined both as a main effect and as an interaction with time. Fixed parameter estimates are given in Table 2.

There was a significant main effect of group status on FFMQ; this indicates that individuals in the DE group had a significantly lower level of trait mindfulness than individuals in both the HE and HC groups ($p<.0001$). In addition, there was a significant interaction of time and group status; specifically, individuals in the DE group had an increase of 4.87 points on their

trait mindfulness score over time compared to the HE group (p=.003), while participants in the HE and HC groups did not have a significant change in trait mindfulness symptoms over time. (See Figure A for a graph of this interaction.)

Trait Mindfulness Subscales

For the purpose of better understanding the aforementioned gains in trait mindfulness, the five FFMQ subscales were examined in separate models. The effect of depressive symptoms on each subscale was examined both as a main effect and as an interaction with time. There was a significant main effect of group status on the following subscales: Act with Awareness (p<.001), Nonjudge (p<.001), and Describe (p<.01) skills; individuals in the DE group had a significantly lower level of these specific trait mindfulness skills than individuals in both the HE and HC groups. In addition, there was a significant interaction of time and group status on Nonjudge skills; while individuals in the HC and HE group remained static in their level of Nonjudge skills throughout the study, individuals in the DE group had an increase of 1.116 points on their Nonjudge score over time (p<.05). Similarly, individuals in the DE group increased their Describe skills by .989 over time (p<.05), while participants in the HC and HE groups did not show a significant increase their Describe skills. See Table 3, 4, and 5 for results.

No significant main effects or interactions were found for the Nonreact or for the Observe subscales.

Trait Mindfulness Acquisition by Depressive Symptom Level (continuous variable)

The effect of depressive symptoms (BDI), operationalized as a continuous variable, on trait mindfulness acquisition was also examined in the study's two experimental groups (HE and DE). Fixed parameter estimates are given in Table 6.

There was a significant main effect of BDI on FFMQ; specifically, for each 1-point increase in BDI there was a -1.49 decrease in trait mindfulness score ($p<.0001$). There was not a significant main effect of Time (mindfulness training over time); this indicates that time in the study did not significantly affect trait mindfulness levels. However, there was a significant interaction of time and BDI ($p<.05$), with the increase in trait mindfulness over time being greater for those with higher BDI scores. (See Graph B for interaction.)

State Mindfulness Acquisition (by group status)

The effect of varying levels of group status (for HE and DE) on self-reported state mindfulness acquisition (as measured by the Toronto Mindfulness Scale), or how well the participants were able to "adhere" to the mindfulness audio clip, was examined both as a main effect and as an interaction with time. Fixed parameter estimates are given in Table 7.

No significant main effects or interaction effects were observed.

State Mindfulness Acquisition (by continuous depressive symptoms)

The effect of BDI as a continuous variable was examined in the experimental groups (HE and DE) on state mindfulness. Fixed parameter estimates are given in Table 8.

There was a significant main effect of BDI on state mindfulness; for each 1-point increase in BDI there was a 0.36 increase in state mindfulness ($p<.05$). There were no other significant main effects or interactions.

Depressive Symptoms

The effect of group status and time on depression symptom severity was examined through dummy coding participants based on the three groups (HC, HE and DE). The effect of group status was examined both as a main effect and as an interaction with time. Fixed parameter estimates are given in Table 9.

As expected, there was a main effect of group status on BDI score; The DE group had significantly more depressive symptoms than the HE and HC groups ($p<.0001$).

In addition, there was a significant interaction of time and group status; individuals in the DE group showed a decrease in BDI score of 1.6 points over time, while the other two groups remained static ($p<.05$). Individuals in the HE group and HC group did not have a significant change in depression symptoms over time. See Figure C for graph of interaction.

Subjective Sleep Quality

The effect of group status and trait mindfulness was examined both as a main effect and as an interaction with time on sleep quality. Fixed parameter estimates are given in Table 10.

A significant main effect of trait mindfulness on sleep quality was found ($p<.05$); for every 1 point increase in FFMQ there was a .03 point increase on the study's 10-point sleep quality measure (Daily Sleep Diary). No other significant main effects or interactions were observed.

Additionally, a paired samples t-test was conducted on sleep quality scores for the DE group to further examine potential adjunctive benefits of mindfulness training. Results suggest that there was a significant difference in the baseline and day 14 sleep quality scores; $t(18)= -2.314$, $p<.05$. Means are given in Table 12.

Rumination Level

The effect of group status and trait mindfulness on rumination was also examined. The effect of group status and trait mindfulness was examined both as a main effect and as an interaction with time. Fixed parameter estimates are given in Table 11.

Two significant main effects were found. Results indicate that those in the DE group had an increased rumination score of 13.04 points compared to the HE and HC groups ($p<.0001$). In addition, a significant main effect of trait mindfulness on rumination was found ($p<.0001$); this indicates that for every 1 point increase in FFMQ there is a .12 decrease in rumination score. No other significant main effects or interactions were observed.

Additionally, a paired samples t-test was conducted on rumination scores for the DE group to further examine potential adjunctive benefits of mindfulness training. Results indicate that there was a statistically significant difference in the baseline and day 14 rumination scores; $t(18)= 2.275$, $p<.05$ for the DE group. Means are given in Table 12.

Discussion

The current study aimed to better understand the effects of depressive symptomatology on mindfulness acquisition, as well as the potential adjunctive benefits of mindfulness acquisition (i.e., decreased depressive symptoms, increased sleep quality and decreased rumination) among those who suffer from varying levels of depressive symptomatology.

Study results suggest that those with current depression symptoms may benefit from engaging in mindfulness meditation training – in this case, a mindfulness routine that focuses attention on the breathing process. In fact, contrary to expectations, participants who began the study with elevated depressive symptoms actually achieved *greater* gains in trait mindfulness skills over the two-week study period than did those participants with no such symptoms. These gains were particularly prominent in so-called “Non-judge” and “Describe” mindfulness skills.

Of particular clinical importance, not only was the increase in trait mindfulness over time significantly greater among those in the study’s depressive experimental group (in comparison with the two other groups), but mindfulness gains were *positively* associated with increased

depressive symptom severity. In other words, over the two-week training period, those who began with the highest levels of depressive symptoms were those who, on average, experienced the greatest gains in trait mindfulness. These results suggest that those with elevated depressive symptoms – even those whose symptom severity is consistent with a potential diagnosis of major depressive disorder (e.g., BDI-II score of 18 to 28) – may be able to acquire trait mindfulness skills.

This finding is somewhat at odds with the initial concern reported by the founders of MBCT that those with acute depression may have "difficulty in concentrating and the intensity of negative thinking may preclude acquisition of the attentional control skills central to the [MBCT] program" (Teasdale et. al, 2000). However, findings are consistent with a few studies that have found that those with active depression do benefit from MBCT (Finucane & Mercer, 2006; Kingston T, Dooley B, Bates A, et. al, 2007; Manicavasgar V, Parker G, Perich T., 2011). Results from the present study provide further evidence that those who have more acute depressive symptoms may have the ability to gain the aforementioned attentional control skills (mindfulness).

Those with higher levels of depression attained significantly higher levels of state mindfulness during the training exercise, although there was no significant increase in attained state mindfulness as a function of time over the course of the study. It is important to note that the state mindfulness measure, the TMS, measures an individual's mindfulness at a "single point in time and thus may not reflect a respondent's true…capacity to evoke a state of mindfulness" (Lau et. al, 2006). In other words, the level of mindfulness reflected by the TMS –i.e., how mindful the individual was while undergoing a 10-minute induction –may not be generalizable to their level of state mindfulness in everyday life (Lau et. al, 2006). Therefore, another

interpretation for this finding is that those with elevated depressive symptoms were able or chose to adhere to the audio clip significantly better than the healthy individuals. It is possible that the individuals with elevated depressive symptoms did not necessarily have "higher levels of state mindfulness" than the healthy individuals, but that the participants with increased depressive symptoms attributed more value to listening to the audio clip, and therefore, paid closer attention and scored higher on the TMS questionnaire. Regardless, this finding is noteworthy and, in contrast to previous literature (e.g., Teasdale et. al, 2000) suggests that those who have elevated depressive symptoms may be able to engage more attentively in brief mindfulness training than previously believed. These findings warrant additional research in this area to further explore the concept of state mindfulness in an acutely depressed population.

Additionally, those in the depressive experimental (mindfulness training) group had a significantly greater decrease in depressive symptoms over time than those in the healthy experimental group. This finding could, of course, be due to a mere "floor effect," since those in the healthy group had (by definition) few depressive symptoms at the beginning of the study. Nonetheless, it is noteworthy that those in the depressive group did experience a significant decrease in symptoms over time. To help clarify the issue, it would be useful for future investigations in the area to include a depressive control group – with no mindfulness training – to help substantiate the hypothesis that reductions in depressive symptomatology are attributable to mindfulness training, rather than mere regression to the mean.

Lastly, while study results did not support the hypothesis that the mindfulness meditation training may enhance sleep quality and reduce rumination *over time*, the results did appear to support the hypothesis that individuals with elevated depressive symptoms may receive some adjunctive benefit to engaging in mindfulness meditation training, inasmuch as they were found

to have both significantly better sleep quality and reduced rumination by the end of the study. Additionally, more trait mindfulness during the study was found to predict significant improvements in sleep quality and reductions in rumination. These findings are consistent with the literature regarding the potential sleep and rumination benefits of MBCT and more specifically of mindfulness practice (Lykins & Baer, 2009; Greeson, 2008; Michalak, Holz & Teisman, 2011; Yook et. al, 2008).

Limitations & Future Directions

While some study hypotheses were supported, the aforementioned results should be interpreted with some caution in light of the study's significant limitations. Notably, for example, the non-clinical undergraduate population from which the study sample was drawn is fairly homogeneous, and it is unknown the degree to which study findings might generalize if applied to a more clinical population or even merely to a more demographically diverse sample of adult community members.

This study was also limited in that it excluded individuals with severe depressive symptoms, as who had a BDI-II score higher than 28 were not included. Had such more participants with more severe depressive symptoms been included, results may have varied. Accordingly it would be valuable in any attempted replication, to include a sample of individuals with more severe depressive symptoms in order to help facilitate a greater understanding of the acquisition of mindfulness skills across a more representative range. This would, in turn, help researchers gain a broader and clearer understanding of the findings mentioned above.

While some significant results were found within the experimental group with elevated depressive symptoms, there was not a depressive control group with which to compare these results. A depressive control group would have allowed for more definitive conclusions that it

was indeed the mindfulness meditation exercise – rather than some other factor (e.g., placebo effect) – that contributed to the observed increase in trait mindfulness skills (along with other related benefits).

Future studies would benefit from increasing the length of mindfulness meditation training to better assess skill acquisition; a 10-minute clip, every other day for two weeks, may not have been a sufficient amount of time for all individuals to achieve substantial gains in mindfulness skills. The short time period may account for the fact that the healthy control and experimental groups had no observed significant gains in mindfulness skills.

Additionally, this study only engaged participants in a mindfulness exercise on the breath, and qualitative research, in those with active depression, shows that individuals adopt a range of views on meditation exercises, and people tend to relate better to certain mindfulness exercises than others (Finucane & Mercer, 2006). Additionally, mindfulness skills can be cultivated through many different paths (Bishop et. al, 2004). Therefore, to reach a larger and more diverse depressed population, future studies would benefit from including varied mindfulness meditations in their training (i.e., mindfulness of emotions, visual imagery, body scan, Loving Kindness meditation, etc).

Another limitation is that this study only assessed depressive symptoms and trait mindfulness skills at three time points. Therefore, *non-linear* time trends could not be adequately investigated with so few time points. To better explore these non-linear trends, future studies would benefit from including a daily mood measure, such as the Profile of Mood States (POMS), and more frequent mindfulness skill observations.

In addition, because the link between depression and stress has also been well established through research – and much of the mindfulness based interventions appear to lead to substantial

reductions in stress (Shapiro, Schwartz, & Bonner, 1998) – future research on mindfulness acquisition within depressed populations may benefit from including a daily stress measure such as the Daily Hassles Scale or the Perceived Stress Scale. These daily measures may provide more information as to the relationship between daily mood, stress and state mindfulness and whether or not stress plays a mediating role in the acquisition of trait or state mindfulness skills.

Finally, study participants listened to the mindfulness audio clip at home; therefore, adherence was not closely monitored. Future studies would likely benefit from either having participants complete an adherence self-report diary at home (see Shaprio et. al, 2008) or listen to the audio clip in an experimental setting in order to better monitor and control for external variables or distractions.

Conclusion

The purpose of this study was to investigate the relationship between the acquisition of mindfulness skills and varying levels of depressive symptoms. A comprehensive review of the relevant literature suggests that this is the first study to systematically begin to address the question: "How much depression is too much to impede the learning of mindfulness skills?" Also, to my knowledge, no other studies have previously examined the potential effects of mindfulness acquisition on rumination and sleep quality at varying levels of depression severity. Study results suggest that those with significant depressive symptoms – even well into the range of diagnosable mood disorder – may be able to acquire trait mindfulness skills over time, with a possible adjunctive benefit in the form of enhanced sleep quality and reduced rumination. Therefore, given the tremendous potential physical and mental health benefits that mindfulness meditation has been shown to cultivate (e.g., Bullis J, Boe H, Asnaani, A., 2013; Keng et. al,

2011; Chiesa & Seretti, 2010; Baer et. al, 2006, Shapiro et. al, 2008) further research is warranted to explore the role and benefits of mindfulness within acutely depressed populations.

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Table 1

Baseline Characteristics of HC, HE, and DE groups

Variable	HC (*n*=33)	HE (*n*=33)	DE (*n*=21)
Female (%)	55	73	62
Age (years)	18.61 ± 1.69	19.15 ± 2.83	19.81 ± 3.49
Range (years)	18-27	18-31	18-34
Ethnicity (%)			
White	82	88	85.7
Hispanic	3	3	9.5
Black	3	-	-
Asian	6	3	-
Middle Eastern/Arabic	-	-	4.8
Native American	3	3	-
Multiracial/Biracial	-	3	-
Other	3	-	-

Table 2

Model Summaries: Group Status and Treatment Time Predicting Total FFMQ

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	133.533 (2.581)***
Healthy Control	4.496 (3.649)
Depressive Experimental	-24.284 (4.134)***
Time	-0.167 (1.017)
Time x Healthy Control	0.026 (1.448)
Time x Depressive Experimental	4.866 (1.667)**

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 3

Model Summaries: Group Status and Treatment Time Predicting Act with Awareness Skills

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	29.110 (1.012)***
Healthy Control	0.273 (1.434)
Depressive Experimental	-8.484 (1.632)***
Time	0.187 (0.372)
Time x Healthy Control	0.272 (0.526)
Time x Depressive Experimental	0.469 (0.608)

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 4

Model Summaries: Group Status and Treatment Time Predicting Nonjudge Skills

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	33.033 (0.914)***
Healthy Control	1.923 (1.293)
Depressive Experimental	-9.391 (1.479)***
Time	0.076 (0.331)
Time x Healthy Control	0.668 (0.474)
Time x Depressive Experimental	1.116 (0.556)*

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 5

Model Summaries: Group Status and Treatment Time on Describe Skills

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	27.963 (1.008)***
Healthy Control	2.091 (1.425)
Depressive Experimental	-4.330 (1.617)**
Time	-0.387 (0.266)
Time x Healthy Control	0.643 (0.380)
Time x Depressive Experimental	0.989 (0.438)*

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 6

Model Summaries: Depressive Symptom Level and Treatment Time on Total FFMQ

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	140.077 (2.708)***
BDI	-1.490 (0.177)***
Time	-1.026 (1.170)
Time x BDI	0.218 (0.089)*

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 7

Model Summaries: Group Status and Treatment Time on TMS

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	33.406 (1.557)***
Depressive Experimental	4.763 (2.510) $^{+}$
Time	0.326 (0.213)
Time x Depressive Experimental	-0.683 (0.351) $^{+}$

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 8

Model Summaries: Depressive Symptom Level and Treatment Time on TMS

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	31.325 (2.184)***
BDI	0.362 (0.250)*
Time	0.790 (0.447)
Time x BDI	-0.060 (0.035)

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 9

Model Summaries: Group Status and Treatment Time on BDI

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	5.520 (0.980)***
Healthy Control	-1.487 (1.386)
Depressive Experimental	12.912 (1.571)***
Time	0.258 (0.477)
Time x Healthy Control	-0.870 (0.682)
Time x Depressive Experimental	-1.600 (0.780)*

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 10

Model Summaries: Group Status, Treatment Time, Trait Mindfulness on Sleep Quality

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	2.779 (1.892)
Healthy Control	0.627 (0.492)
Depressive Experimental	-1.015 (0.646)
FFMQ	0.028 (0.014)*
Time	-0.113 (0.181)
Time x Healthy Control	-0.078 (0.084)
Time x Depressive Experimental	0.052 (0.060)
Time x FFMQ	0.001 (0.001)

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 11

Model Summaries: Group Status, Treatment Time, Trait Mindfulness on Rumination

Parameters	*Regression Coefficients (Fixed Effects)*
Intercept	52.583 (5.836)***
Healthy Control	-2.104 (1.950)
Depressive Experimental	13.043 (2.419)***
FFMQ	-0.159 (0.042)***
Time	-0.114 (0.467)
Time x Healthy Control	-0.049 (0.115)
Time x Depressive Experimental	-0.154 (0.150)
Time x FFMQ	0.0002 (0.003)

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Parameter estimate standard errors are listed in parentheses

Table 12

Questionnaire Means for Depressive Experimental Group

	Time Point			
	Pre	Post	*t*	*df*
FFMQ	108.63	118.32	-2.065^{+}	18
	(21.98)	(14.00)		
TMS	41.44	38.31	1.01	15
	(9.36)	(9.65)		
BDI	19.00	16.16	1.40	18
	(5.12)	(8.69)		
Sleep Quality	4.37	5.89	-2.314*	18
	(2.19)	(2.38)		
RRS	48.58	43.63	2.275*	18
	(8.41)	(10.30)		

Note: $^{+}$p<.06, * p<.05, **p<.01, ***p<.001; Standard deviations are listed in parentheses below means.

Figure A

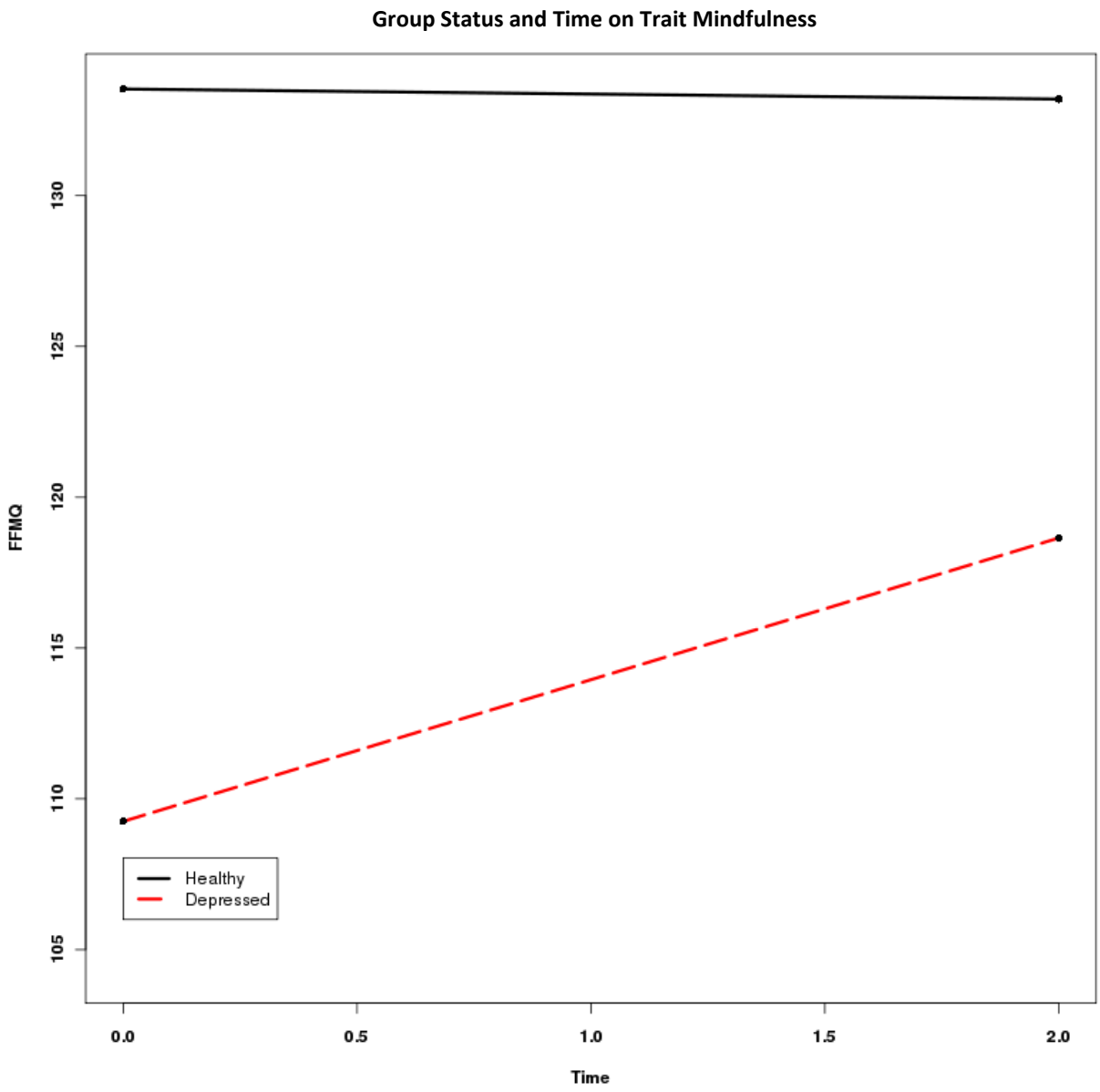

Group Status and Time on Trait Mindfulness
FFMQ
130
125
120
115
110
105
0.0
0.5
1.0
1.5
2.0
Time
Healthy
Depressed

Figure B

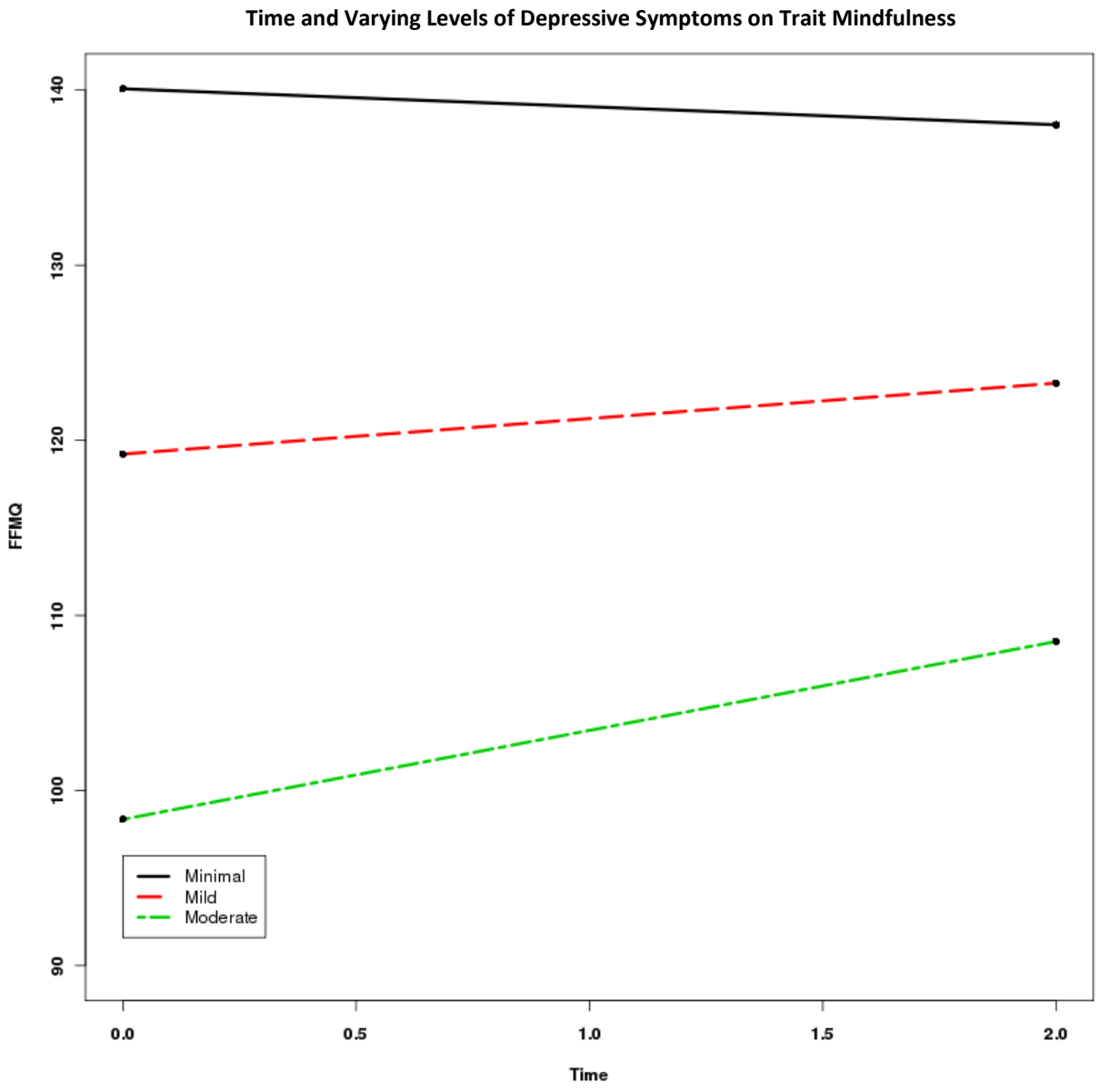
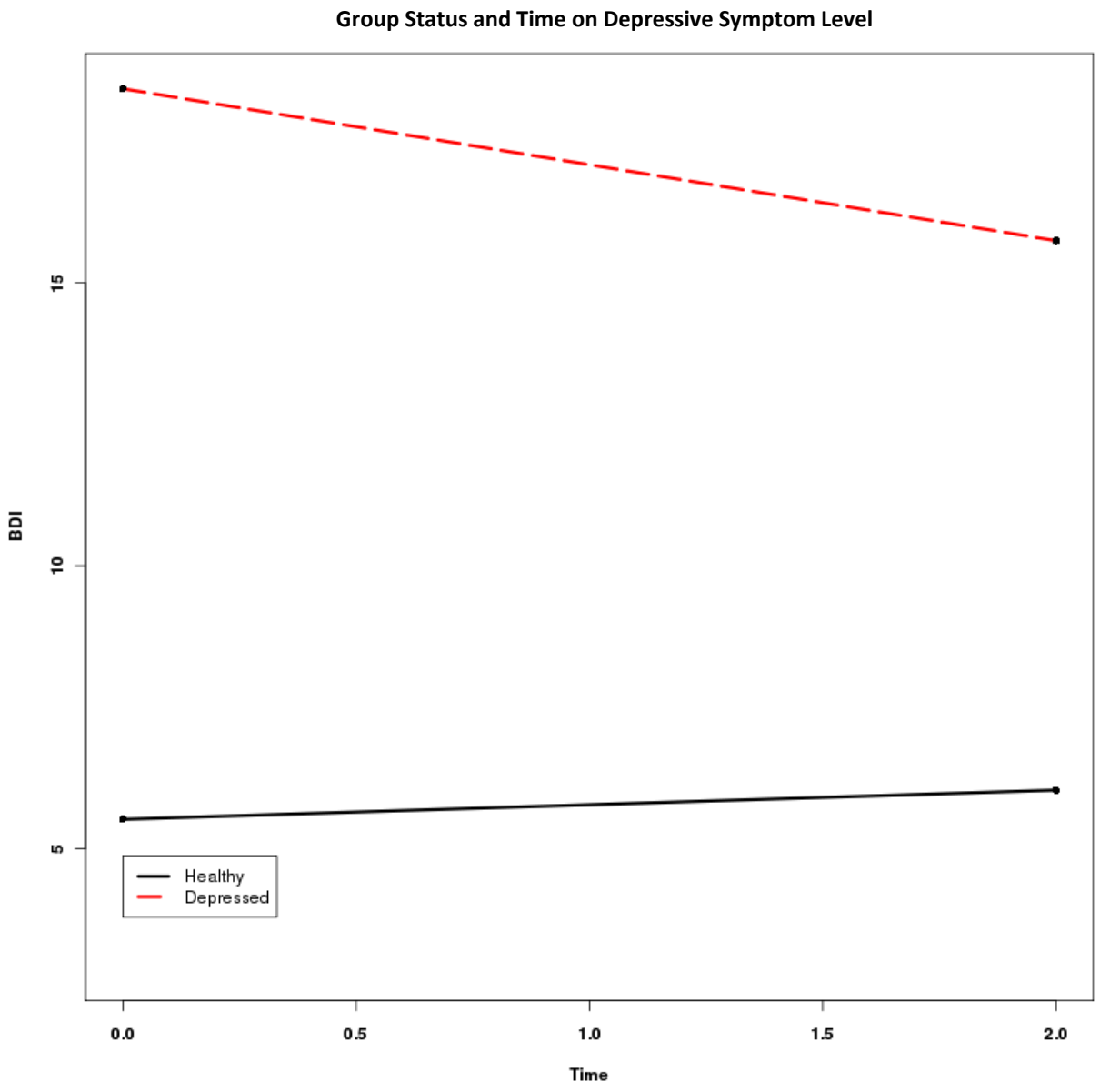

Time and Varying Levels of Depressive Symptoms on Trait Mindfulness
FFMQ
140
130
120
110
100
90
0.0
0.5
1.0
1.5
2.0
Time
Minimal
Mild
Moderate

Figure C


Group Status and Time on Depressive Symptom Level
BDI
15
10
5
Healthy
Depressed
0.0
0.5
1.0
1.5
2.0
Time