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Mindfulness-Based Stress Reduction and Transcranial Direct Current Stimulation as an Intervention for Chronic Pain Management

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DISSERTATION

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Abstract

Chronic pain is a public health concern impacting approximately 100 million Americans; more than the rates of diabetes, coronary heart disease, stroke, and cancer combined. Mindfulness-based stress reduction (MBSR) is an effective treatment for chronic pain; however, the effects of MBSR tend to be small. A recent study suggests that tDCS in combination with a mindfulness-based intervention may enhance the learning of mindfulness skills (Witkiewitz et al., 2015). The current study used a randomized design to examine the effectiveness of active tDCS (2.0 mA) -enhanced MBSR compared to sham tDCS (0.1 mA)- enhanced MBSR. Participants were individuals diagnosed with chronic pain (N= 52) recruited from the community and from providers in primary care and pain clinics. Pre and post measures of mindfulness and pain-related functioning were completed, as well as measures of pain intensity, pain interference, and tDCS sensations. The dorsolateral prefrontal cortex (F3 electrode placement), an area activated during meditation and also important for pain processing, was the target of tDCS stimulation as determined by a pilot test comparing its effects to a placement targeting the anterior frontal cortex (F10 electrode placement). At a four-week follow up, regression analyses found no main effects in support of the active tDCS simulation; however, individuals who received active tDCS and attended more treatment sessions reported significantly higher rates of mindfulness and significant improvements in overall general health after participating in the MBSR group. This study advances our knowledge of behavioral interventions for chronic pain by testing a novel combination intervention that may help individuals struggling with pain to learn mindfulness skills and increase their functioning and quality of life. Although there were no main effects of treatment with our small sample size and short duration follow-up, the current study suggests that combination tDCS and MBSR intervention is feasible, cost-effective, and may improve treatment outcomes for individuals with chronic pain.

Keywords: chronic pain, mindfulness-based stress reduction, transcranial direct stimulation, brain stimulation.

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Introduction

Chronic pain, persistent pain lasting six months or longer, impacts 20% of the general population (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Gureje, Von Korff, & Simon, 1998). The rate of chronic pain is estimated to be as high as 50% of the general medical population. In terms of pain intensity, 66% of individuals with chronic pain rate their pain intensity as moderate and 34% as severe (Johannes, Le, Zhou, Johnston, & Dworkin, 2010). 21% are diagnosed with depression due to pain, 61% are unable to work outside the home, 19% have lost jobs, and 13% have changed jobs due to their pain (Breivik et al., 2006). There is a significant amount of research on the development of treatment methods for chronic pain; however, there continues to be a lack of long-term treatment success (Turner, Loeser, & Bell, 1995). Approximately half of individuals with chronic pain report receiving inadequate pain management and two-thirds take prescription medication for their condition (Breivik et al., 2006). The cost of chronic pain on the healthcare system is high, with more than $70 billion spent annually in medical costs (Gatchel, Peng, & Peters, 2007).

Medical Interventions for Chronic Pain

Commonly used treatments for chronic pain are often invasive and typically provide short-term, but not long-term pain relief. For example, a study of long-term risks and benefits of spinal cord stimulation for found that at follow-up, 59% of individuals had less than 50% pain relief (Turner et al., 1995). Similarly, epidural steroid injections have failed to show longitudinal effects (Armon, Argoff, Samuels, & Backonja, 2007). In fact, steroid injections for chronic pain did not impact average impairment of function,

need for surgery, or long-term pain relief at three months' post-injection (Armon et al., 2007). These findings raise question as to the effectiveness of such practices within pain management. Nevertheless, spinal cord stimulation and epidural steroid injections continue to be common within chronic pain treatment.

Opiate medications are also ubiquitous in chronic pain management. A review examining the efficacy of opioids; however, did not find reduced pain within the opioid conditions (Martell, O'Connor, & Kerns, 2007). Furthermore, 36% to 56% of individuals with chronic pain who take opioids report a lifetime prevalence of substance use disorder and 43% currently meet criteria for substance use disorder (Martell, et al., 2007). A more recent review found that opioid therapy for chronic pain is associated with increased risk for overdose, substance abuse, myocardial infarction, and sexual dysfunction (Chou et al., 2015). There is little evidence for the use of long-term opioid therapy for chronic pain and considerable evidence for the harm of opiate prescriptions in chronic pain treatment, yet opioids continue to be prescribed regularly.

Multidisciplinary and Behavioral Interventions for Chronic Pain

Intensive, multidisciplinary, biopsychosocial rehabilitation with an emphasis on functional restoration reduces pain and improves functioning in patients with chronic low back pain; however less intensive interventions do not show such improvements. Treatment programs that incorporate multiple elements of physical and behavioral interventions show positive effects (McCracken, Gross, & Eccelston, 2002; Morrison, Flanagan, Fischberg, Cintron, & Siu, 2009). For example, individuals in multidisciplinary programs receiving cognitive behavioral treatment (CBT) and physical exercise showed significant improvement in post-treatment pain severity, pain interference, affective

distress, activity level, and depression (McCracken et al., 2002). In addition, changes in pain-related anxiety are important when predicting the effect of treatment on outcome measures (McCracken et al., 2002). Furthermore, compared to individuals who received only a standard nursing pain assessment and were prescribed analgesic medication, individuals in a multidisciplinary program were less likely to report moderate to severe pain with walking, and were less likely to be taking analgesics (Morrison et al., 2009).

Often delivered as part of a multidisciplinary intervention program, Acceptance and Commitment Therapy (ACT) increases psychological flexibility though acceptance and mindfulness of one's experience (Hayes et al., 2012). Measures of acceptance such as the Chronic Pain Acceptance Questionnaire (CPAQ, Vowles, McCracken, McLeod, & Eccleston, 2008) show significant effects in ACT-based treatment outcomes for chronic pain. For example, one study found at a three-month follow-up that 58.9% achieved reliable change in measures of depression, pain anxiety, and disability (Vowles, Witkiewitz, Sowden, Ashworth, 2014). In addition, changes in measures of psychological flexibility significantly mediate changes in depression, pain-related anxiety, disability, number of medical visits, and the number of classes of prescribed analgesics in individuals with chronic pain (Vowles et al., 2014). Acceptance of one's pain can also have a significant impact on emotional processing. Pain acceptance has been associated with higher levels of positive affect, but not negative affect, among individuals diagnosed with osteoarthritis and fibromyalgia (Kratz, Davis, & Zautra, 2007). Pain acceptance may also moderate the association between negative affect and pain severity, such that expected increases in negative affect during painful episodes are attenuated by higher levels of pain acceptance (Kratz et al., 2007). ACT-based treatments that moderate

negative affect through acceptance approaches may be useful for managing the impact of chronic pain on the individual's life.

Control- and acceptance- oriented coping are two techniques often used in ACT with individuals with chronic pain. Data suggests that attempting to gaining control over pain may not be as useful as skills that require the acceptance of pain. Four factors within the coping data that have been studied include: pain management, pain control, help seeking, and activity persistence (McCracken, Vowles, & Gauntlett-Gilbert, 2007). Some factors, such as activity persistence, the ability to follow-through with a task despite difficulties, is associated with better functioning over time while control-oriented coping responses, such as medication consumption are associated with greater difficulty. Activity persistence is a particularly important factor when considering the common belief among individuals with chronic pain that increased activity level leads to increased pain. In fact, the data shows that decreases in fear of pain are related to increases in an individual's physical capability for work (Vowles & Gross, 2003).

Mindfulness-Based Stress Reduction for Chronic Pain

The practice of mindfulness is rooted in Theravada Buddhism and is used as a means to cultivate greater awareness and insight. Mindfulness is effective in reducing many forms of psychological distress including generalized anxiety disorder (Kabat-Zinn et al., 1992), social anxiety disorder (Goldin and Gross, 2010), depression (Kumar, Feldman, & Hayes, 2008; Shapiro, Schwartz, & Bonner 1998; Speca, Carlson, Goodey, & Angen, 2000), and parasuicidal behavior (Linehan et al., 1991). A meta-analysis reported robust effects for the impact of mindfulness training on anxiety and depression (Hofmann et al., 2010). Others show that mindfulness training leads to increased sense of

overall well-being (Lau et al., 2006; Shapiro, Brown, Thoresen, & Plante, 2011) as well as increased "dispositional mindfulness", one's level of mindfulness outside of formal practice (Cohen- Katz, Wiley, Capuano, Baker, & Shapiro, 2005; Shapiro, Brown, & Biegel, 2007). When practiced in a clinical setting, mindfulness techniques such as sitting and walking meditation, deep breathing, body scan relaxation, hatha yoga, are most taught independent of their Buddhist origins (Kabat-Zinn, 1982).

Mindfulness-based stress reduction (MBSR), developed by Kabat-Zinn (1982), is a group-based intervention focused on the acquisition of meditation skills used to decrease stress and increase mental and physical well-being. The intervention is traditionally an eight-week course for two and one-half hours each week. The goal is to learn meditation skills during group sessions and practice throughout the week at home, most days, working up to 45 minutes of daily home practice with or without an instructional CD with guided skills. In addition to learning specific meditation techniques, the course encourages an attitude of non-judgment and acceptance toward one's experience (Brantley, 2005). A meta-analysis of MBSR studies in pain, cancer, heart disease, depression, and anxiety populations, indicated that MBSR had a medium-to-large effect size (d= .54) on standardized measures of physical and mental well-being (Grossman, 2004). A more recent meta-analysis examining the effects of MBSR on individuals with chronic medical disease (Bohlmeijer, Prenger, Taal, & Culijpers, 2010) identified small-to-medium effects of MBSR on depression (d=0.26), psychological distress (d=0.32), and anxiety (d=0.47). Another review found small effects on changes in depression (d=0.26), anxiety (d=0.24), and psychological distress (d=0.32; Bohlmeijer, 2010).

MBSR impacts certain psychological processes associated with chronic pain and pain acceptance such as, increasing the ability to self-regulate affect (Tacon et al., 2003) and increasing one's perception of control (Astin, 1997). Two different studies found significant reductions in anxiety in medical students who received MBSR, compared to controls (Shapiro et al., 1998; Rosenzweig et al., 2003). MBSR also decreases avoidance behaviors among individuals with panic disorder (Miller et al., 1995). MBSR reduced reports of overall psychological distress including depression and results were replicated in a wait-list control group and held across multiple experiments (Shapiro, Schwartz, & Bonner, 1998). MBSR has been successful in longitudinal studies, maintaining a reduction in psychological distress at three-month (Williams, Kolar, Reger, & Pearson, 2001), six-month (Carlson et al., 2001), three-year (Miller et al., 1995), and four-year (Kabat-Zinn, Lipworth, Burney, & Sellers, 1987) follow-up time points for a variety of chronic health conditions

There is a considerable amount of research on the efficacy of MBSR for chronic pain. One meta-analysis of twenty-two studies reported effects of MBSR on the mental and physical health of individuals with chronic pain. Primary outcome measures were pain intensity and depression and the secondary outcomes were anxiety, physical wellbeing, and quality of life. A small effect size (d= 0.37) for pain and (d= 0.32) for depression were found in randomized controlled trials. The quality of the studies was not found to moderate the effects of the interventions studied. Researchers concluded that MBSR was not superior to CBT, but could be a good alternative (Veehof, Oskam, Schreurs, & Bohlmeijer, 2011).

Interestingly, the type of chronic pain and compliance with meditation practice may mediate the effects of MBSR on pain, health related quality of life, and psychological well-being (Rosenzweig, Greeson, & Reibel, 2010). Results from the Short Form Health Survey (SF-36; Ware & Sherbourne, 1992), a measure of global health, indicate that individuals with arthritis show the largest changes during MBSR (d=0.67). Those with back or neck pain also show significant improvement (d=0.52) on a measure of global health. Those with fibromyalgia (d=0.49) and headache/migraine (d=0.41) also show improvements after an MBSR intervention. Medium to large effects were found in changes in psychological distress except for those with fibromyalgia, who experienced only a small reduction in distress (d=0.39). Importantly, greater average weekly home meditation practice has been shown to be associated with reduction in psychological distress, suggesting a possible dose-response effect.

MBSR has been compared to multidisciplinary pain interventions including physical therapy and analgesic medication management. Pain intensity and pain-related distress improved significantly in the two groups, however, no between group differences were found (Wong, Chan, & Wong, 2011). When comparing MBSR or MBSR plus massage to treatment-as-usual, MBSR groups report less pain and psychological distress, increases in physical functioning, and a greater ability to accept their pain compared to the treatment-as-usual (Morone, Greco, & Weiner, 2008). A study by Rosenkranz and colleagues (2013) comparing MBSR to an active control intervention examined the ability to reduce experimentally-induced psychological stress and inflammation using the Trier Social Stress Test (Kirschbaum, 2009) to induce psychological stress. In addition, a topical application of capsaicin cream was used to induce inflammation and both groups

demonstrated similar post-training stress-evoked cortisol responses and reductions in psychological distress and physical symptoms. The MBSR group had significantly decreased post-stress inflammatory responses, despite equivalent levels of stress hormones.

In addition to chronic pain, MBSR is effective in treating anxiety and depression symptoms in chronic conditions such as cancer. Cancer patients in a randomized, wait-list controlled trial of a heterogeneous group had significantly lower depression, anxiety, anger as well as fewer cardiopulmonary and gastrointestinal symptoms after participating in an MBSR group. In a population of individuals with Stage II breast cancer, MBSR improved stress-related sleep difficulties (Shapiro, Bootzin, Figueredo, Lopez, & Schwartz, 2003). Individuals with cancer also demonstrate greater increases in spirituality and reductions in stress, depression, and anger after participating in MBSR compared to a creative arts intervention (Garland, Carlson, Cook, Lansdell, & Speca, 2007). One possible mechanism involved in the improvement of chronic symptoms is the ability for mindfulness techniques to increase quality of life in both healthy (Monti et al., 2005) and patient populations (Brown & Ryan, 2003; Carlson, Speca, Patel, & Goodey, 2003). For example, individuals with chronic pain experience a decrease in activity avoidance post-MBSR intervention, which may help to improve overall functioning (Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn et al., 1987). Others find improvements in social functioning, suggesting that relief from mental and physical health problems allows for increased involvement in social activities (Roth & Robbins, 2004). Therefore, reductions in anxiety and depression found in MBSR interventions may be related to improvements in overall functioning and quality of life.

There is emerging support for the use of brief, adapted MBSR interventions for treatment in various clinical populations. For example, in a group of 55 individuals with chronic pain, two 10 min mindfulness-based body scan sessions were administered over 24 hours were shown to have led to significant reductions in ratings for pain related distress and for pain interfering with social relations when compared to controls (Ussher et al. 2014). Improvements in cognitive impairment in breast cancer survivors after a six-week adapted MBSR course compared to care-as-usual (Lengacher et al., 2015). A five-week MBSR course found significant enhancement in psychological well-being immediately after training and up to four years after initial intervention (Mitchell & Heads, 2015). A bi-weekly, four-week mindfulness group conducted in nicotine-dependent adults compared the American Lung Association's "freedom from smoking" treatment to MBSR and found greater reductions in cigarette use during treatment and maintained during follow-up (Brewer et al., 2011). In sum, there is evidence that MBSR can be adapted from the standard eight-weekly session format for a variety of clinical populations, including individuals with chronic pain.

Neural Correlates of Mindfulness

There has been substantial advancement in the knowledge of the neural mechanisms related to mindfulness. Electroencephalographic (EEG) studies reveal the presence of significant increases in alpha and theta activity during mindfulness meditation practice (Davidson et al., 2003). Functional magnetic resonance imaging (fMRI) studies suggest mindfulness induces 'state' changes in the brain including activations of the anterior cingulate cortex and the dorsal medial prefrontal cortex (Holzel et al., 2007). A study comparing experienced and novice meditators found that meditation

training was related to greater activation in regions of the ventral posteromedial cortex (Pagnoni, 2008). The ventral posteromedial cortex is a core region of the default mode network, linked to automatic cognitive activity that is specifically targeted by many meditative practices. Therefore, mindfulness may regulate innate levels of mindfulness. In addition to such 'state' changes, fMRI studies show changes in 'trait' mindfulness including changes in attention and interoception in areas such as the prefrontal cortex and right anterior insula (Lazar et al., 2005) and the right hippocampus (Holzel et al., 2008), suggesting mindfulness training may improve cerebral areas related to attention and awareness of bodily sensations.

Cognitive regulation of emotional responses to aversive events is a skill practiced in MBSR. In terms of brain regions, increasing both positive and negative emotions is related to activation of the left lateralized prefrontal regions, whereas decreasing emotion is related to greater activation in bilateral prefrontal regions. In addition, amygdala activation is greater for positive stimuli than negative stimuli (Kim, & Hamann, 2007). The dorsolateral prefrontal cortex (dLPFC) is related to emotional processing, particularly the ability to reappraise negative stimuli and decrease negative affect. Reappraisal of highly negative scenes reduces subjective experience of negative affect (Ochsner, Bunger, Gross, & Gabriel, 2002). The dLPFC can be understood as having an executive-attention role by maintaining access to stimulus representations and goals (Kane & Engle, 2002). In fact, individuals participating in an MBSR course had significant increases in right inferior frontal cortex activation compared to a wait-list control and the magnitude of the increases were predictive of immune functioning

(Davidson et al., 2003). Such findings suggest that frontal cortical brain regions may be related to the 'mind-body connection' often referred to in behavioral pain management.

Transcranial Direct Current Stimulation

Transcranial direct current stimulation (tDCS) involves the use of small, electric currents applied to the scalp and is safe for experimental use in healthy subjects (Bikson et al. 2009). Stimulation involves altering the electrical environment of cortical neurons. Anodal tDCS passes a positive current through the cortex to increase the resting state potential in neurons. Anodal tDCS decreases the resting potential of neurons thus increasing the chance of depolarization in the targeted region (Nitsche & Paulus, 2003). Cathodal tDCS transmits a negative current, thereby suppressing activity in the region (Bikson et al. 2006). A meta-analysis on the effects of tDCS on motor and cognitive functioning found that anodal-excitation and cathodal-inhibition effects occur commonly in motor studies, but rarely in cognitive studies (Jacobson, Koslowsky, & Lavidor, 2012). Some posit that it may be that the lack of cathodal inhibition that leads to compensatory cognitive effects. Brian stimulation, including tDCS, modulates neural functioning and may be an important tool for behavior modification.

Clark and colleagues (2012) found significant improvements in learning and performance in a complex visual perceptual learning task with tDCS stimulation of the right frontal and parietal cortex, with improvements increasing by a factor of two compared to sham after a one-hour delay. The effects of training were most significant in the right middle frontal gyrus. Other research showed differential effects on learning by repetition and target presence based on electrical current strength such that target learning discrimination sensitivity was greater for 2.0 mA current (d=1.77) compared to 0.1 mA

(*d*=0.95; Coffman et al., 2012). These results suggest that tDCS enhances performance and is sensitive to repetition and target presence, but not to changes in other factors such as expectancy or mood. Most recently, research has supported the use of tDCS in conjunction with mindfulness-based relapse prevention (MBRP; Witkiewitz, et al. 2015) as a smoking cessation intervention. Results indicate a large effect size (*d*=0.95) reduction in cigarettes per day from baseline to the end of a four-week group treatment. The scope of tDCS is far-reaching, with studies showing therapeutic effects in epilepsy, Parkinson's disease, stroke recovery, and pain (Fregni & Pascual-Leone, 2007).

Brain Stimulation and Chronic Pain

Chronic pain is associated with a network of brain regions termed the 'pain matrix' that include the lateral thalamus, somatosensory cortex, and posterior insula. Emotional processing of pain is associated with increased activation in the anterior insular, cingulate cortices, as well as prefrontal regions (Knotkova, 2013). A meta-analysis reviewing the use of repetitive transcranial magnetic stimulation (rTMS), cranial electrotherapy stimulation (CES) and tDCS demonstrated a short-term effect on pain in rTMS studies and no significant changes in pain with CES. tDCS stimulation of the motor cortex over five to ten consecutive day sessions was significantly greater in the active group compared to sham, but authors concluded there was insufficient evidence (O'Connell, Wand, Marston, Spencer, & Desouzam, 2010).

Research examining the effects of tDCS on pain has attempted to use anodal stimulation of the motor cortex (Fregni et al., 2006; Fenton et al., 2008), cathodal stimulation of the somatosensory cortex (Antal et al., 2008) and anodal stimulation of the dorsolateral prefrontal cortex (Riberto et al., 2011; Valle et al., 2009). Stimulation has

focused on a number of populations including spinal cord injury (Fregni et al., 2006) and chronic pelvic pain (Fenton et al., 2009). One study evaluated the effects of a five day tDCS intervention) and divided participants into types of chronic pain: neuropathic, central, nociceptive/somatic, nociceptive/visceral and headache (Knotkova, Greenberg, Leuschner, Soto, & Cruciani, 2013). Twenty-minute tDCS sessions were conducted and either anodal motor cortex stimulation or the cathodal somatosensory cortex stimulation was applied. Results showed significant pain reduction in the anodal condition compared to the cathodal condition in 76% of the neuropathic pain group, 77% of the nociceptive/somatic category, 83% of the headache group, and 20% of the central-pain group. Secondary benefits in addition to pain relief included decreased medication use, improvements in mood, mobility, sleep, and pain-related functioning, as well as itch relief. Durability of analgesic effects were reported up to 12 weeks after tDCS and showed high inter-individual variability. Others have investigated the use of anodal tDCS among individuals with fibromyalgia who received 20 minutes of tDCS on five consecutive days and participants were randomized to either sham tDCS or active tDCS at the motor cortex or dLPFC (Fregni, Gimenes, & Valle, 2006). Motor cortex was found to be related to greater pain improvement as well as quality of life compared to sham or dLPFC stimulation, a result that was significant at a three-week follow-up compared to sham. In addition to fibromyalgia, low back pain has shown both pain reduction and improved sensory function during tDCS stimulation of the motor cortex (Luedtke, Rushton, Wright, 2011).

In terms of the affective component of pain, the dLPFC has been found to increase the pain threshold in healthy individuals (Boggio, Zaghi, & Lopes, 2008).

Participants randomized to anodal dLPFC or a sham tDCS condition demonstrated that stimulation of the dLPFC increased individual's pain threshold, suggesting that stimulation impacted the perception of pain. In a study of individuals with fibromyalgia, participants were randomized to receive ten weekly sessions of multidisciplinary rehabilitation approach combined with sham or anodal tDCS of the motor cortex and found a significant decrease in SF-36 Pain Domain Scores, a measure of overall health, and an increase in Fibromyalgia Impact Questionnaire scores (Riberto et al., 2011). In addition, daily sessions of dLPFC stimulation in individuals with fibromyalgia are related to improvements in pain scores and quality of life at the end of a ten-day outpatient treatment (Valle et al., 2009).

In sum, these studies suggest that tDCS can be applied in a chronic pain population and may impact one's ability to manage pain effectively. MBSR is easily adapted for brief intervention to treat a number of chronic health conditions including chronic pain. Support for the involvement of the dLPFC as well as the right inferior frontal cortex in the practice of mindfulness suggests that tDCS may enhance the learning of mindfulness skills. In addition, similar brain regions are also related to the emotional regulation of pain. Previous research has focused primarily on pain reduction through stimulation of the motor cortex and research have not fully taken into account the difference between pain intensity and pain-related functioning. Therefore, tDCS stimulation that focuses on increasing mindfulness and pain-related functioning is a worthy focus for future intervention research.

Current Study

The overall objective of the current study was to examine tDCS as a treatment for individuals with chronic pain and to obtain preliminary data on the effectiveness of using tDCS with MBSR to increase mindfulness and improve chronic pain functioning (the impact of chronic pain on one's ability to live a meaningful life).

There are promising results from prior studies of MBSR for chronic pain, as well as evidence indicating that tDCS may help to manage pain. The aim of this study was to conduct a randomized controlled trial comparing the efficacy of tDCS- enhanced MBSR with sham tDCS-enhanced MBSR in increasing mindfulness and pain- related functioning. The primary goal was to assess whether MBSR + tDCS was a feasible and effective intervention for chronic pain management.

In this study, tDCS was piloted in two anodal placements, the right dorsolateral prefrontal cortex (dlPFC; F3) and the right inferior frontal gyrus (IFG; F10), both of which have demonstrated effects in the acquisition of mindfulness skills. Anodal dLPFC and anodal right IFG both used a left upper arm cathodal placement. The first group (11 participants) were part of a pilot session and effect size differences on primary outcome measures were compared between the two placements. The dLPFC placement (F3) had larger effects on mean outcomes and was implemented for the remainder of the study.

Aim 1: To conduct a pilot MBSR group to identify the tDCS placement that provides the largest pre- to post-treatment effect size differences on pain related functioning, as measured by the Euro QoL-5 Dimensions (EQ-5D), Chronic Pain Values Inventory (CPVI), Chronic Pain Acceptance Questionnaire (CPAQ) and the Brief Pain

Coping Inventory (BPCI) as well as mindfulness, as measured by the Mindfulness Attention and Awareness Scale (MAAS).

Aim 2: To test the degree to which active tDCS (2.0 mA)- enhanced MBSR increases mindfulness as measured by the MAAS and pain-related functioning using scores on the EQ-5D, CPVI, CPAQ, and BCPI four weeks following baseline assessment, as compared to sham tDCS (0.1 mA) enhanced MBSR.

Hypothesis 1. Pain-related functioning will be higher in the active tDCS-enhanced MBSR group compared to the sham tDCS-enhanced MBSR group at four weeks following baseline assessment.

Hypothesis 2. Mindfulness will be higher in the active tDCS-enhanced MBSR group compared to the sham tDCS MBSR group at four weeks following baseline assessment.

Method

The current study included a pilot phase (Aim 1) and a randomized controlled trial (RCT) phase (Aim 2). The methods for both phases were identical, with the exception of using both tDCS placements (rIFG and dlPFC) in the pilot phase and using the dlPFC placement in the RCT phase. Methods for both phases are summarized below.

Participants

The University of New Mexico Institutional Review Board approved all procedures carried out during this research study and all participants provided informed consent prior to participating. The study was conducted at UNM's Psychology Department, Logan Hall. Participants included 52 individuals with a self-reported diagnoses of chronic pain. Recruitment began in July 2015 and ended in July 2016.

Inclusion criteria. Participants were between the ages 18-60, able to provide informed consent, self-reported a diagnosis of chronic pain, and right-handed. Screening was based on self-report responses to a telephone screening form (see Appendix A).

Exclusion criteria. Participants were excluded if they had a serious medical illness within the past six months (e.g. cancer, hepatic, or renal disease), significant cardiovascular disease (e.g. recent stroke or heart attack, arrhythmias, worsening angina pectoris, uncontrolled hypertension), current use of illicit drugs (excluding marijuana) in the previous 30 days, current psychosis, psychotic disorder, bipolar disorder, clinically significant suicidal ideation, prior seizure, current use of nitrosodimethylamine (NMDA) medications including tramadol, methadone, and ketamine), current pregnancy, trying to become pregnant, or breastfeeding, current active alcohol use disorder (symptoms in last 30 days), left-handedness, metal in the head, implanted brain medical devices, or electromedical device, previous tDCS exposure, or any neurological condition or a brain injury with loss of consciousness for more than five minutes. Participants were not allowed to receive tDCS if they had the following: cardiac pacemaker; implantable defibrillator; metal objects in the upper body that might interfere with tDCS or be negatively impacted by tDCS including metal plates, screws, aneurysm clips, neural stimulators of any kind, ear implants, insulin pumps, prosthetic devices in the head, drug infusion devices and dental appliances, and/or allergies to materials used in tDCS. Participants were also excluded if they had older tattoos and/or permanent makeup (eyeliner) with ferrous inks.

Measures

Demographic Questionnaire included demographic and background variables including age, gender, years of education, marital status, employment status, and ethnic/racial background.

Mindful Attention Awareness Scale *(*MAAS; Brown & Ryan, 2003) is a 15-item scale that measures the frequency of mindful states using a Likert-type scale ranging from 1 ("Almost Always") to 6 ("Almost Never"). Items include, 'I find it difficult to stay focused on what's happening in the present' and 'I do jobs or tasks automatically, without being aware of what I'm doing.' Higher scores indicate greater mindfulness. The internal consistency reliability of the MAAS at baseline in the current sample was $\alpha = 0.847$.

Euro QoL-5 Dimensions (EQ-5D; Janssen et al., 2012) is a brief, self-report measure of current health on five dimensions (Mobility, Self-Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression), each with five levels of functioning ranging from no problems to extreme problems with higher scores on the EQ-5D indicating poorer health. The internal consistency reliability of the EQ-5D at baseline in the current sample was $\alpha = 0.731$.

The Chronic Pain Acceptance Questionnaire (CPAQ; Vowles, McCracken, McLeod, & Eccleston, 2008) is a 20-item measure used to test pain acceptance. Two subscales, activities engagement and pain willingness were used. Individuals were asked to rate items on a scale from 0 ("Never") to 6 ("Always True"). The internal consistency reliability of the CPAQ at baseline in the current sample was $\alpha = 0.789$.

Chronic Pain Values Inventory (CPVI; McCracken & Yang, 2006) is a 12-item brief inventory that was used to determine which values were important to the individual and to assess the degree of success they were having in following their values. The valued domains included in the inventory were: Family, Intimate relations, Friends, Work, Health, and Growth/Learning. The internal consistency reliability of the CPVI at baseline in the current sample was α =0.697.

Brief Pain Coping Inventory (BPCI; McCracken, Eccleston & Bell, 2005) is an 18-item measure designed to assess acceptance-oriented and control or avoidance-oriented responses to pain. Individuals are asked to indicate the number of days in the past week they responded to their pain as indicated in each item. Three acceptance items are positive and three negative, six directly assess pain control oriented strategies, and the remaining seven items assess commonly used practice strategies, such as activity management methods. The internal consistency reliability of the BPCI at baseline in the current sample was α =0.757.

Procedures

Recruitment & Screening. Recruitment included direct referrals from providers at local pain clinics as well as advertising via the newspaper, Craigslist, email listservs, and fliers throughout the greater Albuquerque area (see Appendix A). Interested individuals emailed or called the study group at the email address and phone numbers provided in the advertisement documents. Study staff contacted potential participants via telephone to complete phone screening. Initial eligibility was determined via telephone with a

Screening Questionnaire (see Appendix A). Eligible individuals were scheduled for the upcoming MBSR group.

Baseline Session. Informed consent was obtained and participants completed the Handedness Questionnaire (Oldfield, 1971). Participants completed a one-hour assessment of mindfulness and pain functioning including the demographic questionnaire, MAAS, EQ-5D, CPAQ, CPVI, BPCI. Consent and assessment lasted approximately one hour. Participants were informed via consent documents in a quiet, secure office in UNM's Logan Hall which described the study and were told that they were participating in an experiment on chronic pain and brain stimulation. The consent form was signed and dated by both the researcher and participant. A copy of the consent form along with contact information for the principal investigator and other primary researcher staff was provided for the participants' records. The consent occurred on the same day as the baseline assessment and initial treatment session unless the individual preferred to leave and review the consent further and return to participate in the study at a later time.

MBSR + tDCS (Sessions 1-8). Participants were randomized using a random number generator to one of two treatment groups: MBSR + active tDCS (*n*=24) or MBSR +sham tDCS. (*n*=23) The MBSR groups were led by the author (EAM), a Master's level clinician with professional training in MBSR, whose clinical work has focused on the treatment of chronic pain, and who is obtaining teacher certification through the Center for Mindfulness at University of Massachusetts Medical Center. The study therapist (EAM) has a daily meditation practice and residential retreat experience.

The MBSR + tDCS sessions took approximately two hours, with the first 40 minutes composed of ten minutes of tDCS preparation and 30 minutes of meditation practice and the remaining time devoted to MBSR content delivery. For tDCS preparation, two moistened, thin sponges approximately 2x2 inches square were placed on the participants' scalp and upper arm. The sponges were connected to electrodes that delivered an electrical current that briefly resulted in an itching or tingling sensation. The tDCS current strength was set at 0.1 mA in subjects receiving sham tDCS for 30 minutes. The participants in the active tDCS condition received up to 2.0 mA tDCS for 30 minutes. A sensation questionnaire was administered after five minutes and 15 minutes of stimulation. If at any point the participant rated their sensations as a seven or above and/or requested an end to stimulation, tDCS was discontinued immediately stopped. Participants were run as a group using equipment that allowed for 12 simultaneous tDCS sessions. When run as a group, participants were instructed not to interact throughout the testing. The tDCS equipment consisted of a generator, a nine-volt battery, electrode wires and electrodes, rubber covers, latex-free, self-adherent bandages, coban (head wrap) and heat-shrink wrap, in order to ensure safe and comfortable conduction of the electrical current to the participant. The procedure ensures that no metallic equipment will make contact with participants while tDCS is active.

All participants engaged in MBSR which consisted of eight sessions delivered in small, group format (maximum of 12 participants) by the study therapist, with bi-weekly sessions offered over a period of four weeks. The first 40 minutes of the course included tDCS stimulation. The course closely paralleled the MBSR curriculum developed at the University of Massachusetts Medical Center (Kabat-Zinn, 1990). Weekly sessions were

aimed at increasing mindfulness awareness and attention through the use of breathing, body scans, meditation, gentle hatha yoga, and group discussion.

Post-Intervention Assessments. At the end of session eight, participants completed a post-intervention assessment of mindfulness and pain functioning including the MAAS, EQ-5D, CPAQ, CPVI, BPCI and participants were compensated $30 for completing the post-intervention assessment.

Data Management. Data was stored on a password-protected, restricted-access secure server. A single master list linking participant names and PINs was stored in a password-protected database and was only available to research staff who had completed a training course in the protection of human participants. The linkage between study data and individually identifiable information was destroyed at the end of the study.

Sample Size Considerations. Sample size for the current study was based on practical considerations, as well as a power analysis using the proposed analysis methods. With two groups (active vs. sham) and two time-points (baseline to post-treatment) we would have power greater than 80% (power = 0.83) to detect a significant between groups effect of f = .35 (roughly $d = 0.70$; $\alpha < 0.05$) at the end of treatment with 54 participants. While this is a somewhat higher effect size estimate than prior studies have found using MBSR for chronic pain, it was justified based on the large effect sizes ($d > 0.95$) observed in prior tDCS studies (Clark et al., 2012; Coffman et al., 2012; Witkiewitz et al., 2015). The study was able to recruit 52 participants and thus the power to detect an effect of f = .35 was reduced. With 52 participants power to detect an effect of f = .35 was still greater than 80% (power = 0.81).

Statistical Analysis

Descriptive statistics were calculated for demographic variables and self-report measures using SPSS version 24.0 (SPSS Inc., 2016). For the Aim 1 analyses we calculated Cohen's d effect sizes differences at the end of the four-week pilot group by placement type. For the Aim 2 analyses we conducted multiple regression analyses using Mplus version 7.4 (Muthén & Muthén, 2012) with each outcome variable as the dependent measure (i.e., criterion) and the following predictors: treatment group (active versus sham), baseline level of the outcome variable, age, gender, the number of groups attended, and an interaction between number of groups attended-by-treatment group. The number of treatment groups attended variable was mean-centered prior to calculating the interaction term. We had a 23.4% dropout rate from the treatment groups for the Aim 2 analyses, thus there was some missing data at the post-treatment assessment. To accommodate the missing data, maximum likelihood estimation was used and all available data were used in the final regression models. There were no significant differences between those who completed the post-treatment assessment and those who were lost to follow-up on any of the demographic or baseline measures (all $p > 0.05$).

Results

Aim 1 Pilot Study

The pilot study included the first 11 participants and included active tDCS of the dLPFC placement (F3; n = 6) and of the right IFG placement (F10; n=6). The sham condition included sham tDCS of the dLPFC placement (F3; n=3) and sham tDCS of the right IFG placement (F10; n=2). Active and sham tDCS were compared between the two tDCS placement to determine study placement.

Participant Baseline Characteristics and Descriptives

Descriptive statistics for the pilot sample by group treatment are shown in Table 1. The sample was predominantly female (81.8% female; n=9). Participants' age ranged from 24 to 50 with a mean of 38.73 years (SD =10.04). 45.5% of the participants identified themselves as Hispanic, 81% identified as non-Hispanic Caucasian, and 18% Native American. 27% participants had completed a college degree and 9.1% were receiving disability for their chronic pain condition.

Means, standard deviations and Cohen's d effect size measures for each outcome by placement type are provided in Table 2. As seen in Table 2, the dLPFC (F3) placement showed greater differences on mean outcome effect sizes for mindfulness and pain-related functioning measures and the F3 placement was then used throughout the remainder of the study. The effect sizes for all measures including the MAAS, EQ-5D, CPAQ, CPVI, and BPCI were larger for the F3 placement than the F10 placement. In addition, the change in scores from baseline to post-treatment was greater for the F3 placement for nearly all measures.

Aim 2 Randomized Controlled Trial (RCT)

Participant Baseline Characteristics and Descriptives

Descriptive statistics for the RCT sample by treatment group are shown in Table 3. The sample was predominantly female (68.1% female; n=32). Participants' age ranged from 21 to 59 with a mean age of 37.15 years (SD =9.96). Nearly half (46.8%) of the participants identified themselves as Hispanic, 63.8% identified as non-Hispanic Caucasian, 10.6% Native American, 8.5% African American or Black, 2.1% as Asian,

and 14.9% as "other" or multiracial. In terms of education and employment, 74% participants had completed a college degree and 19.1% were receiving disability for their chronic pain condition.

The scales were normally distributed (skewness and kurtosis values less than 1.5), thus no transformations were applied. Means, standard deviations and Cohen's d effect size measures for each outcome by treatment group are provided in Table 3. Effect sizes comparing active and sham at post-treatment were generally in the small-to-medium range. Only one effect size exceeded the anticipated effect size of f = .35 (corresponding to d=.70), which was the effect of treatment on CPVI success (Cohen's d = .89). As described below, this effect was not in the expected direction with sham scoring higher on the CPVI success at post-treatment than active. Pre- to post-treatment effects sizes within each of the tDCS groups were also small-to-medium. Observed power to detect main effects of active versus sham tDCS, after controlling for baseline, was less than 0.80 for all outcomes. Observed power to detect a main effect of treatment was .55 for the MAAS, .71 for the EQ-5D, and less than .40 for all other outcomes.

Regression Analyses

Multiple linear regression analyses with baseline levels of each measure as covariates were used to examine tDCS active vs. tDCS sham on measures of mindfulness and pain functioning. Analyses controlled for demographic variables including age and gender, as well as the number of treatment groups attended (Mean (SD) = 4.72 (1.68), ranged from 1 to 8 groups) and an interaction between the number of groups attended and treatment group assignment (active versus sham tDCS).

As shown in Table 5, results from the regression analysis of the MAAS indicated that baseline MAAS (β = 0.51, $p < .001$), age (β = -0.21, $p = .049$), number of groups attended (β = 0.93, $p < .001$), and the group-by-number of groups attended interaction (β = -0.61, $p = .004$) were significant predictors of the post-treatment MAAS score and the total regression equation explained 61.7% of the variance in post-treatment MAAS scores. Thus, higher baseline MAAS, younger age, and more groups attended predicted higher MAAS scores at post-treatment. The interaction between group and number of groups attended in predicting post-treatment MAAS scores was examined using simple slopes analysis, shown in Figure 2. Results indicated that individuals in the active tDCS-enhanced condition who attended more groups had significantly higher mindfulness scores, as measured by the MAAS, at post-treatment (B (SE) = 0.40 (0.08), $p < 0.001$), whereas individuals in the sham tDCS-enhanced condition who attended more groups did not report higher mindfulness scores at post-treatment (B (SE) = 0.06 (0.07), $p = 0.342$).

Results from the regression analysis of the EQ-5D, a measure of general health, are provided in Table 6. Results from the regression analyses indicated that baseline EQ (β = 0.29, $p < .004$), the number of groups attended (β = -0.81, $p < .001$), and the group-by-number of groups attended interaction (β = 0.87, $p = .001$) significantly predicted EQ-5D scores. Higher baseline EQ-5D and fewer groups attended predicted higher EQ-5D scores (indicating worse general health). The interaction between group and number of groups attended in predicting post-treatment EQ-5D scores was examined using simple slopes analysis, shown in Figure 3. Results indicated that individuals in the active tDCS-enhanced condition who attended more groups had significantly better health functioning, as indicated by lower scores on the EQ-5D, at post-treatment (B (SE) = -1.25 (0.35), $p <$

0.001), whereas individuals in the sham tDCS-enhanced condition who attended more groups did not report significantly better health functioning at post-treatment (B (SE) = 0.67 (0.38), $p = 0.08$).

As shown in Tables 7 through 10 and Figures 4 through 7, there were no additional significant main effects of treatment in the expected direction. Table 7 shows that for the CPAQ, regression analysis indicated that baseline CPAQ ($\beta = 0.68$, $p < .001$) significantly predicted post-treatment CPAQ and no other covariates were significant. Table 8 shows that for CPVI success, regression analysis indicated that baseline CPVI success ($\beta = 0.602$, $p < .001$) and treatment group ($\beta = 0.47$, $p < .001$) were significantly associated with post-treatment CPVI success. The treatment group was coded as 0=Active and 1=Sham, thus the results indicate an iatrogenic effect showing that individuals in the sham condition had significantly higher CPVI-success at post-treatment. In other words, individuals in the sham tDCS group reported greater success at living out their own values related to one of six values domains (family, friends, intimate relations, work, health, growth/learning).

Table 9 and 10 show that for CPVI-importance and BPCI, regression analysis indicated that only the baseline levels of the outcome were associated with post-treatment levels of the outcome. Baseline CPVI-importance ($\beta = 0.65$, $p < .001$) significantly predicted post-treatment CPVI-importance and baseline BPCI scores ($\beta = 0.46$, $p < .001$) significantly predicted post-treatment BPCI scores.

Discussion

The current study provides initial evidence regarding the feasibility and acceptability of a tDCS-enhanced MBSR protocol in a chronic pain population. In terms

of design, the MBSR protocol was provided in an adapted form with tDCS administered simultaneously during a guided meditation training. The study used a single-blind design and there were no adverse reactions to the tDCS-enhanced protocol among individuals with chronic pain. Fidelity in the delivery of MBSR was assessed through supervision of protocol adherence by the clinical supervisor and dissertation chair (KW). Due to the nature of the academic setting in which the study was performed, the research team was able to have control over all elements of the provided treatment, often not the case in studies being conducted within external treatment programs such as a pain clinic where participants are receiving multiple treatments within the same setting and wherein there may be less flexibility to implement pilot interventions, such as neurostimulation.

The results from this preliminary research found support for an interaction between number of groups attended and active tDCS in predicting mindfulness scores, as measured by the MAAS, at the end of treatment. The interaction effect was such that those who attended more groups in the active condition had significantly higher MAAS scores at post-treatment than those in the sham group. This relationship was also found for the EQ-5D such that those who attended more groups in the active condition had lower scores indicating better health functioning than sham. In terms of interactions, these two interactions effects were in the expected direction and warrant further discussion. There were no significant main effects in the expected direction and no additional significant interaction effects, therefore Aim 2, Hypotheses 1 & 2, were not met.

We did identify one main effect of tDCS, however it was not in the expected direction. Specifically, individuals who were randomized to receive sham tDCS had

higher post-treatment scores on a measure of the degree of success participants viewed with respect to following their values (CPVI-success). An inspection of the CPVI-success items indicated that four individuals in the active condition (24% of those with follow-up data) rated their level of success as "not at all successful" or only "slightly successful" on most items of the measure, whereas all individuals in the sham condition rated their level of success as at least "somewhat successful" on most items. It is unclear why sham tDCS would enhance success with following one's values and this is an important question worthy of future research.

Importantly, effect sizes in the current study were much lower than anticipated based on prior studies of tDCS enhanced interventions (Witkiewitz et al., 2015) and we were underpowered to detect main effects of active tDCS on all outcome measures. Post-hoc power analyses indicated a sample size of at least 84 subjects was needed to detect a main effect of active tDCS on EQ-5D scores and at least 200 subjects would be required to detect a main effect of active tDCS on MAAS scores.

Clinical Research Implications

This study used a randomized design to evaluate the treatment efficacy of an adapted manualized empirically support treatment. Given the consistent pre-post effect sizes in the small-to-medium range across active and sham treatment, this study highlights the importance of mindfulness-based interventions for chronic pain. Importantly, the current study did not examine daily mindfulness practice, which would have been a useful comparison since prior studies have found daily practice to be a mediating factor in treatment efficacy (Rosenzweig, Greeson, & Reibel, 2010. Behavioral interventions that focus on self-management through a multimodal approach can help to

create a stronger internal locus of control for individuals with chronic pain who may have been engaged in a more passive approach to their own pain management. Mindfulness skills such as non-judgmental acceptance and self-compassion may be useful in helping individuals with chronic pain take a more flexible approach to pain and begin to focus less on pain reduction and more on increasing their functioning and quality of life. In addition, it is likely that treatments such as ACT and other acceptance-based programs would be useful in enacting such change. This shift in focus toward self-management and away from passive, symptom reduction can be profound for individuals and can impact future treatment. One important consideration within MBSR treatment is that the focus is on the individual and not one's larger environment; a point of critique within MBSR research. This is particularly important given the high rates of ethnic and racial minorities within the current sample.

The current study found tDCS to be an accessible, well-tolerated treatment that was able to be applied simultaneously with a guided meditation practice. The incorporation of neuro-stimulation interventions into clinical treatment can pose challenges for the fidelity of the treatment, however; the current protocol allowed for group tDCS using a single-blind method that included stimulation of both active and sham participants in a single group. Some issues related to the group protocol included cross-talk and discussion throughout the session regarding tDCS sensations. Future research would benefit from more clear guidelines around discussion of tDCS sensations.

Data also supported the study of the role of the dLPFC in mindfulness practice. Prior research found increased resting-state functional connectivity between dLPFC, posterior cingulate, and dorsal anterior cingulate cortices at baseline and during

meditation (Brewer 2011). The current study found that repeated active stimulation of the dlPFC increased mindfulness scores, therefore future tDCS research would benefit from exploring other elements of this possible 'mindfulness network'. Furthermore, research has been able to demonstrate cortical thickness in PFC regions through mindfulness training (Lazar 2005), suggesting that both functional and structural changes occur via mindfulness practice. It is likely that tDCS-enhanced MBSR may also have an impact on cortical thickness.

Implications for Pain Management

Clinicians would benefit from considering alternative methods for measuring pain outcomes as well as incorporating multiple treatment modalities into their approach. Taking a multimodal approach to pain management has been shown to be effective in the treatment of individuals with chronic pain (McCracken, Gross, & Eccelston, 2002; Morrison, Flanagan, Fischberg, Cintron, & Siu, 2009). Alternatives, such as surgical interventions and opioid medications, have side effects and can be detrimental to an individual's well-being. In terms of increasing pain functioning, focusing on increasing overall mindfulness and general health through increased engagement in mindfulness skills may be a more useful long-term strategy than our current pain management methods.

Specifically, an interdisciplinary approach to pain is a key element in comprehensive pain management. Involving disciplines such as psychology and physical therapy into pain clinics can increase the likelihood that an individual would be exposed to more behavioral forms of treatment. Therefore, medical educational programs that emphasize a multidisciplinary approach are more likely to produce medical providers that

are willing to engage with professions outside their own. Psychology can play a large role in both team management and provider burnout as it relates to patient care. These issues are particularly important in pain management, an area in which provider-patient relationships can be conflicted. Continuing to encourage cross-disciplinary collaborations between providers is one way to increase exposure to alternative models of treatment. It may also be that an emphasis on stress reduction and acceptance-based coping leads to better pain management in general. One common critique of MSBR is that it's multiple components make it difficult to determine what element of the treatment is useful for managing pain. In other words, if the intervention includes walking meditation, deep breathing, body scan relaxation and hatha yoga, how do we know which element of the treatment is most useful? Future research that can study the individual segments or core skills of MBSR would improve our understanding of MBSR's active ingredients.

Limitations

This study has several shortcomings. Most notably, the small sample size and high attrition rates limited power to detect effects of interest. As seen in Table 4, there were small-to-medium effect size differences of the tDCS+MBSR treatment, but the effects did not reach statistical significance in inferential analyses. In addition, due to limitations of time and funding, this study did not measure the effects of treatment longitudinally beyond the end of the intervention. The goal of the study was to measure effects at both post-treatment and 1-month follow-up, however; after completing two intervention groups with a follow-up rate of below 20%, the research team made the decision to focus efforts on retaining participants through post-treatment. One possible explanation for such difficulties may have been the small monetary compensation for the

study's considerable time commitment. On the other hand, it is likely that individuals who did participate in the study were interested primarily in the treatment provided and not the compensation. Another limitation was that the tDCS portion of the MBSR protocol was single-blinded (blind to participants) and not double-blinded, such that the research assistants and the study therapist were aware of participant's group assignment. In addition, there were a number of deviations from the typical MBSR treatment that were made in the service of adapting the protocol to integrate tDCS. Specifically, sessions were cut in length to fit in tDCS into the group time. Therefore, instead of a 90-minute group, the current study held a one-hour group with one 30-minute session of tDCS with guided meditation. In addition, the current study held MBSR groups twice weekly for four weeks rather than once weekly for eight weeks. The current study also did not include a retreat day, which is an element of the standard MBSR program. The study also had missing data across measures primarily due to participant attrition and non-compliance. Finally, the use of self-reported chronic pain provides some question as to the accuracy of diagnosis as well as the possibility for false positive screening. Future studies would benefit from requiring additional information regarding medical history related to chronic pain. Such limitations to the study warrant caution in interpretation. It could be the case that tDCS would provide greater enhancement of the full version of MBSR.

Conclusion

Despite these limitations, this research study contributes to the literature by demonstrating the feasibility of incorporating neuro-stimulation techniques into clinical practice. The study has several strengths including the use of a randomized designed to

evaluate treatment efficacy of an adapted empirically-supported treatment, the single-blind delivery of active versus sham tDCS, and the inclusion of an ethnically-diverse sample (46.8% Hispanic).

The results from the current study provide preliminary data that support the use of tDCS-enhanced MBSR as an efficacious intervention for chronic pain. Data suggesting there is a relationship between number of MBSR classes attended and overall mindfulness could be seen as support for the fidelity of MBSR within the context of this experimental protocol. Furthermore, data suggesting a relationship between number of MBSR classes attended and overall health may indicate that tDCS-enhanced MBSR may have a dose-response effect and be a useful treatment for a variety of health condition. The study extends the literature on MSBR and tDCS by demonstrating that a tDCS-enhanced MBSR treatment can be used and can improve both general mindfulness and overall health. It also provides further evidence for the role of the rLPFC in meditation. This is the first randomized trial to show the feasibility of tDCS-enhanced MBSR in a group of individuals with chronic pain. This research study also demonstrated the benefits of delivering MBSR in its adapted form. Future research that corrects the methodological shortcomings of this study should continue to examine the use of tDCS as an adjunct to behavioral treatment for chronic illness.

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Figure 1. CONSORT Participant Flowchart

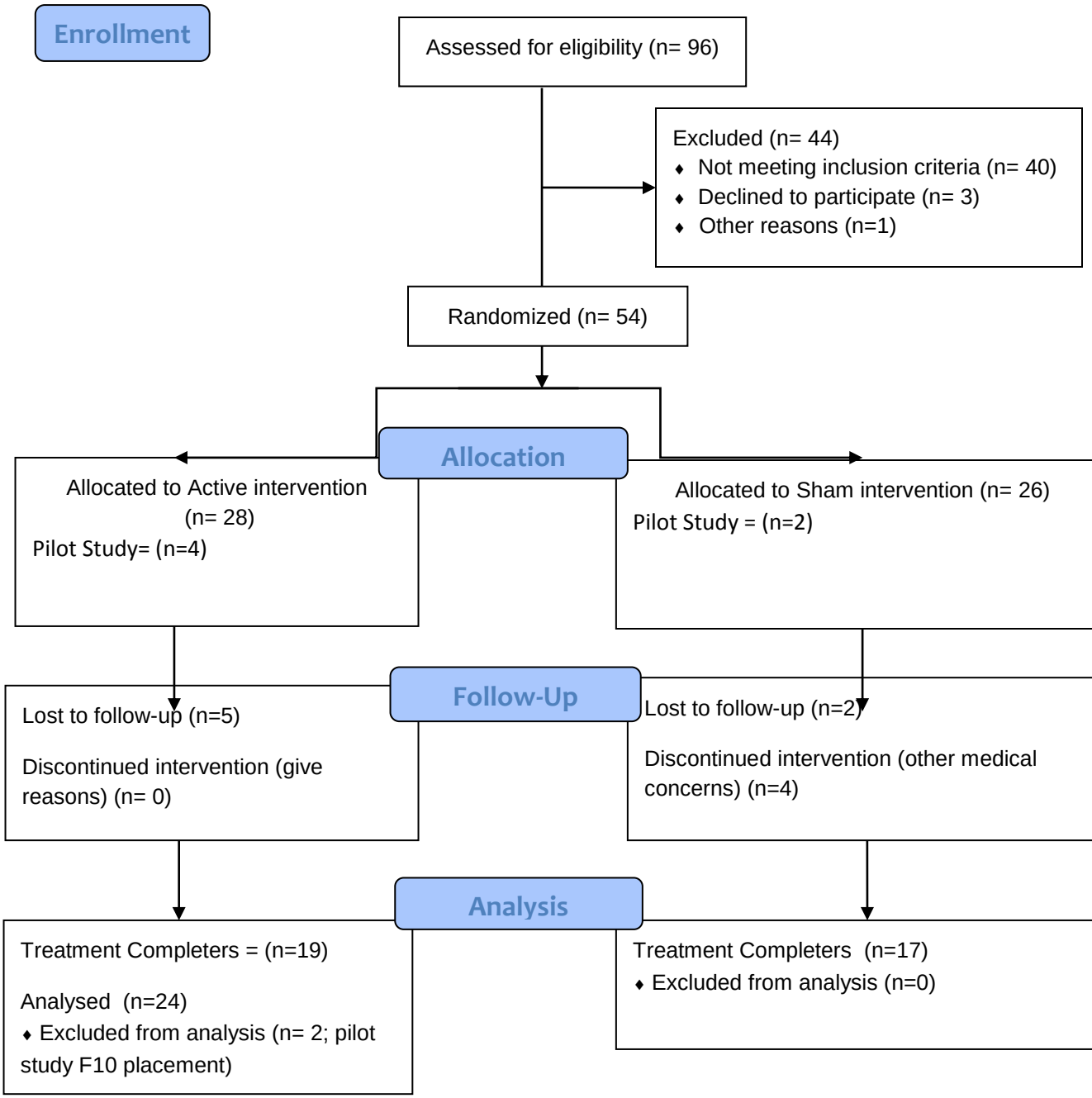


Table 1. Descriptive statistics, mean (standard deviation) or N (%), for demographic variables placement pilot study

	Overall N=11	Active N= 6	Sham N=5
Age M (SD)	38.73 (10.04)	36.16 (SD=11.96)	41.8 (SD= 7.19)
Gender N (%)			
Female	9 (81.8%)	5(83.3%)	4 (80%)
Male	2 (18.2%)	1 (16.7%)	2 (20%)
Ethnicity N (%)			
Hispanic or Latino	5 (45.5)	3 (50%)	2 (40%)
Caucasian/White	9 (81.8)	6(100%)	3 (60%)
African American/Black	(00.0)	000 (00.0%)	0 (0.0%)
American Indian/Alaska Native	2 (18.2)	000 (00.0)	2 (40%)
Asian	000 (00.0)	000 (00.0)	000 (00.0)
Multiracial	000 (00.0)	000 (00.0)	000 (00.0)
Education N (%)			
12th grade or less	1 (9.1%)	1 (16.7%)	000 (00.0)
Some college	2 (18.2%)	1 (16.7%)	1 (20%)
Bachelor's degree	3 (27.3%)	1 (16.7%)	2 (40%)
In graduate school	2 (18.2%)	1 (16.7%)	1 (20%)
Master's degree	3 (27.3%)	2 (33.3%)	1 (20%)
Doctoral degree	000 (00.0)	000 (00.0)	000 (00.0)
Professional degree	000 (00.0)	000 (00.0)	000 (00.0)
Employment N (%)			
Unemployed	000 (00.0)	000 (00.0)	000 (00.0)
Receiving disability	1 (9.1%)	000 (00.0)	1 (20%)
Part-time employed	3 (27.3%)	1 (16.7%)	2 (40%)
Full-time employed	5 (45.5%)	3 (50%)	2 (8.7%)

Student	2 (18.2%)	2 (33.3)	5 (00.0)
Retired	000 (00.0)	000 (00.0)	000 (00.0)

Table 2. Descriptive statistics, mean (standard deviation) and Cohen's d for outcome measures in placement pilot study.

Measure	Active F3	Active F10	Sham (F3 & F10)	Cohen's d (Active F3 vs. Sham)	Cohen's d (Active F10 vs. Sham)
Baseline	N=11	N= 6	N=5		
MAAS	3.43(0.94)	3.21 (0.96)	3.71 (0.95)	d=0.52	d=0.30
EQ	11.18 (2.48)	10.66 (2.50)	11.80 (2.59)	d=0.45	d=0.24
CPAQ total	59.00 (12.6)	58.50 (14.56)	59.60 (11.44)	d=0.08	d=0.05
CPVI Success	2.52 (0.85)	2.94 (0.58)	2.00 (0.87)	d=1.27	d=0.60
CPVI Importance	4.45 (0.63)	4.36 (0.68)	4.56 (0.61)	d=0.31	d=0.18
BPCI	3.57 (0.95)	3.77(0.90)	3.33 (1.06)	d=0.45	d=0.24

Measure	Active F3	Active F10	Sham (F3 & F10)	Cohen's d (Active F3 vs. Sham)	Cohen's d (Active F10 vs. Sham)
Post-Treatment	N=7	N= 4	N=3		
MAAS	3.50(0.71)	3.12 (0.55)	4.00(.67)	d=1.43	d=0.72
EQ	9.71 (1.60)	10.00 (1.42)	9.33 (2.08)	d=0.38	d=0.20
CPAQ total	69.3 (10.2)	69.00 (5.72)	69.7 (16.26)	d=0.05	d=0.03
CPVI Success	3.36 (0.45)	3.29 (0.55)	3.44 (0.39)	d=0.31	d=0.19
CPVI Importance	4.17 (0.59)	4.11 (0.64)	4.04 (0.60)	d=0.11	d=0.22
BPCI	3.86 (1.20)	3.72 (2.06)	4.04 (1.73)	d=0.16	d=0.12

Table 3. Descriptive statistics, mean (standard deviation) or N (%), for demographic variables in primary study.

	Overall N=47	Active N= 24	Sham N=23
Age M (SD)	37.15 (9.96)	36.25 (SD=10.7)	38.10 (SD= 9.32)
Gender N (%)			
Female	32 (68.1)%	17 (70.8%)	15 (65.2%)
Male	15 (31.9%)	7 (29.0%)	8 (34.8%)
Ethnicity N (%)			
Hispanic or Latino	22 (46.8%)	9 (37.5%)	13 (56.5%)
Caucasian/White	30 (63.8%)	17 (70.8%)	13 (56.5%)
African American/Black	4 (8.5%)	2 (8.3%)	2 (8.7%)
American Indian/Alaska Native	5 (10.6%)	2 (8.3%)	3 (13.0%)
Asian	1 (2.1%)	1 (4.2%)	000 (00.0)
Multiracial	7 (14.9%)	2 (8.3%)	5 (00.0)
Education N (%)			
12th grade or less	3 (6.4%)	3 (12.5%)	000 (00.0)
Some college	3 (6.4%)	2 (8.3%)	1 (4.3%)
Bachelor's degree	13 (27.7%)	7 (29.2%)	6 (26.1%)
In graduate school	8 (17.0%)	4 (16.7%)	4 (17.4%)
Master's degree	9 (19.1%)	4 (16.7%)	5 (26.1%)
Doctoral degree	4 (8.5%)	2 (8.3%)	2 (8.7%)
Professional degree	7 (14.9%)	2 (8.3%)	5 (21.7%)
Employment N (%)			
Unemployed	4 (8.5%)	1 (4.2%)	3 (13%)
Receiving disability	9 (19.1%)	7 (29.2%)	2 (8.7%)
Part-time employed	6 (12.8%)	3 (12.5%)	3 (13%)
Full-time employed	9 (19.1%)	8 (33.3%)	2 (8.7%)
Student	18 (38.3%)	8 (33.3)	10 (00.0)

Retired	1 (2.1%)	1 (4.2%)	000 (00.0)

Table 4. Descriptive statistics, mean (standard deviation) and Cohen's d for outcome measures.

Measure	Overall	Active	Sham	Cohen's d (Active vs. Sham)
Baseline	N=47	N= 24	N=23	
MAAS	3.72 (0.81)	3.56 (0.78)	3.80 (0.82)	d=0.30
EQ	10.76 (3.19)	10.66 (3.09)	10.87 (3.63)	d=0.06
CPAQ total	60.06(14.1)	61.37 (13.41)	58.70 (14.8)	d=0.20
CPVI Success	3.08 (1.08)	3.33 (1.06)	2.88 (1.07)	d=0.42
CPVI Importance	4.17 (0.62)	4.11 (0.57)	4.23 (0.68)	d=0.20
BPCI	3.56 (0.99)	3.80 (1.06)	3.30 (0.83)	**d=0.53**

Measure	Overall	Active	Sham	Cohen's d (Active vs. Sham)	Cohen's d (Pre-Post Sham)
Post-Treatment	N=36	N= 19	N=17		
MAAS	3.81 (0.66)	3.80 (0.71)	3.82 (0.62)	d=0.30	d=.00
EQ	8.92 (2.51)	9.11 (2.56)	8.71 (2.52)	d=0.16	d=.68
CPAQ total	66.88 (13.07)	68.37 (13.11)	65.24 (13.23)	d=0.24	d=.46
CPVI Success	3.32 (0.95)	2.96 (1.04)	3.73 (0.65)	d=0.89	d=.86
CPVI Importance	4.00 (0.59)	4.02 (0.54)	4.00 (0.68)	d=0.03	d=.33
BPCI	3.83 (0.99)	3.95 (1.12)	3.68 (0.85)	d=0.27	d=.50

Table 5. Results of Regression Model for Mindful Attention Awareness Scale (MAAS).

Predictor	B (SE)	β	*p*-value
MAAS baseline	0.43 (0.10)	0.51	$p < 0.001$
Age	-0.02 (0.01)	-0.21	$p = 0.049$
Gender	0.02 (0.16)	0.02	$p = 0.891$
Group (0=Active, 1=Sham)	-0.15 (0.16)	-0.12	$p = 0.337$
# of groups attended	0.38 (0.08)	0.93	$p < 0.001$
Group-by-# of groups attended interaction	-0.32 (0.11)	-0.61	$p = 0.004$
R^2 (predicted MAAS post-treatment) = 0.617			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered.

Table 6. Results of Regression Model for Current Health (EQ-5D).

Predictor	B (SE)	β	*p*-value
EQ-5D baseline	0.23 (0.12)	0.29	$p = 0.04$
Age	-0.03 (0.04)	-0.01	$p = 0.48$
Gender	0.28 (0.77)	0.05	$p = 0.72$
Group (0=Active, 1=Sham)	-0.77 (0.74)	-0.15	$p = 0.29$
# of groups attended	-1.24 (0.39)	-0.81	$p = 0.001$
Group-by-# of groups attended interaction	1.73 (0.53)	0.87	$p = 0.001$
R^2 (predicted EQ-5D post-treatment) = 0.358			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered.

Table 7. Results of Regression Model for the Chronic Pain Acceptance Questionnaire (CPAQ).

Predictor	B (SE)	β	*p*-value
CPAQ baseline	0.63 (0.12)	0.68	$p < 0.001$
Age	0.25 (0.16)	0.19	$p = 0.13$
Gender	3.07 (3.29)	0.11	$p = 0.35$
Group (0=Active, 1=Sham)	-3.27 (3.10)	-0.13	$p = 0.29$
# of groups attended	-1.23 (1.67)	-0.16	$p = 0.46$
Group-by-# of groups attended interaction	1.39 (2.27)	0.14	$p = 0.54$
R^2 (predicted CPAQ post-treatment) = 0.546			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered. Results did not change for the analysis of CPAQ subscales.

Table 8. Results of Regression Model for the Chronic Pain Values Inventory (CPVI) - Success.

Predictor	B (SE)	β	*p*-value
CPVI Success baseline	0.62 (0.14)	0.60	$p < 0.001$
Age	-0.03 (0.01)	-0.22	$p = 0.04$
Gender	-0.42 (0.25)	-0.18	$p = 0.09$
Group (0=Active, 1=Sham)	1.03 (0.23)	0.47	$p < 0.001$
# of groups attended	-0.03 (0.14)	-0.05	$p = 0.80$
Group-by-# of groups attended interaction	-0.14 (0.17)	-0.16	$p = 0.43$
R^2 (CPVI Success post-treatment) = 0.660			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered.

Table 9. Results of Regression Model for the Chronic Pain Values Inventory (CPVI) - Importance.

Predictor	B (SE)	β	*p*-value
CPVI Importance baseline	0.67 (0.12)	0.65	$p < 0.001$
Age	0.003 (0.01)	0.04	$p = 0.72$
Gender	-0.10 (0.15)	-0.08	$p = 0.50$
Group (0=Active, 1=Sham)	0.06 (0.15)	0.05	$p = 0.68$
# of groups attended	-0.09 (0.08)	-0.23	$p = 0.25$
Group-by-# of groups attended interaction	-0.04 (0.11)	-0.09	$p = 0.69$
R^2 (CPVI Importance post-treatment) = 0.593			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered.

Table 10. Results of Regression Model for the Brief Pain Coping Inventory (BPCI)

Predictor	B (SE)	β	*p*-value
BPCI baseline	0.46 (0.13)	0.46	$p < 0.001$
Age	-0.009 (0.01)	-0.09	$p = 0.54$
Gender	-0.42 (0.30)	-0.20	$p = 0.16$
Group (0=Active, 1=Sham)	0.00 (0.30)	0.00	$p = 1.00$
# of groups attended	0.15 (0.15)	0.25	$p = 0.32$
Group-by-# of groups attended interaction	0.02 (0.20)	0.02	$p = 0.93$
R^2 (BPCI post-treatment) = 0.335			

Note. B = unstandardized regression coefficient; SE = standard error; β = standardized regression coefficient; # of groups attended was mean centered.

Figure 2. Scores post-treatment for MAAS measure and dose by treatment group (active tDCS (blue) and sham tDCS (green)).

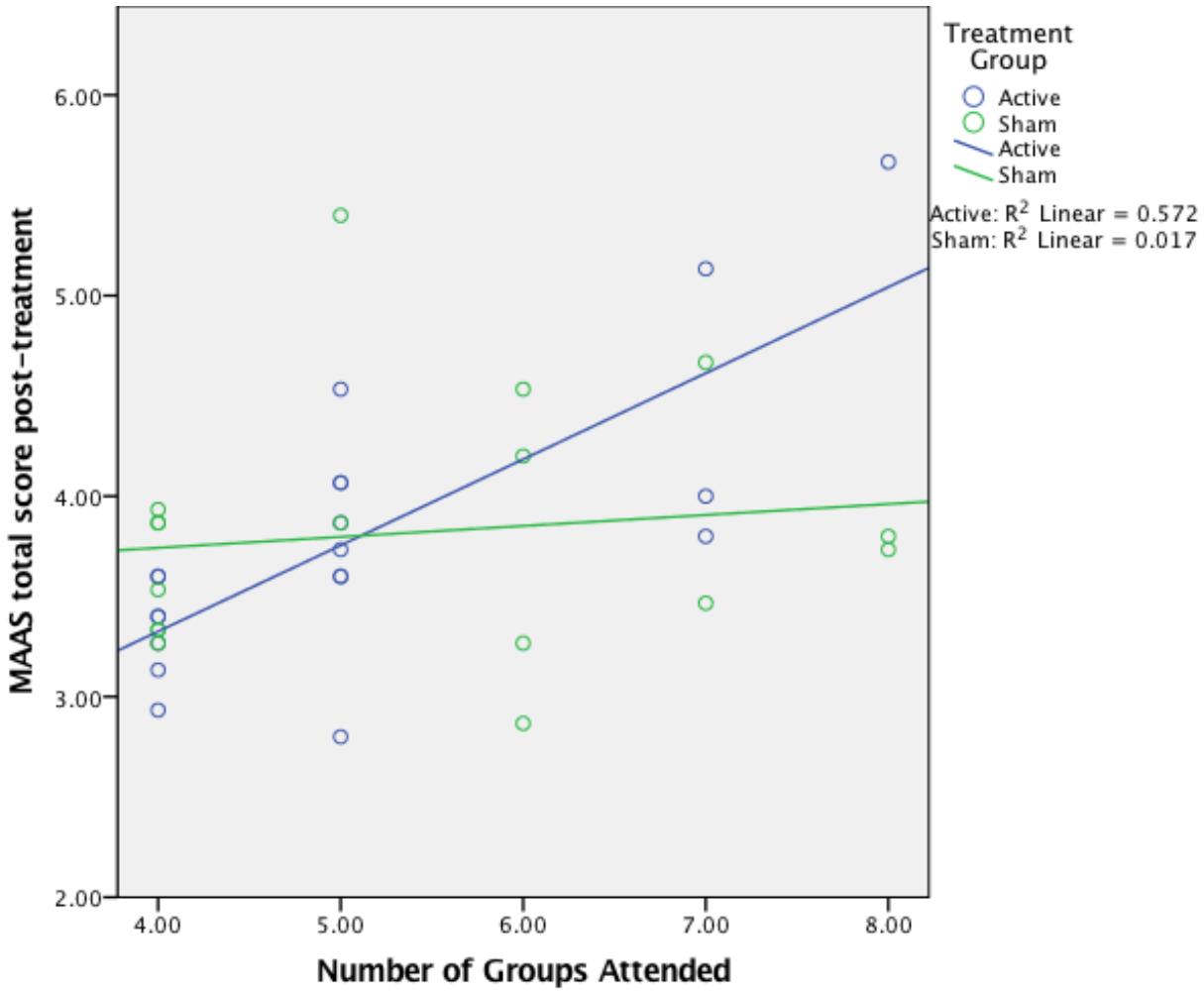


Figure 3. Scores post-treatment for EQ measure and dose by treatment group (active tDCS (blue) and sham tDCS (green)).

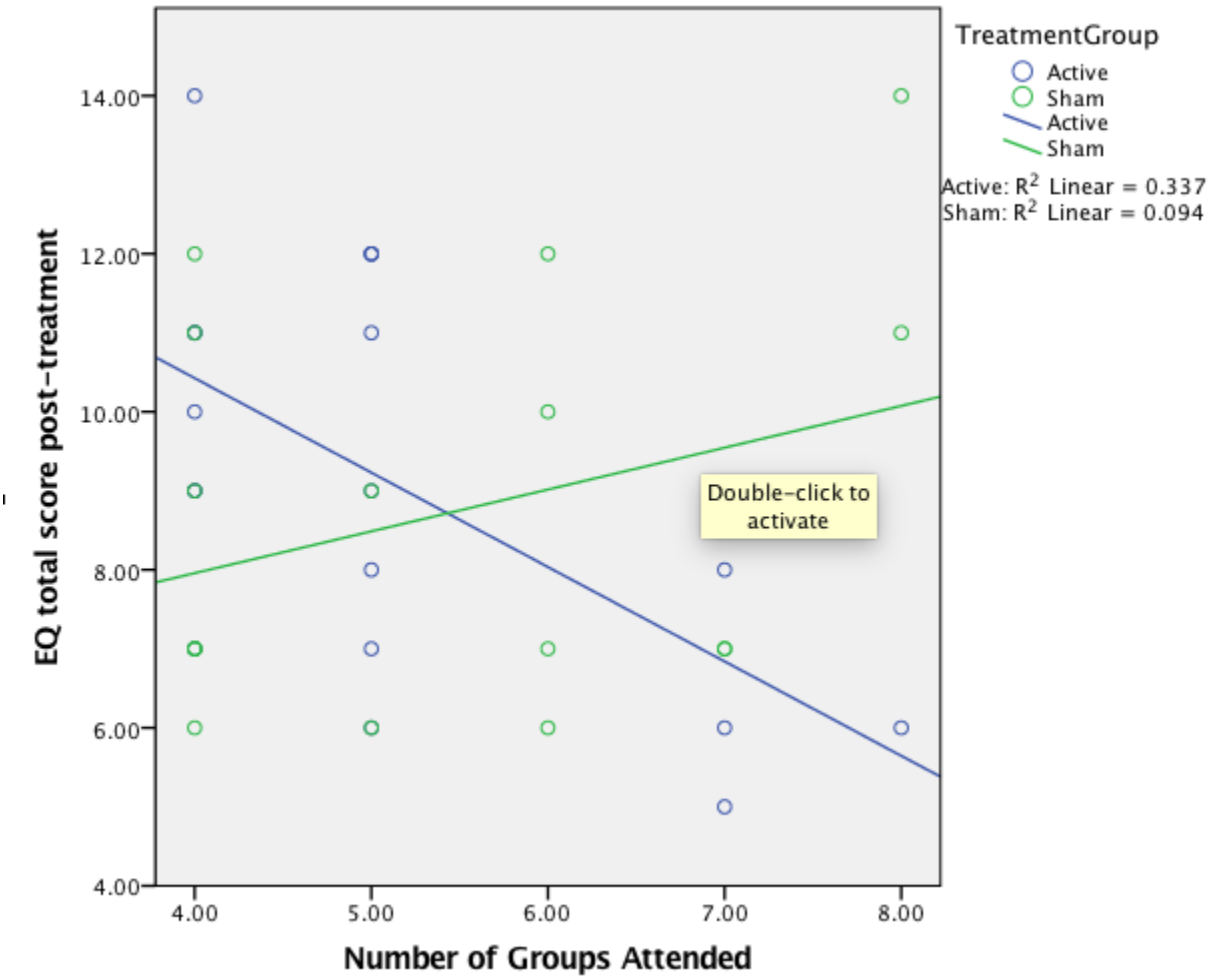


Figure 4. Scores post-treatment for CPAQ total measure and dose by treatment group (active tDCS (blue) and sham tDCS (green)).

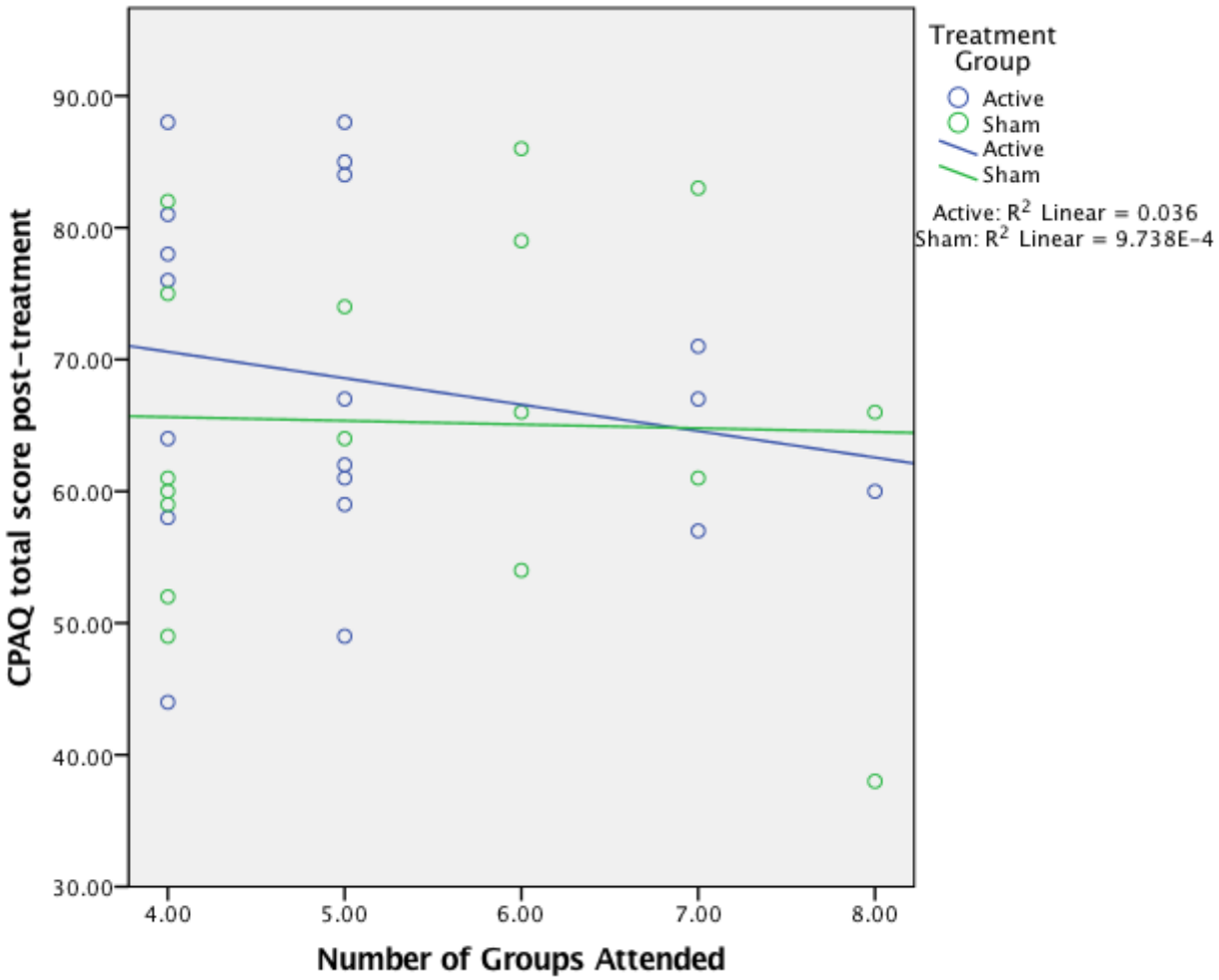


Figure 5. Scores post-treatment for CPVI success measure and dose by treatment group (active tDCS (blue) and sham tDCS (green)).

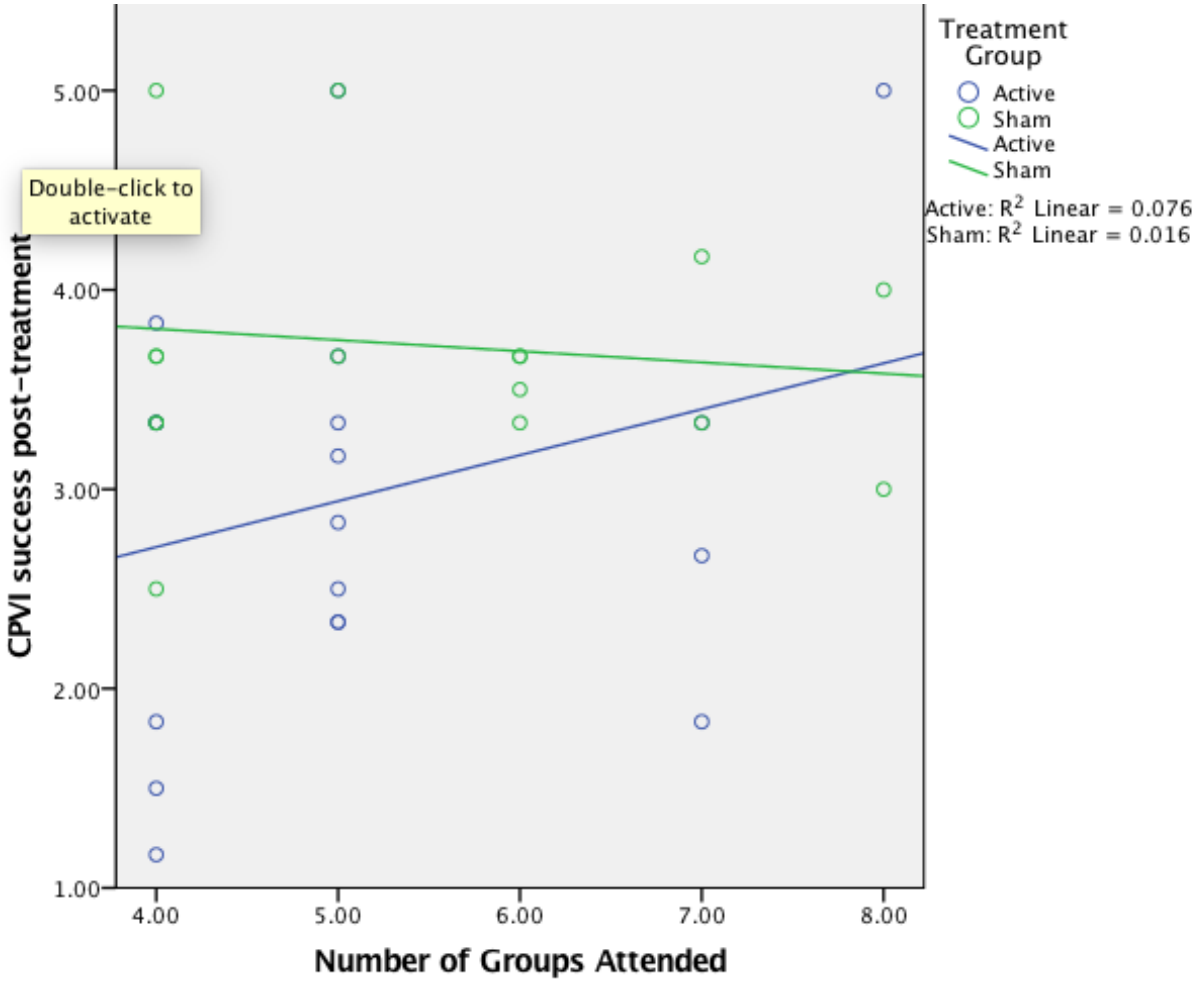


Figure 6. Scores post-treatment for CPVI importance measure and dose by treatment group (active tDCS (blue) and sham tDCS (green)).

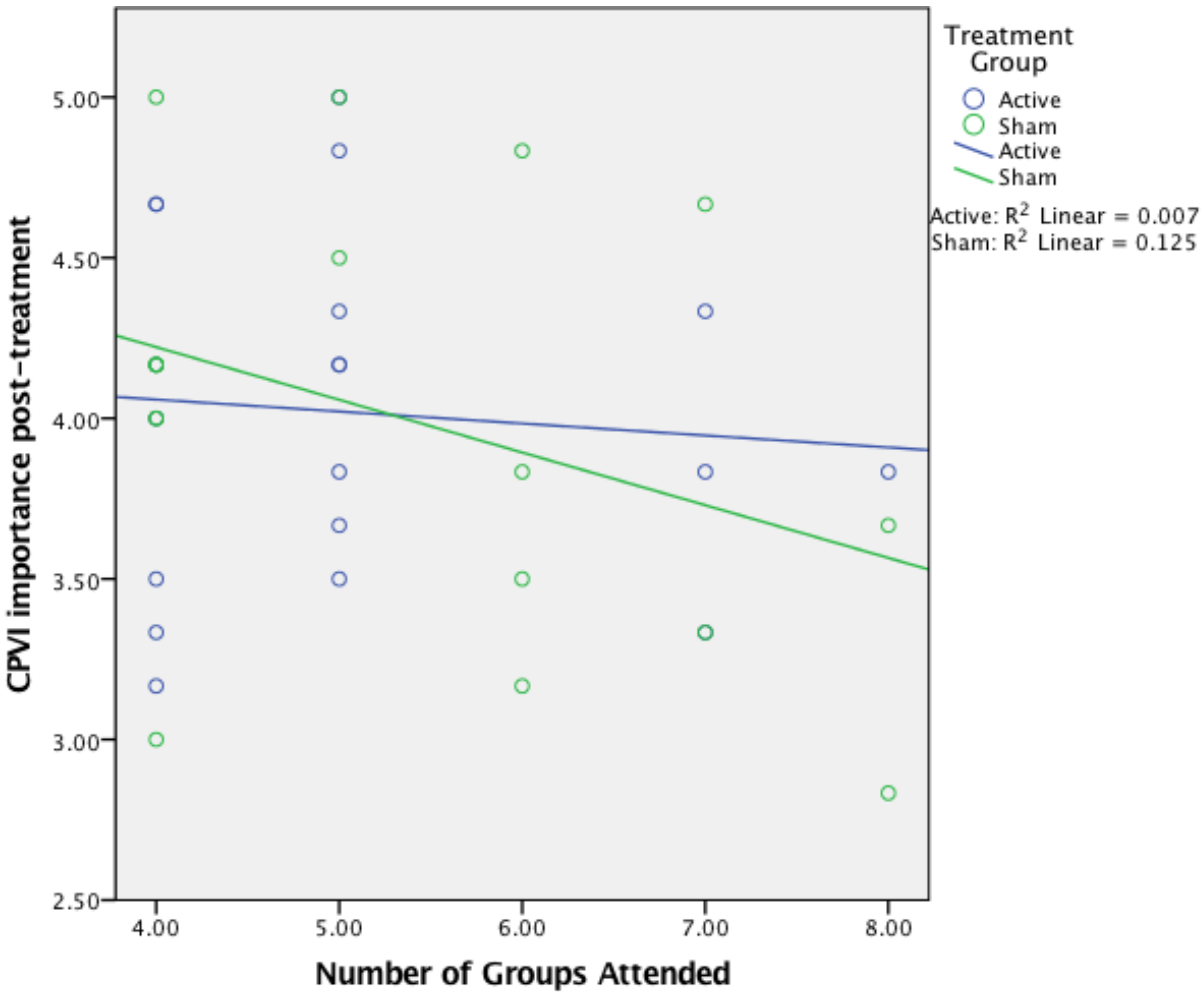
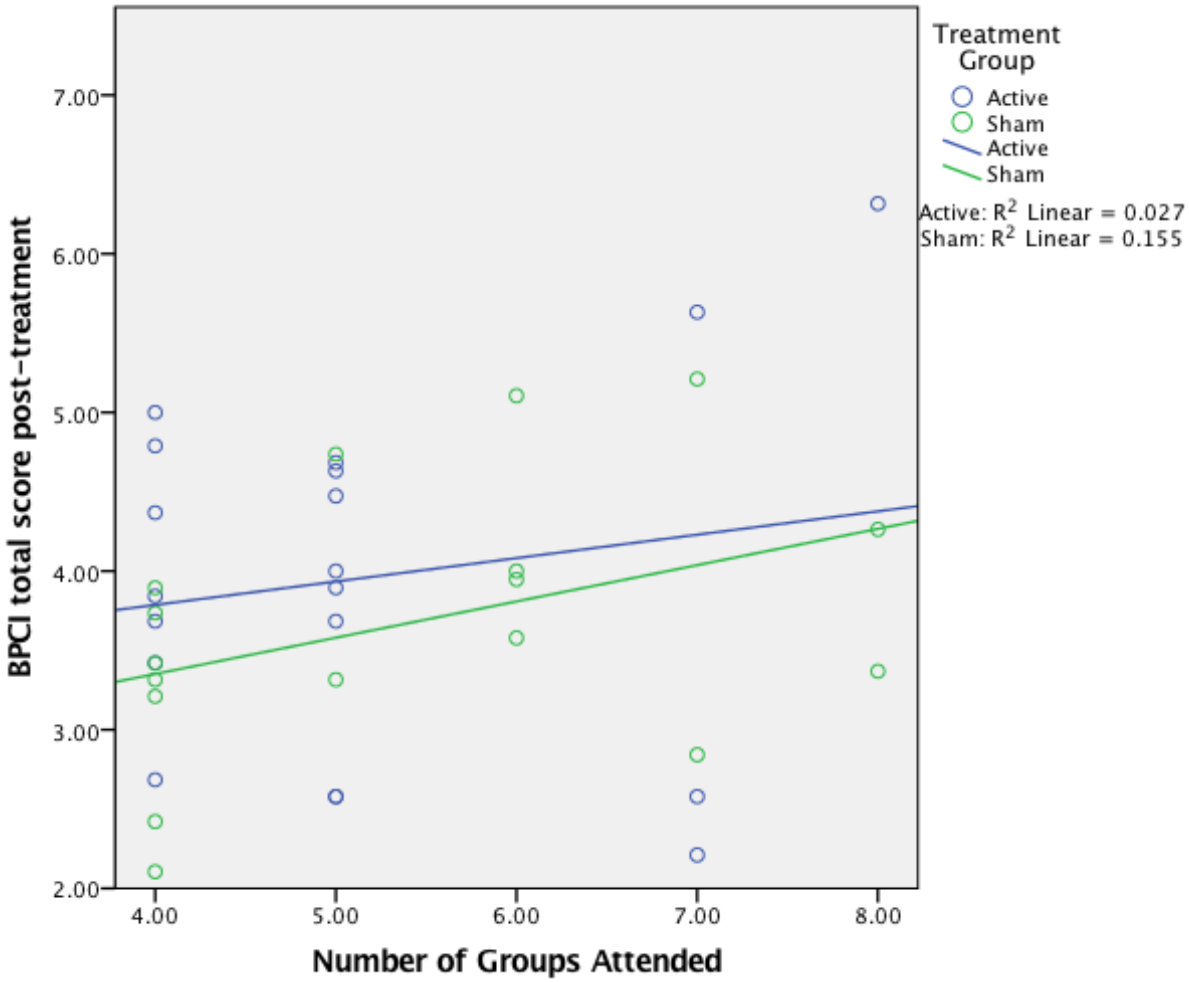


Figure 7. Scores post-treatment for BPCI measure and dose by treatment group (active tDCS (blue) and sham tDCS (green))



Appendix A: Recruitment & Screening Questionnaire

Do you have chronic pain?
Want to learn to meditate?

New Research Opportunity

You are invited to participate in a study to evaluate the effect of brain stimulation and mindfulness meditation on chronic pain.

Must:

- **Be 18-50 years of age**
- **Have a chronic pain diagnosis**
- **Be willing to participate in 8 sessions of group mindfulness meditation**

You will be paid up to $50 for your time. Participation is completely voluntary.

(505) 633-8849
unmchronicpain@gmail.com

Chronic Pain Study
(505) 633-8849
unmchronicpain@gmail.com

Craigslist Ad

CHRONIC PAIN STUDY: This study is looking at individual responses to an experimental chronic pain treatment. It involves answering questions about your mood, and chronic pain history over the phone and in the laboratory. It consists of four weeks of two weekly visits to UNM Logan Hall. Eligible participants will be given free chronic pain treatment. We are currently seeking individuals with chronic pain between the ages of 18-60 who are interested in learning meditation. If you would like to participate please call (505) 633-8849 or email emccalli@unm.edu. Mention the "Chronic pain study".

Screening Form

*Please see screening form below and fill in your answers to determine your eligibility.

We are conducting a research study that aims to investigate the impact of brain stimulation and meditation on chronic pain.

If you choose to participate in this study you may be asked to undergo a meditation training while undergoing tDCS, a safe form of neurostimulation in which a very weak electric current is passed through the brain to increase brain activity in the area. You may complete a few brief measures afterward to measure the effects that the training and tDCS may have.

Whether or not you to take part in this research study is completely up to you.

If we learn that you are eligible for the study, then we will proceed with discussing the study and will set you up for your study date. But if you are not able, or if you decide not to participate in the study, the information that you have given to me will be destroyed, except for your name.

The following questions will determine if you are a good fit for the study. If you are not a good fit for the study or do not want to participate, then all information collected will be destroyed aside from your name, which will be kept until the study is completed. If your answers to the following questions indicate that you are a good fit for the study, we will keep this information until you come in to participate in the study and are further briefed on what it entails. On that day, you will sign a document that authorizes us to keep this data until the project ends, and acknowledges that you wish to participate in the study.

_____

—

May I have your full name, phone number, and the address for your current location please?

What is your date of birth?

Specify Preferred Gender:

Do you speak English fluently?

Have you been diagnosed with chronic pain?
If yes, what is your diagnosis?
When did you receive it and by whom?

Have you ever received neurostimulation (e.g. tDCS, tACS, TMS)?
If yes, please provide us with more information regarding the circumstances and duration.
Have you had any previous experience with meditation?
If yes: What type of meditation practice? How many estimated hours per week do you meditate?

Have you had any form of head trauma? If so, what sort of head trauma or injury have you had?
If yes: How long did you lose consciousness after the head injury?

What current medications are you taking? Record type of medication, dose, whether it is a
prescription medication or otherwise (over-the-counter, herbal supplement, etc.)

Do you have any allergies? If so, please list them.

Do you have any hearing loss that you are aware of?

Do you have any visual problems not correctable by lenses, such as color blindness or astigmatism?

Are you right handed or left handed, or a mixture of both (ambidextrous)?

Do you have any history of neurological disorders such as synesthesia, epilepsy, or narcolepsy?
If yes, please list and describe severity:

Have you been diagnosed and or treated for an emotional or psychiatric problem, including
alcohol or substance-use disorders, or post-traumatic stress disorder?
If yes, which one and when?

Do any of the following apply to you? (If yes: List all that apply)

cardiac pacemakers; implantable defibrillators; aneurysm clips; neural stimulators; ear implants; insulin pumps; drug infusion devices; magnetic dental appliances; metal fragments or foreign objects in the eyes, scalp or head; metal plates, screws and prosthetics in the head; non-removable metal piercings; certain older tattoos and permanent makeup (e.g., eyeliner) with metal containing inks, any medicated patches.

If you agree to participate, the following things will happen:

You may be scheduled to come in for the next available MBSR course and provide written informed consent to participate at the beginning of Session 1. You will have time to discuss the study in detail and will have the opportunity to take the informed consent document home for your records should you prefer. If you decide to provide consent immediately after reading the consent form and having it explained to you, you may attend the first group which will include filling out a battery of assessments and receiving mindfulness training in conjunction with transcranial direct stimulation.

Are you interested in participating in the study?

When are you available to for the study?

How long are you available to participate in the study?

Would you be interested in participating in this study at a later date?

Thank you very much for your time. We will get back to you ASAP with your eligibility and scheduled time if eligible.

Appendix B: Consent Form

The University of New Mexico
Combined Informed Consent
[07/19/15]
Study of Mindfulness-Based Stress Reduction and tDCS for Chronic Pain

Introduction

You are being asked to participate in a research study that is being done by Katie Witkiewitz, Ph.D., who is the Principal Investigator, and Elizabeth McCallion, M.S from the Department of Psychology. This research is studying the effects of meditation practice on chronic pain. Further, meditation practice will be investigated in conjunction with transcranial (through the brain) direct current stimulation (tDCS) to investigate whether neurostimulation enhances the effects of meditation on the brain. tDCS is a brain stimulation technique that delivers a low electrical current to a specific brain region using electrodes placed on the scalp.

You are being asked to take part in this research study because you are an adult between the ages of 18-60, you are right handed, a fluent English speaker, and have a chronic pain diagnosis.

Up to 70 people will take part in this study at the University of New Mexico.

This form will explain the research study, and will also explain the possible risks as well as the possible benefits to you. We encourage you to talk with your family and friends before you decide to take part in this research study. If you have any questions, please ask one of the study investigators.

What will happen if I decide to participate?

If you agree to participate, the following things may happen: after review of this informed consent document, we may ask you to serve as a participant in this study. Your participation is entirely voluntary and you can stop participating at any time. You will be assigned by random chance (like the flip of a coin) to one of two groups: mindfulness-based stress reduction with 2.0 milliamps (mA) of active brain stimulation or mindfulness-based stress reduction with 0.1 mA of active brain stimulation. You will not know which group you have been assigned to.

Once you are assigned to a group, you will be asked to complete a battery of questionnaires that collect information about your ability to pay attention as well as your ability to cope and manage your chronic pain. This will take approximately 30 minutes to complete. You may refuse to answer any question at any time. However, if you refuse some of the questions, such as medical

history, you would not be able to be in the study for your own safety. You will also be asked to fill out questionnaires before and after sessions, at your last visit, and at a 1-month follow-up. These will be similar to the ones you filled out on the first day.

After completing initial questionnaires, you will participate in a two-hour group session called mindfulness-based stress reduction. The groups consist of eight sessions over the course of four weeks and will be available free of charge as part of your participation in this study. These eight sessions will be two hours long and will be led by 1-2 trained clinical psychology graduate students or a licensed clinical psychologist. The group leaders will receive training and ongoing supervision from a licensed clinical psychologist. During groups, you will receive 30 minutes of guided meditation with tDCS. You will be asked to complete brief assessments before and after each group. Visit 1 will last no longer than three (3) hours total.

tDCS will be applied by first swabbing the face and left arm with alcohol wipes and then applying electrodes to those locations. A sponge soaked in conductive fluid will be used in the electrode to aid conductivity and separate the skin from anything metallic; however parts of the electrode may contain latex or rubber so please remember to disclose any allergies that you may have been forgotten during the screening process.

tDCS uses a small electric current produced by a 9-volt battery, which is designed to influence brain function for a short time. In all cases, tDCS will be delivered through electrodes placed on your head or arm. A Sensation Questionnaire will be administered during tDCS, which will ask you to rate the sensations (on a scale from 0 to 10) that you get from tDCS, including heat, tingling and itching. If you rate any sensation above 7, or if you feel uncomfortable and want to stop at any time, the tDCS will be discontinued for the day. The Sensation Questionnaire will be administered up to three (3) times during the session.

After Visit 1, you will be asked to return for seven additional two-hour group sessions over the next four weeks (twice a week). Thirty (30) minutes of guided meditation with tDCS will be included at each session. You will be asked to complete a similar battery of questionnaires to what you completed at the beginning of session 1 again at the end of session 8. Session 8 will not take longer than three (3) hours total.

You will be asked to return one month later to complete a 1-month follow-up session in which you will complete the same battery of questionnaires as you did at session 8. This session will last no longer than 1 hour total.

How long will I be in this study?

Participation in this study may take a total of 22 hours over a period of 2 months.

Duration of participation is as follows:

Visit 1 (Consent, Assessment 1, Group Session 1): 3 hours
Visits 2-7 (Group Session 2-7): 2.5 hours
Visit 8 (Assessment 2, Group Session 8): 3 hours
1-Month Follow-up (Assessment 3): 1 hour

What are the risks or side effects of being in this study?

Every effort will be made to protect your personal information. However, there is a small risk of loss of privacy and/or confidentiality associated with participation in this study.

Risks of participating in this research are primarily psychological in nature and may include discomfort associated with answering sensitive questions (e.g., about mental health). Additionally, there is the risk that you may not benefit from the mindfulness based stress reduction intervention. Should you experience any psychological distress, Dr. Katie Witkiewitz is a licensed clinical psychologist and is available for emergencies 24 hours/day at (505) 225-3647.

No risk determination has been made by the FDA for tDCS, but the side effects of tDCS during the procedure are typically:

· feelings of warmth
· itchiness
· tingling
· a small risk of receiving an electric shock (like a static electric shock you might get from a doorknob)

People have sometimes reported the symptoms below immediately following the procedure, however these side effects are relatively uncommon, and usually resolve quickly afterwards when they do occur:

· skin irritation and redness under the electrode
· fatigue
· transient headaches
· nausea
· dizziness
· insomnia

Rarely people who have had tDCS report freckling, tanning, and/or a small patch of redness like a sunburn under the electrode. The top layer of skin may get dry and flake off. If this happens, it may last for a few days before it gets better. In addition, very rarely, people may receive an actual burn from the electrodes or wires used to carry electrical current. If this happens, the effects may last for a few days before healing.

If you notice any of these side effects during your session or after leaving the laboratory, please contact the research staff to let them know.

You may not be allowed to receive tDCS if you have the following:

- Cardiac pacemaker
- Implantable defibrillator
- Metal objects in your upper body that might interfere with tDCS or be negatively impacted by tDCS including metal plates, screws, aneurysm clips, neural stimulators of any kind
- Ear implants
- Insulin pumps
- Prosthetic devices in the head
- Drug infusion devices
- Magnetic dental appliances.
- Certain older tattoos and/or permanent makeup (such as permanent eyeliner) with inks that contain metal
- Medication patches
- An allergy to materials used in this study including metals, latex, plastic, rubber, and/or conductive mediums like electrode gel and/or saline.

If you may have any of these or you are not sure, tell the experimenter and we will evaluate whether it may be dangerous for you to receive tDCS.

The research study will not be a good fit for you and you will not be allowed to participate if any of the following are true:

- You are left-handed
- You are bound to a wheelchair
- Do not have a chronic pain diagnosis
- Have a history of head trauma,
- Problematic medical conditions such as serious medical illness within 6 months (e.g. cancer, liver, or kidney disease),
- Significant cardiovascular disease (e.g. recent stroke or heart attack, arrhythmias, worsening chest pain, uncontrolled hypertension)
- Use of illicit drugs (excluding marijuana) in the previous 30 days
- Current psychosis, psychotic disorder, or bipolar disorder
- Clinically significant suicidal ideation
- Current use of Nitrosodimethylamine (NMDA) medications including tramadol, methadone, and ketamine
- Seizure disorder
- Vision or hearing loss
- Current pregnancy or trying to become pregnant,
- Breastfeeding
- Current active alcohol use disorder (symptoms in last 30 days)

- Previous tDCS exposure, or previous meditation experience.

What are the benefits to being in this study?

There will be no direct benefit to you from being in this study other than receiving free group meditation training. However, your participation may help us find out if tDCS is a possible method for chronic pain management. It is possible that you might find that the trainings help you better manage your pain. We do not know if the trainings in this study will help you or not.

What other choices do I have if I do not want to be in this study?

You have the option not to take part in this study. There will be no penalties involved if you choose not to take part in this study.

If you do not feel comfortable or do not wish to participate, you have the option of terminating your participation at any time.

How will my information be kept confidential?

We will take measures to protect the security of all your personal information, but we cannot guarantee confidentiality of all study data.

Information contained in your study records is used by study staff. The University of New Mexico Institutional Review Board (IRB) that oversees human subject research and/or other entities may be permitted to access your records. There may be times when we are required by law to share your information. Your name will not be used in any published reports about this study.

The medical information collected during the pre-screening process prior to you signing this document will only be kept if you consent to it, and sign this document. If you do not consent and sign this document, the information, aside from your name, will be destroyed. We will keep record of names and eligibility status until the end of study recruitment to ensure that they are not allowed to participate. Information will be deleted from password-protected file at the end of the recruitment phase. If you do not sign this form, you will not be able to participate in this study.

If deemed eligible during the screening, you will be assigned a unique PIN number for data collection purposes. All assessments and Personal Health Information (PHI) collected will be coded with your unique PIN, such that data will be collected using a number rather than using your name, thereby de-identifying data. Online data will be collected via an online survey system, hosted on a secure server supporting 128-bit encryption and protected both physically

(located in a locked room) as well as electronically using security software. Other data will be retained at the study site in password-protected files on computers with restricted access. A single master list linking participant names and PINs will be stored in a password-protected database and will only be available to research staff who have completed a training course in the protection of human participants. The linkage between study data and individually identifiable information will be destroyed at the end of the project.

De-identified non-PHI data may be shared with other qualified personnel or organizations that may wish to conduct additional data analyses. None of these researchers or organizations will make any attempt to re-identify data with individuals. The results of the study, including laboratory or any other data, may be published for scientific purposes but will not give your name or any identifiable references to you.

Information from your participation in this study may be reviewed by the UNM Main Campus Institutional Review Board (IRB) which provides regulatory and ethical oversight of human research, or by the persons conducting the study, provided that such inspectors are legally obligated to protect any identifiable information from public disclosure, except as otherwise authorized or required by law.

What are the costs of taking part in this study?

You will not be charged for any study procedures. Any medical costs due to any injury received in this study will not be paid for by the study or affiliates of the university.

Will I be paid for taking part in this study?

In return for your time and the inconvenience of participating in this study, you will be paid $30 cash for completing session 8.

Financial compensation is considered taxable income. Amounts of $600 or more will be reported by UNM to the Internal Revenue Service (IRS).

How will I know if you learn something new that may change my mind about participating?

You will be informed of any significant new findings that become available during the course of the study, such as changes in the risks or benefits resulting from participating in the research or new alternatives to participation that might change your mind about participating.

Can I stop being in the study once I begin?

· Entering a research study is voluntary.
· If you start a study, you may stop at any time. You do not need to give a reason.
· If you do not want to be in a study or you stop the study at a later time, you will not be penalized or lose any benefits.
· If you stop, you should tell the study staff and follow the instructions they may give you.

Your part in the research may stop at any time for any reason, such as:

· The Principal Investigator decides to stop the study.
· The Principal Investigator decides to stop your participation in the study.
· You do not follow the study rules.
· You decide to stop.

You may be asked to stop the study even if you do not want to stop.
You can withdraw from this study at any time without penalty or affecting your ability to participate in future studies or access to health care or other services to which you are entitled.

Whom can I call with questions or complaints about this study?

If you have any questions, concerns or complaints at any time about the research study, contact the study staff

· By mail:

MSC03-2220
1 University of New Mexico,
Albuquerque, NM 87131

· By phone: (505) 633-8849
· By email: emccalli@unm.edu

If you would like to speak with someone other than the research team, you may call the UNM Office of the Institutional Review Board (IRB) at (505) 277-2644, which oversees research participant safety and welfare.

Whom can I call with questions about my rights as a research participant?

If you have questions regarding your rights as a research participant, you may call the UNM Office of the IRB (OIRB) at (505) 277-2644. The OIRB is a group of people from UNM and the community who provide independent oversight of safety and ethical issues related to research involving human participants. For more information, you may also access the OIRB website at irb.unm.edu/

CONSENT

You are making a decision whether to participate in this study. Your signature below indicates that you have read the information provided (or the information was read to you, it's contents explained to you, and all of your questions were answered to your satisfaction. By signing this form, you agree to participate in this study and to the use of your PHI as described above. In signing this form, you are not waiving any of your legal rights as a research participant.

_____
Name of Adult Subject (print)

_____ _____
__ _
Signature of Adult Subject Date

INVESTIGATOR SIGNATURE

I have explained the research to the participant and answered all of his/her questions. I believe that he/she understands the information described in this consent form and freely consents to participate.

_____
Name of Investigator/ Study Team Member (print)

_____ _____
Signature of Investigator/ Study Team Member Date

Optional consent to be contacted for other studies:

By checking YES, I consent to be contacted to participate in other studies. I may elect not to participate in these other studies, but it will be OK for you to contact me about them so I can decide if I want to participate. I can ask you to take my name off of the contact list at any time. If you check NO, you may still take part in the study.

YES NO

Appendix C: Study Measures

Demographics and Contact Information

Age:
Best address to send mail:
Phone number:
Is it okay to leave a message?

Do you have an alternate phone number?
Is it okay to leave a message?

Email(s):

We'd like the names of some relatives or friends who would always know how to reach you.
Closest relative or friend
Name:
Address:
Phone:
Email
Next closest relative or friend or another person who would know how to reach you
Name:
Address:
Phone:
Email

Birth Sex:
Male
Female
Transgender

Gender Identity:
Male
Female
Transgender

Highest level of education you have completed?
Completed 12th grade or less, no highs school diploma
High school diploma or equivalent (GED)
Diploma or certificate from vocational, technical, trade school beyond high school level
Some college (but did not complete a degree)
Associate's degree
Bachelor's degree
In graduate school, but have not received degree
Master's degree
Doctoral degree (e.g., Ph.D., EdD)
In professional program, but have not received degree
Professional degree (e.g., MD, JD)

Are you employed?
Unemployed, not seeking employment
Unemployed, seeking employment
Receiving disability social security benefits
Part-time employed
Full-time employed
Student
Retired
Other:_____

What is your monthly household income?

Ethnic Background:
Are you Hispanic or Latino/a? 0 Yes 0 No

Racial Background (please check ONE):

American Indian/Alaska Native
Asian
African American / Black
Caucasian / White
Native Hawaiian or other Pacific Islander
Multi-racial: _____
Other: _____

What is your religious preference?
_____ Roman Catholic _____ Jewish _____ None
_____ Christian, non-Roman Catholic If so, what denomination?_____
_____ Other (Specify:_____

To what extent do you consider yourself a religious person?

Not at all. 1 2 3 4 5 A great deal

To what extent do you consider yourself a spiritual person?

Not at all. 1 2 3 4 5 A great deal

MAAS

Instructions: 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. Please treat each item separately from every other item.

1 = almost always; **2** = very frequently; **3** = somewhat frequently;
4 = somewhat infrequently; **5** = very infrequently; **6** = almost never.

1. I could be experiencing some emotion and not be conscious of it until some time later.

2. I break or spill things because of carelessness, not paying attention, or thinking of something else.

3. I find it difficult to stay focused on what's happening in the present.

4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.

5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.

6. I forget a person's name almost as soon as I've been told it for the first time.

7. It seems I am "running on automatic" without much awareness of what I'm doing.

8. I rush through activities without being really attentive to them.

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.

10. I do jobs or tasks automatically, without being aware of what I'm doing.

11. I find myself listening to someone with one ear, doing something else at the same time.

12. I drive places on "automatic pilot" and then wonder why I went there.

13. I find myself preoccupied with the future or the past.

14. I find myself doing things without paying attention.

15. I snack without being aware that I'm eating.

Health Questionnaire

Under each heading, please check the ONE box that best describes your health TODAY

MOBILITY

I have no problems walking ❑
I have slight problems walking ❑
I have moderate problems walking ❑
I have severe problems walking ❑
I am unable to walk ❑

SELF-CARE

I have no problems washing or dressing myself ❑
I have slight problems washing or dressing myself ❑
I have moderate problems washing or dressing myself ❑
I have severe problems washing or dressing myself ❑
I am unable to wash or dress myself ❑

USUAL ACTIVITIES *(e.g. work, study, housework, family or leisure activities)*

I have no problems doing my usual activities ❑
I have slight problems doing my usual activities ❑
I have moderate problems doing my usual activities ❑
I have severe problems doing my usual activities ❑
I am unable to do my usual activities ❑

PAIN / DISCOMFORT

I have no pain or discomfort ❑
I have slight pain or discomfort ❑
I have moderate pain or discomfort ❑
I have severe pain or discomfort ❑
I have extreme pain or discomfort ❑

ANXIETY / DEPRESSION

I am not anxious or depressed ❑
I am slightly anxious or depressed ❑
I am moderately anxious or depressed ❑
I am severely anxious or depressed ❑
I am extremely anxious or depressed ❑

- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine.
  0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below.

YOUR HEALTH TODAY = ☐

CPAQ

Directions: Below you will find a list of statements. Please rate the truth of each statement as it applies to you. Use the following rating scale to make your choices. For instance, if you believe a statement is 'Always True,' you would write a 6 in the blank next to that statement.

0 = Never True 1= Very rarely true 2=Seldom true 3=Sometimes true 4=Often true 5=Almost always true 6=Always true

1. _____I am getting on with the business of living no matter what my level of pain is.
2. _____My life is going well, even though I have chronic pain.
3. _____It's OK to experience pain.
4. _____I would gladly sacrifice important things in my life to control this pain better.
5. _____It's not necessary for me to control my pain in order to handle my life well.
6. _____Although things have changed, I am living a normal life despite my chronic pain.
7. _____I need to concentrate on getting rid of my pain.
8. _____There are many activities I do when I feel pain.
9. _____I lead a full life even though I have chronic pain.
10. _____Controlling pain is less important than any other goals in my life.
11. _____My thoughts and feelings about pain must change before I can take important steps in my life.
12. _____Despite the pain, I am now sticking to a certain course in my life.
13. _____Keeping my pain level under control takes first priority whenever I'm doing something.
14. _____Before I can make any serious plans, I have to get some control over my pain.
15. _____When my pain increases, I can still take care of my responsibilities.
16. _____I will have better control over my life if I can control my negative thoughts about pain.
17. _____I avoid putting myself in situations where my pain might increase.
18. _____My worries and fears about what pain will do to me are true.
19. _____It's a relief to realize that I don't have to change my pain to get on with my life.
20. _____I have to struggle to do things when I have pain.

CPVI

Many people with chronic pain find that their pain and other symptoms are barriers to engaging in activities that are personally important to them. These people have **"VALUES"** but they are not living according to their values.

For example, you may want to be a loving partner, a warm and supportive parent, a helpful and reliable friend, a person who keeps physically fit and able, or a person who is always learning new skills, but you may find yourself in circumstances where you are not living that way.

For each of the areas listed below consider how you most want to live your life. Then rate how IMPORTANT each domain is for you. This is NOT about how well you are doing in each area – it is about how important it is to you. Rate the importance you place in each domain using any number on the scale from 0 (not at all important) to 5 (very important). Each area need not be important to you - **rate an area low if it is not important to you personally**.

0	1	2	3	4	5
Not at all Important	**Slightly Important**	**Somewhat Important**	**Moderately Important**	**Very Important**	**Extremely Important**

Consider each area according to your values, the important ways that you most want to live your life in each domain.	IMPORTANCE **Of This Domain To You**
1. FAMILY: Participation in your relationships with your parents, children, other close relatives, people you live with, or whoever is your "family."	
2. INTIMATE RELATIONS: Being the kind of partner you want to be for your husband/wife or closest partner in life.	
3. FRIENDS: Spending time with friends, doing what you need to maintain friendships, or providing help and support for others as a friend.	
4. WORK: Engaging in whatever is your occupation, your job, volunteer work, community service, education, or your work around your own home.	

5. HEALTH: Keeping yourself fit, physically able, and healthy just as you would most want to do.	
6. GROWTH AND LEARNING: Learning new skills or gaining knowledge, or improving yourself as a person as you would most want.	

In this section we want you to look at how much SUCCESS you have had in living according to your values. Many times when people have chronic pain they find it difficult to live their life as they want to live it.

For each of the areas of life listed below consider again how you most want to live your life. Then rate how SUCCESSFUL you have been living according your values during the past two weeks. These questions are not asking how successful you want to be but how successful you have been. Rate your success using any number on the scale from 0 (not at all successful) to 5 (very successful).

0	1	2	3	4	5
Not at all Successful	**Slightly Successful**	Somewhat **Successful**	**Moderately Successful**	**Very Successful**	**Extremely Successful**

Consider each area according to your values, the important ways that you most want to live your life in each domain.	SUCCESS **At Living Your Values**
1. FAMILY: Participation in your relationships with your parents, children, other close relatives, people you live with, or whoever is your "family."	
2. INTIMATE RELATIONS: Being the kind of partner you want to be for your husband/wife or closest partner in life.	
3. FRIENDS: Spending time with friends, doing what you need to maintain friendships, or providing help and support for others as a friend.	

4. WORK: Engaging in whatever is your occupation, your job, volunteer work, community service, education, or your work around your own home.	
5. HEALTH: Keeping yourself fit, physically able, and healthy just as you would most want to do.	
6. GROWTH AND LEARNING: Learning new skills or gaining knowledge, or improving yourself as a person as you would most want.	

BPCI – II

During the **PAST WEEK**, how many days did you do each of the following at least once in the day to cope with the pain? Please indicate the number of days you used each "strategy" **IN RESPONSE TO PAIN.**

	NUMBER OF DAYS (please circle only one)							
1. Encouraged myself or changed my thinking about my situation or pain	0	1	2	3	4	5	6	7
2. Avoided a painful activity	0	1	2	3	4	5	6	7
3. Used physical exercise or stretching	0	1	2	3	4	5	6	7
4. Kept doing what I was doing without letting pain stop me	0	1	2	3	4	5	6	7
5. Rested most of the day	0	1	2	3	4	5	6	7
6. Used a relaxation strategy to reduce feelings of pain	0	1	2	3	4	5	6	7
7. Paced myself (set reasonable goals, used rest breaks, or used appropriate rate of activity)	0	1	2	3	4	5	6	7
8. Realised that pain did not need to keep me from engaging in activity	0	1	2	3	4	5	6	7
9. Changed my activity to keep myself focused on something other than pain	0	1	2	3	4	5	6	7

10. Used ice, heat, massage, or a TENS unit (electrical stimulator)	0	1	2	3	4	5	6	7
11. Struggled to get control of the pain	0	1	2	3	4	5	6	7
12. Just noticed the pain without doing anything else about it	0	1	2	3	4	5	6	7
13. Remained aware of my pain while staying aware of the larger situation at the same time	0	1	2	3	4	5	6	7
14. Chose not to struggle with thoughts or feelings related to pain	0	1	2	3	4	5	6	7
15. Used pain as a reason not to do something	0	1	2	3	4	5	6	7
16. Rested for a short time (less than 30 minutes) and then resumed activity	0	1	2	3	4	5	6	7
17. Made a choice to do what I value rather than to do something about my pain	0	1	2	3	4	5	6	7
18. Did what works best for my goals in life regardless of what I was thinking or feeling at the time	0	1	2	3	4	5	6	7
19. Tried to "think positive" before I took some action	0	1	2	3	4	5	6	7

Please answer each question as honestly as possible. Keep in mind that we are only asking about the **past 30 days**. There are no right or wrong answers. If you are unsure about how to answer the question, please give the best answer you can.

Please answer the questions using the following scale:	**Never** 0	**Seldom** 1	**Sometimes** 2	**Often** 3	**Very Oft** 4
1. In the past 30 days, how often have you had trouble with thinking clearly or had memory problems?	O	O	O	O	O
2. In the past 30 days, how often do people complain that you are not completing necessary tasks? (i.e., doing things that need to be done, such as going to class, work or appointments)	O	O	O	O	O

3. In the past 30 days, how often have you had to go to someone other than your prescribing physician to get sufficient pain relief from medications? (i.e., another doctor, the Emergency Room, friends, street sources)	O	O	O	O	O
4. In the past 30 days, how often have you taken your medications differently from how they are prescribed?	O	O	O	O	O
5. In the past 30 days, how often have you seriously thought about hurting yourself?	O	O	O	O	O
6. In the past 30 days, how much of your time was spent thinking about opioid medications (having enough, taking them, dosing schedule, etc.)?	O	O	O	O	O

Please answer the questions using the following scale:	Never 0	Seldom 1	Sometimes 2	Often 3	Very Often 4
7. In the past 30 days, how often have you been in an argument?	O	O	O	O	O
8. In the past 30 days, how often have you had trouble controlling your anger (e.g., road rage, screaming, etc.)?	O	O	O	O	O
9. In the past 30 days, how often have you needed to take pain medications belonging to someone else?	O	O	O	O	O
10. In the past 30 days, how often have you been worried about how you're handling your medications?	O	O	O	O	O
11. In the past 30 days, how often have others been worried about how you're handling your medications?	O	O	O	O	O
12. In the past 30 days, how often have you had to make an emergency phone call or show up at the clinic without an appointment?	O	O	O	O	O
13. In the past 30 days, how often have you gotten angry with people?	O	O	O	O	O
14. In the past 30 days, how often have you had to take more of your medication than prescribed?	O	O	O	O	O
15. In the past 30 days, how often have you borrowed pain medication from someone else?	O	O	O	O	O
16. In the past 30 days, how often have you used your pain medicine for symptoms other than for pain (e.g., to help you sleep, improve your mood, or relieve stress)?	O	O	O	O	O

Please answer the questions using the following scale:	Never 0	Seldom 1	Sometimes 2	Often 3	Very Often 4
17. In the past 30 days, how often have you had to visit the Emergency Room?	O	O	O	O	O

Hand Usage
Questionnaire

Please indicate below which hand you ordinarily use

for each activity. With which hand do you:

1. Draw?	1. Left	2. Either	3. Right
2. Write?	1. Left	2. Either	3. Right
3. Use a bottle opener?	1. Left	2. Either	3. Right
4. Throw a snowball to hit a tree?	1. Left	2. Either	3. Right
5. Use a hammer?	1. Left	2. Either	3. Right
6. Use a toothbrush?	1. Left	2. Either	3. Right
7. Use a screwdriver?	1. Left	2. Either	3. Right
8. Use an eraser on paper?	1. Left	2. Either	3. Right
9. Use a tennis racket?	1. Left	2. Either	3. Right
10. Use a scissor?	1. Left	2. Either	3. Right
11. Hold a match when striking it?	1. Left	2. Either	3. Right
12. Stir a can of paint?	1. Left	2. Either	3. Right

13. On which shoulder do you rest a bat before swinging?	1. Left	2. Either	3. Right

BDI-II

Date:

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment Feelings

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying

0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

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Subtotal Page 1

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11. Agitation

0 I am no more restless or wound up than usual.
1 I feel more restless or wound up than usual.
2 I am so restless or agitated that it's hard to stay still.
3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0 I have not lost interest in other people or activities.
1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It's hard to get interested in anything.

13. Indecisiveness

0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14. Worthlessness

0 I do not feel I am worthless.
1 I don't consider myself as worthwhile and useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15. Loss of Energy

0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don't have enough energy to do very much.
3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day.
3b I wake up 1–2 hours early and can't get back to sleep.

17. Irritability

0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18. Changes in Appetite

0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than usual.
3a I have no appetite at all.
3b I crave food all the time.

19. Concentration Difficulty

0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 It's hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

20. Tiredness or Fatigue

0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of the things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

Subtotal Page 2
Subtotal Page 1
Total Score

NR15645

MOOD QUESTIONNAIRE

Date of Visit_____Entrance_____Exit_____

Please answer the following questions by circling the appropriate number, where:
0 = not at all, strongly disagree
1 = very mildly, disagree
2 = mildly, slightly disagree
3 = mildly, slightly agree
4 = significantly, agree
5 = very much so, completely, strongly agree

1) I feel nervous or excited: 0 1 2 3 4 5

2) I feel tired or fatigued: 0 1 2 3 4 5

3) I feel confused or disoriented: 0 1 2 3 4 5

4) I feel sad or down: 0 1 2 3 4 5

5) I feel tense or frustrated: 0 1 2 3 4 5

6) I feel dizzy or light-headed: 0 1 2 3 4 5

7) I feel nauseous: 0 1 2 3 4 5

8) Physically, I feel pain or discomfort: 0 1 2 3 4 5

9) I feel unable to concentrate or pay attention: 0 1 2 3 4 5

If this is being completed after the tDCS session, please answer the following:

Did you notice or feel any sensation during the tDCS application? Yes_____ No_____

If yes, please describe:_____
_____

tDCS Sensation Questionnaire

Circle the number describing what you are feeling for the following descriptors using the following scale:

SCALE

0	1	2	3	4	5	6	7	8	9	10
None					**Moderate**		**Stop tDCS**			**Excessive**

Time Started:_____

Time of First Sensation Check:_____

Circle the number that best describes what you are feeling for the following descriptors:

Itching

0	1	2	3	4	5	6	7	8	9	10

Heat/Burning

0	1	2	3	4	5	6	7	8	9	10

Tingling

0	1	2	3	4	5	6	7	8	9	10

Describe the sensations you are feeling:

_____

_____

_____

Time of Second Sensation Check:_____

Time Finished:_____

Circle the number that best describes what you are feeling for the following descriptors:

Itching

0	1	2	3	4	5	6	7	8	9	10

Heat/Burning

Appendix D: MBSR Manual

Ten Helpful Attitudes toward Practice

1. **Don't expect anything**. Just sit back and see what happens. Treat the whole thing as an experiment. Take an active interest in the test itself but don't get distracted by your expectations about results. For that matter, don't be anxious for any result whatsoever. Let the meditation practice unfold at its own speed and in its own direction.

2. **Don't strain**: Don't force anything or make grand exaggerated efforts. Meditation is not aggressive. There is no violent striving. Just let your effort be relaxed and steady.

3. **Don't rush**: There is no hurry, so take your time. Settle yourself on a cushion and sit as though you have a whole day. Anything really valuable takes time to develop. Patience, patience, patience.

4. **Don't cling to anything and don't reject anything**: Let come what comes and accommodate yourself to that, whatever it is. If good mental images arise, that is fine. If bad mental images arise, that is fine, too. Look on all of it as equal and make yourself comfortable with whatever happens. Don't fight with what you experience, just observe it all with equal interest.

5. **Let go**: Learn to flow with all the changes that come up. Loosen up and relax.

6. **Accept everything that arises**: Accept your feelings, even the ones you wish you did not have. Accept your experiences, even the ones you hate. Don't condemn yourself for having human flaws and failings. Learn to see all the phenomena in the mind as being perfectly natural and understandable. Try to exercise a "disinterested acceptance" at all times and with respect to everything you experience.

7. **Be gentle with yourself**: Be kind to yourself. You may not be perfect, but you are all you've got to work with. The process of becoming who you *will be* begins first with the total acceptance of who *you are*.

8. **Investigate yourself**: Question everything. Take nothing for granted. Don't believe anything because it sounds wise and pious or because "that's how it always goes". See for yourself, trust your own experiences. Subject all statements and stories to the actual test of your experience and let the results be your guide to the truth. Without it, the practice is superficial.

9. **View all problems as challenges**: Look upon negatives that arise as opportunities to learn and to grow. Don't run from them, condemn yourself, or bear your burden in saintly silence. You have a problem? Great! More grist for the mill. Rejoice, dive in and investigate.

10. **Don't dwell upon contrasts**: Differences do exist between people, but dwelling upon them is a dangerous process. Ordinary human thinking is full of greed, jealousy and pride. A man seeing another man on the street may immediately think, "He is better looking than I am." The instant result is envy or shame. A girl seeing another girl may think, "I am prettier than she is." The instant result is pride. This sort of comparison is a mental habit, and it leads directly to ill feeling of one sort or another: greed, envy, pride, jealousy, hatred. It is an unhelpful mental state, but we

do it all the time. We compare our looks with others, our success, our accomplishments, our wealth, possessions, or I.Q. and all these lead to the same place--estrangement, barriers between people, and ill feeling. *From: Mindfulness in Plain English by Venerable H. Gunaratana Mahathera/* [*www.budsas.org*](http://www.budsas.org)

Bells of mindfulness (or: reminders for taking one mindful breath):

Waking up, first breath

In the shower or bath

At breakfast

While the car warms up

While driving

While waiting at a red light

When the phone rings

While walking

When choosing food

While working at the computer

While talking on the phone

During lunch

While sitting in a meeting or class

While having a conversation

When buying things

When considering turning on the TV or radio

Arriving home

Eating dinner

When choosing night-time activities

Going to bed, noticing the very last breath of the day.

**For your phone: Insight Meditation Timer Free (download from "Google Play"

**Bells for the computer: http://www.mindfulnessdc.org/mindfulclock.html

Awareness of Pleasant Events

DAY 1

What was the *pleasant event*? _____
_____
_____

Were you *aware* of the pleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

DAY 2

What was the *pleasant event*? _____
_____
_____

Were you *aware* of the pleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____

What *thoughts* accompanied this experience? _____

What thoughts are in your mind *now* as you describe this event? _____

DAY 3

What was the *pleasant event*? _____

Were you *aware* of the pleasant feelings while the event was happening? _____

How did your *body* feel during this experience? _____

What *moods* or *feelings* accompanied this experience? _____

What *thoughts* accompanied this experience? _____

What thoughts are in your mind *now* as you describe this event? _____

DAY 4

What was the *pleasant event*? _____

_____

_____

Were you *aware* of the pleasant feelings while the event was happening? _____

_____

How did your *body* feel during this experience? _____

_____

_____

What *moods* or *feelings* accompanied this experience? _____

_____

_____

_____

_____

_____

What *thoughts* accompanied this experience? _____

_____

_____

What thoughts are in your mind *now* as you describe this event? _____

_____

_____

DAY 5

What was the *pleasant event*? _____

Were you *aware* of the pleasant feelings while the event was happening? _____

How did your *body* feel during this experience? _____

What *moods* or *feelings* accompanied this experience? _____

What *thoughts* accompanied this experience? _____

What thoughts are in your mind *now* as you describe this event? _____

DAY 6

What was the *pleasant event*? _____

Were you *aware* of the pleasant feelings while the event was happening? _____

How did your *body* feel during this experience? _____

What *moods* or *feelings* accompanied this experience? _____

_____

What *thoughts* accompanied this experience? _____

_____

What thoughts are in your mind *now* as you describe this event? _____

_____

Awareness of Unpleasant Events

DAY 1

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

DAY 2

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

Awareness of Unpleasant Events

DAY 3

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

DAY 4

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

Awareness of Unpleasant Events

DAY 5

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____
_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

DAY 6

What was the *unpleasant event*? _____
_____
_____

Were you *aware* of the unpleasant feelings while the event was happening? _____
_____

How did your *body* feel during this experience? _____
_____
_____

What *moods* or *feelings* accompanied this experience? _____
_____

_____
_____
_____
_____

What *thoughts* accompanied this experience? _____
_____
_____

What thoughts are in your mind *now* as you describe this event? _____
_____
_____

Mindful Yoga

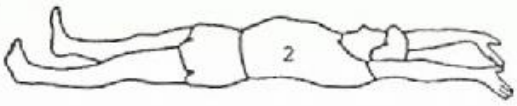
On the next 4 pages are diagrams of the yoga postures covered on the CDs which you have for home practice. You may want to have the workbook open to them when you first attempt the yoga at home on your own, to make sure you are familiar with the positions. (The numbers in the diagrams correspond to the track numbers on the CD. For example, tracks 1 and 21 on the first yoga CD are the corpse pose.)

At the same time, it is possible to practice mindfulness in any position. You do not have to look exactly like the diagrams. If a position is not right for you, simply adopt a position that is more appropriate, or listen to the CD in a sitting or laying position while imagining your body in the positions. The point here is to cultivate moment-to-moment awareness. This awareness includes acknowledgement of the body's and the mind's limitations, and responding appropriately to the body's signals of pain or danger.

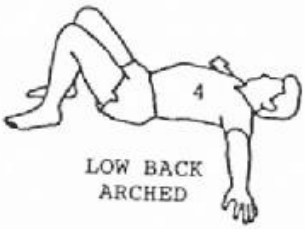
As you practice this cycle of poses regularly, you will probably find that they will become more "obvious" to you, more natural. Some might say "easier," but it is always possible to get deeper into a pose, even if you are very familiar with it. Poses that are simple or not demanding are still an opportunity to practice mindfulness.

Although these poses are gentle, many will enable you to come right up against the limits of your body as it is now. You are encouraged to carefully explore these limits, and notice how they shift with continued practice of yoga. Of course, you may choose to practice other yoga positions and stretches to create your own cycle of poses. These poses are meant to be a starting place for exploring the body, movement, and mindfulness. I hope it leads to health and well-being.

SEQUENCE OF YOGA POSTURES
CD #1



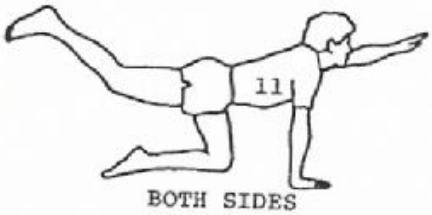
LOW BACK
PRESSED AGAINST
FLOOR



LOW BACK
ARCHED

BOTH SIDES

BOTH SIDES



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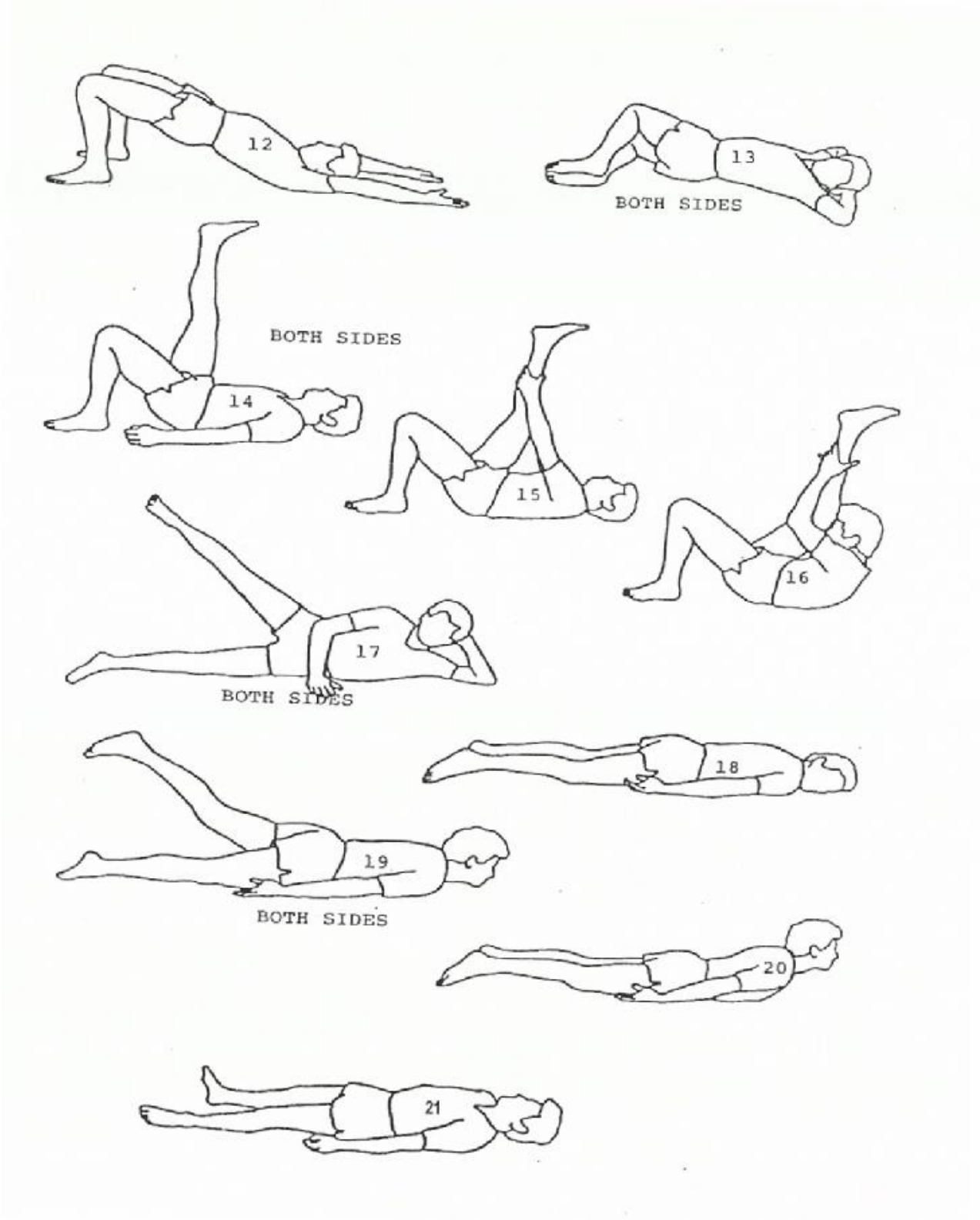

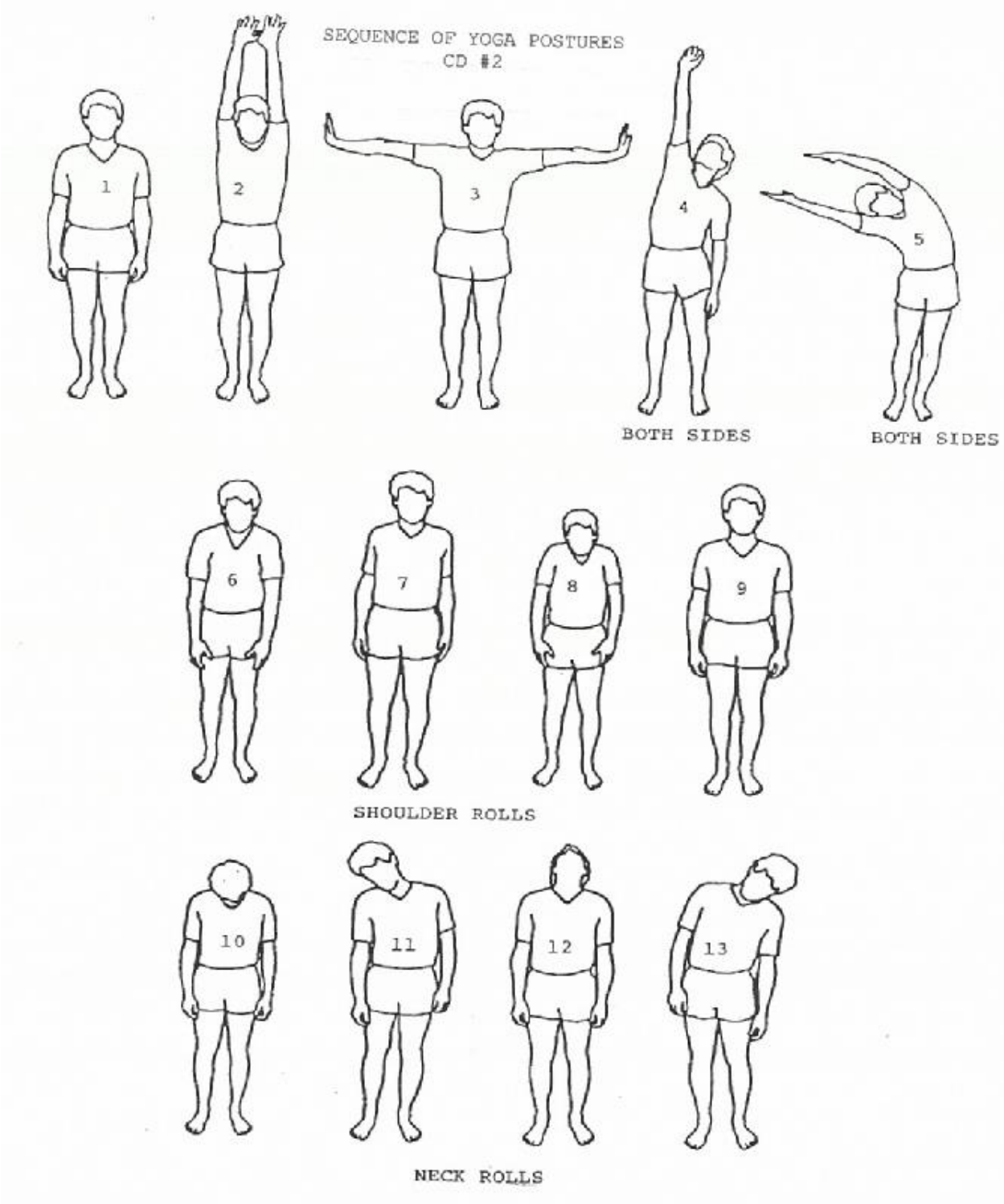

REACTIONS TO STRESS

List External *Stressors* in your life:

List Internal *Stressors* in your life:

List the sensations you feel in your body when you are stressed:

List the things you do in response to stress:

STRESS REDUCTION

List External *Soothers* in your life:

List Internal *Soothers* in your life:

List the sensations you feel in your body when you are mindful or calm:

List the things you do in order to cultivate mindfulness:

Journaling

Feel free to write down observations of your experience if that is useful to you. This writing is just for you. Please do not feel compelled to write if you do not wish to.

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Feel free to write down observations of your experience if that is useful to you. This writing is just for you. Please do not feel compelled to write if you do not wish to.

READINGS

Listen now
before you make any sudden move
for your breathing
which once accompanied you.

Leslie Marmon Silko: *Storyteller*/"Out of the Works No Good Comes From: Possession"

You see the sky now
but the earth
is lost in it
and there are no horizons.
It is all
a single breath.

Leslie Marmon Silko: *Storyteller*/"How to Write a Poem about the Sky"

On this cloudy May day,
I keep thinking
maybe June is what I need
to make me happy

Jim Moore, *The New Yorker* 5/23/05, p 75

Morning is when I am awake and there is a dawn in me...
To be awake is to be alive...
We must learn to reawaken and keep ourselves awake, not by mechanical aids, but by an infinite expectation of the dawn, which does not forsake us in our soundest sleep...
To affect the quality of the day, that is the highest of arts.

Henry David Thoreau: *Walden*/Where I Lived

I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived.

Henry David Thoreau: *Walden*/Where I Lived

By a conscious effort of the mind we can stand

aloof from actions and their consequences; and all things, good and bad, go by us like a torrent.

Henry David Thoreau: *Walden*/Solitude

Only that day dawns to which we are awake.

Henry David Thoreau: *Walden*/Conclusion

You talk when you cease to be at peace with your thoughts;
And when you can no longer dwell in the solitude of your heart you live in your lips, and sound is a diversion and a pastime.

There are those among you who seek the talkative through fear of being alone.
The silence of aloneness reveals to their eyes their naked selves and they would escape.

Kahlil Gibran: *The Prophet*

This minute that comes to me over the past decillions,
There is no better than it and now.

Walt Whitman: *Leaves of Grass*/ "Song of Myself"

I inhale great draughts of space,
The east and the west are mine, and the north and the south are mine.
I am larger, better than I thought,
I did not know I held so much goodness.

Walt Whitman: *Leaves of Grass*/ "Song of the Open Road"

After a week of physical anguish,
Unrest and pain, and feverish heat,
Toward the ending day a calm and a lull comes on,
Three hours of peace and soothing rest of brain.

Walt Whitman: *Leaves of Grass*/ "An Evening Lull" (after illness, age 70)

So, when you hold
the hemisphere
of a cut lemon
above your plate, you spill
a universe of gold,
a
yellow goblet
of miracles,
a fragrant nipple
of the earth's breast,
a ray of light that was made fruit, the minute fire of a planet.

Pablo Neruda: *Selected Odes of Pablo Neruda*/ "Ode to the Lemon" (Transl. by MS Peden)

Time
is divided
into two rivers:
one
flows backward, devouring
life already lived;
the other
moves forward with you
exposing
your life.
For a single second
they may be joined.
Now.
This is that moment,
the drop of an instant
that washes away the past.
It is the present.
It is in your hands.
Racing, slipping,
tumbling like a waterfall.
But it is yours.

Pablo Neruda: *Selected Odes of Pablo Neruda*/ "Ode to the Past" (Transl. by MS Peden)

The time will come
when, with elation
you will greet yourself arriving
at your own door, in your own mirror
and each will smile at the other's welcome,

and say, sit here. Eat.
You will love again the stranger who was your self.
Give wine. Give bread. Give back your heart
to itself, to the stranger who has loved you

all your life, whom you ignored
for another, who knows you by heart.
Take down the love letters from the bookshelf,

the photographs, the desperate notes,
peel your own image from the mirror.
Sit. Feast on your life.

Derek Walcott: ***Love after Love***

RESOURCES

Suggestions for continued practice.....

UNM MBSR and MEAL courses
See website: http://hsc.unm.edu/som/cfl/mindfulnessprog.shtml
Or call 925-7464 for info.

Books (just four out of hundreds):
Full Catastrophe Living, by Jon Kabat-Zinn
Wherever You Go There You Are, by Jon Kabat-Zinn
The Miracle of Mindfulness, Thich Nhat Hanh
After the Ecstasy, the Laundry, Jack Kornfield

Gear:
Samadhi site: http://www.samadhi-meditation.com/

OTHER MBSR TEACHERS IN AREA

VAMC: for veterans
Thomas Vosburgh MD (and colleagues): Thomas.Vosburgh@va.gov

Everyday Zen Foundation
Rev. Deborah Russell Albuquerque, NM
Phone: 505-255-4041
Web Site: http://www.everydayzen.org/
EMail:russ@oceanmirror.org

Daniel Bruce DOM:
Daniel Bruce, DOM (MBSR Teacher)
1301 St. Francis Dr., Ste. C, SANTA FE; Phone: 988-5106

U. MASS Center For Mindfulness
Search "Other MBSR Programs" for other programs in NM: www.umassmed.edu/cfm

OTHER MEDITATION GROUPS AND TEACHERS IN AREA (not MBSR)

Buddhist Center of New Mexico:
145 Madison NE (at Copper, between Washington and San Mateo), phone: 256-7520
Sitting meditation with Albuquerque Vipassana Sangha Thursdays at 6:30-7:15 (free; you can attend without calling ahead)
Dharma talk to follow (about applying Buddhist teachings to life)

Albuquerque Vipassana Sangha:
Lots of events and information at www.abqsangha.org/

Kadampa Meditation Center (formerly: Shakyamuni Buddhist Center):
8701 Comanche NE, phone 505-292-5293,
Offer courses and meetings, and lunch-time group meditations.
www.meditationinnewmexico.org

Albuquerque Zen Center
2300 Garfield SE, 268-4877
The Albuquerque Zen Center offers daily practice and study opportunities to anyone interested in the many ways of knowing Zen Buddhism.
http://www.azc.org/

Santa Fe Vipassana Sangha
Mountain Cloud Zen Center is located off Old Santa Fe Trail, one mile south of the intersection with Zia Road. Look for the mailbox post *125 MCZC* at the entrance. Phone: 989-7610. www.santafevipassana.org

Upaya Zen Center
1404 Cerro Gordo Road, Santa Fe
Phone: 986-8518
Participate in daily meditations, retreats, and workshops
www.upaya.org

Life Transition Institute
110 Delgado Street ,Santa Fe, New Mexico 87501
Phone: 982.4183
www.lifetransition.com

Vallecitos Mountain Refuge
Taos, NM 87571
Phone : 751-9613
www.vallecitos.org

Introduction

Congratulations on completing the Stress Reduction Program. You have already dedicated yourself to many hours of meditation and yoga practice during the course and have hopefully seen the benefits of your hard work. This packet consists of a variety of information that will help you continue to build on the skills you've learned during the program and will hopefully encourage you to pursue and deepen your commitment to your own health and well-being. We hope you will continue to practice what you began in the Stress Reduction Program, refining your ability to handle difficult and stressful life circumstances and moving toward a life of increased awareness, satisfaction and good health.

I. Meditation (20 - 30 minutes once or twice a day)

Sitting as still as you can in a comfortable position with a straight back, head erect:

1. being aware of the in breath and the out breath
2. being aware of any sensations in particular regions of the body
3. being aware of the body as a whole
4. hearing silence and sounds
5. observing thoughts and emotions as they move in and out of awareness moment by moment not getting involved in the content of them but observing them as thoughts, as emotions
6. when you notice the mind has drifted into fantasy, the past, or the future, gently bring it back to alert attention in the present moment

Meditation begins with the non-judgmental observation of life from moment to moment. When you find that the mind is being judgmental, i.e. pushing away things it doesn't like, and holding on to things it likes, simply observe that this is occurring. Meditation is an

effortless and choiceless awareness of the totality of life expressing within you and around you in any and every moment. It is a state of being, not an activity. It is not something to do, rather it is allowing yourself to just be. It is not a tuning out process. Rather it is being fully present with a larger perspective grounded in the sense of being.

It is helpful to sit quietly in this way one or two times a day for 15 to 30 minutes and to do it at regular times, and every day. By doing it every day, whether you feel like it or not, you allow a sense of strength and balance to develop in your life which goes beyond moods, emotional turmoil, busyness, and beyond the particular experiences—pleasant, unpleasant or neutral—in your life. This quality of mind or sense of being is, of course, independent of being still or moving: it is awareness in each moment, the simple remembering of your completeness as a human being. If you notice yourself resisting or avoiding a daily period of silent awareness, bring your attention to the resistance itself and observe it. By sitting in this way daily you will establish a more relaxed and balanced tone for your day's activities and encounters. Use the sitting medication CD as often as you like to reinforce your regular meditation practice.

II. <u>Body Scan</u> (Do as much as you can during the day)

You now have the skill to scan your body with precise and concentrated attention. When you notice tension in specific regions, bring non-judgmental awareness, spaciousness and curiosity to the sensation, and watch how the sensation may change. You may do this at any time of day, under any circumstances.

It only takes an awareness of the body and a willingness to pay attention. Also, bringing awareness to the sensations of breathing and where you experience those sensations (in the chest or belly) as much of the time as possible during the day. Again, this should not require effort, simply awareness.

Continue to use the Body Scan CD as much as you like, or do it without the CD. Feel free to modify this practice and make it your own.

Remember that the body scan allows you to have a sense of being comfortable with your own being, in your own skin. This feeling goes beyond external circumstances and internal mental states, which may at times cause feelings of tension and unpleasantness and at other

times feelings of relaxation and pleasure. Directing your attention into the detached observation of these fluctuations of circumstances and of mood, allows you to develop a deep sense of balance and presence, which is really an expression of wisdom.

III. Mindful Walking (Do as often as you can during the day)

It is helpful to catch yourself every once in a while as you are walking, and just slow down a little and remind yourself "Here I am, complete in this moment." Notice the way you carry your body, the feeling in the feet, the legs, the chest and head as you walk. Do what you are doing mindfully. Be open to the sights around you. This can be done anywhere. Try it while shopping, walking down the street, going up or down stairs, or while standing and waiting for something or someone. Of course, this can be combined with an awareness of breathing and an opportunity to notice the body: stopping at any time to simply stand in mountain pose.

IV. Mindful Eating

Much physical illness comes from improper eating habits. You might want to pay attention to the quality and the quantity of the food you put into your body and what functions eating is performing at this moment. Are you eating to nourish you body and to keep it finely tuned? Are you eating to satisfy cravings for taste sensations, to feel more full, more complete, more secure? Are you aware of the source of the food you are eating? Does much of it come out of factories? Have the substances you eat been processed? If so, how much? What has been removed? What has been added? Are chemicals really harmless in food? Do you pay attention on this level?

Try eating with greater awareness, and somewhat slower than usual. As an experiment, you might try intentionally eating one meal a week in silence just to experience the eating itself. Also, you might consider not reading or watching TV during meals. This will help you become more sensitive to how you eat and what you are choosing to eat. Explore bringing increased awareness to not only the foods you eat, but awareness of those you might eat with, and your surrounding environment you eat in.

V. Yoga

Do 20-45 minutes of yoga-type stretching and relaxing as regularly as you can. Vary the routine so as to cover the whole range within a week. Use either of the yoga CD's as often as you like, but try to do the yoga by yourself from time to time. Remember to do them slowly, mindfully, working with the breath, referring to the manual you received in class for illustrations of the movements if you need. See if it's possible to bring awareness to all movement throughout the day, allowing the breath to complement and enhance however you're moving.

It may help to ask yourself every day: What is my body like right now? How is my health right now? Do I know? Do I need an expert to know? Am I allowing some aspect of my body or mind to be in an unhealthy condition through neglect, inattention, or inactivity? Is greater wellness an intention of mine? What am I doing today to realize this intention?

VI. Coping with Stress

1. Be mindful of physical, mental, and emotional cues informing you that a particular situation is stressful. Remember the possibility of a measured response rather than a knee-jerk reaction. Be mindful of the breath at these times in particular.

2. Try to remember as often during the day as possible that you are a complete, infinite being who loses nothing by allowing your fullest sensitivity and love to express itself (see attached quote from A. Einstein).

3. Notice judgmental feelings of liking/disliking or wanting/rejecting. When they are present, be aware of how they get expressed in your activities and behavior: i.e., your tone of voice or the choices you make. Be aware of the consequences (outcomes) of these activities and behavior. For example, if you immediately form a strong negative impression of someone, does this prevent you from really seeing the whole person clearly? When someone flatters you, does this result in your doing things you really don't want to do? Be aware of the presence and strength of the "wanting mind" during the day. Notice your feelings of incompleteness. Are they accurate?

4. Be aware of how much our moods and reactions to events influence how we feel physically. Be in touch with how you carry yourself, how you look, how and how much you eat, drink, talk. Use the breathing to tune in to the difference.

5. Notice how much the mind dwells in memories of the past or anticipation of the future. And how much all thinking revolves around "I," "me," "mine." Notice how much of the day is spent calculating ways to strengthen this aspect of your being. Is this necessary? Do you suffer for it? Be aware of the "judging mind."

6. Practice using awareness of the breath to help ground you in the present moment. Right now. And now, too . . .

7. Be aware of it when you are feeling:

fearful	fearless
angry	joyful
jealous, envious	happy for others
lazy	enthusiastic
low energy	infinite energy resources
agitated	peaceful
bored	open
anxious	calm
worried, insecure	secure
greedy	satisfied
hateful	caring

Notice how strong and overwhelming the emotions on the left are when they come up. Notice how much blindness and inaccuracy they usually entail. Notice the quality of the emotions on the right when they happen. Are they as strong? How can they be supported, strengthened, nourished? Is there also blindness and inaccuracy in these realms? Why?

Notice the thoughts that are associated with moods of depression and anxiety. Are these thoughts accurate? What thoughts might you think to support your self-esteem and sense of well being? Are these thoughts more accurate?

9. Imagine that you could die at any moment... you could. How would you want your mind to be at that moment? Can you think of practical steps to allow this intention to be realized in everyday life? How about right now? Today?

Remember that by pursuing the activities and nourishing the awareness you have developed in the Stress Reduction Program, you are engaged in an on-going process of learning and growth which amounts to a retuning of the nervous system and a total self re-education. Remember that "... the learning process is irregular and consists of steps, and there will be downs as well as ups... We must not become discouraged, therefore if we find we have slipped back to the original condition at any time: these regressions will become rarer and return to the original condition less frequently as the learning process continues... It should be further realized that as changes take place in the self, new and hitherto unrecognized difficulties will be discovered. The consciousness previously rejected them either from fear or because of pain, and it is only as self-confidence increases that it becomes possible to identify them." (from Awareness Through Movement, by Moshe Feldenkrais)

An ordained rabbi had written (to Einstein) explaining that he had sought in vain to comfort his 19-year-old daughter over the death of her sister, "a sinless, beautiful, 16-year old child." "A human being, "wrote Einstein in reply, "is a part of the whole, called by us 'Universe,' a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest -- a kind of optical delusion of his consciousness. This delusion is a kind of prison for us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole nature in its beauty. Nobody is able to achieve this completely, but the striving for such achievement is in itself a part of the liberation and a foundation for inner security."

By being with yourself, by watching yourself in your daily life with alert interest, with the intention to understand rather than to judge, in full acceptance of whatever may emerge, because it is there, you encourage the deep to come to the surface and enrich your life and consciousness with its captive energies. This is the great work of awareness; it removes obstacles and releases energies by understanding the nature of life and mind. Intelligence is the door to freedom and alert attention is the mother of intelligence.

--Nisargadatta Maharaj, 1971