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The Effect of Mindfulness and Acupuncture on Psychological Health in Veterans

A DISSERTATION

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By

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The Effect of Mindfulness and Acupuncture on Psychological Health in Veterans

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iRest Yoga Nidra® (iRest; Miller, 2005), is a guided mindfulness meditation practice that encourages participants to become relaxed, learn to focus their attention, experience joy, observe opposite feelings and emotions, welcome the sensations of their body and mind in a non-judgmental fashion, access the observer in them who is always present no matter the transient emotional or physical sensation, and, finally, to integrate what is learned in meditation into daily life. This study investigated whether or not iRest in combination with acupuncture treatment was effective in improving psychological symptoms in the Veteran population. Veterans who participated in iRest in addition to acupuncture treatment achieved significant psychological benefit on all outcome measures. They had significantly decreased symptoms of depression, psychological symptom severity, depression or tension due to pain, and emotional interference with life activities, while patients who received only acupuncture did not. Although both the treatment and control conditions improved significantly in perception of stress, the treatment group improved with a medium-to-large effect size and the active control group improved with a small effect size. The reductions in depression symptoms for the treatment group receiving iRest and acupuncture translated to clinically meaningful change, with significant decreases in the number of people meeting criteria for mild, moderate, and severe depression from pretest to posttest. While at pretest “moderate depression” was the most frequent category experienced by
Veterans receiving iRest and acupuncture, at posttest “no depression” was the most frequent. iRest in conjunction with acupuncture was equally beneficial for Veterans independent of factors such as age, gender, or race. Finally, changes in psychological outcome measures for those receiving iRest and acupuncture were seen independent of the number of sessions of iRest the Veterans attended or the baseline level of depression. These findings have important implications for the treatment of Veterans. Given the pervasiveness of psychological distress and depression in the Veteran population and the efficiency with which these group treatments can be provided, this research lends support for the extension of complementary and integrative medicine offerings that include iRest and acupuncture treatments in more Veterans Administration hospitals across the country to improve military mental health.

Additionally, this dissertation includes a review of the literature on the neuroscience of mindfulness. Recent research reveals that those high in dispositional mindfulness, but without formal mindfulness practice, engage in emotion regulation largely through the down-regulation of the amygdala brought on by response modification. During early stages of mindfulness practice, on the other hand, novice practitioners not only down-regulate the amygdala through response modification, but also display a significant increase in activity in neurologic structures that facilitate attentional deployment. Finally, as people become experienced in mindfulness practice, an important shift occurs: there is a true decoupling of the narrative-generation network from the primary sensory network, allowing experienced mindfulness practitioners to experience primary emotions in the present moment. Experienced mindfulness practitioners are able to experience negative emotions and sensations without adding further negative valence brought on by past experience or concern for the future, which is critical for psychological health.
This dissertation by Megan Suzann Wheeler fulfills the dissertation requirement for the doctoral degree in clinical psychology approved by Carol R. Glass, Ph.D., and Diane B. Arnkoff, Ph.D., as Co-directors, and by Amanda E. Hull, Ph.D. as Reader.

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CHAPTER 1
The Neuroscience of Mindfulness:
How Mindfulness Alters the Brain and Facilitates Emotion Regulation

Mindfulness involves non-judgmental, present-focused, moment-to-moment awareness of both one’s physical and mental states (Kabat-Zinn, 1990). Mindfulness meditation originated over 2,500 years ago with the Buddhist Vipassana meditation techniques that were practiced by Gautama the Buddha himself (Ahir, 1999). Starting in the mid-20th century, mindfulness became incorporated into psychological interventions as a secularized and manualized means of reducing psychological distress and improving emotional well-being in both clinical and non-clinical populations (Chiesa & Serretti, 2009; Hofmann, Sawyer, Witt, & Oh, 2010).

Mindfulness is now a major component of several empirically-supported psychological interventions such as mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982, 1990), mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2012), acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 2011), dialectical behavior therapy (Linehan, 1993), and integrative restoration (iRest®) yoga nidra (Miller, 2005). In addition, transdiagnostic psychotherapeutic interventions (e.g., the unified protocol, emotion regulation therapy) that target emotion regulation also commonly include mindfulness exercises (Barlow et al., 2011; Mennin & Fresco, 2013). Indeed, mindfulness interventions have been found to be successful in treating a number of different psychological disorders including anxiety and depression (Hofmann et al., 2010), post-traumatic stress disorder (PTSD; King et al., 2013), and addiction (Chiesa, 2014). Given the wide array of psychological concerns that can be alleviated through mindfulness, it likely targets a common factor among these disparate disorders. In fact,
growing research suggests that mindfulness accomplishes psychological change by strengthening the ability to regulate one’s emotions (Farb, Segal, & Anderson, 2013).

While formal research on the behavioral outcomes of mindfulness meditation began in the 1950s, researchers are only just beginning to understand the neurologic changes underpinning these behavioral outcomes. Previous reviews with relevance to the current discussion have outlined the effect of mindfulness interventions on psychological health (Keng, Smoski, & Robins, 2011) and cognitive ability (Chiesa, Calati, & Serretti, 2011), concluding that mindfulness both improves well-being, emotional reactivity, and psychological symptoms such as anxiety and depression, as well as cognitive abilities, such as selective and sustained attention.

Three general reviews of the neuroscience of mindfulness have been conducted in the past decade. Treadway and Lazar (2008) summarized the areas of the brain involved in mindfulness meditation (including research literature through 2007), and Fox et al. (2014) updated these findings and conducted a meta-analysis looking exclusively at changes in brain structure with data published through early 2014. Tang, Hölzel, and Posner (2015) built upon these reviews to summarize the areas of the brain involved in mindfulness meditation, in particular, and updated the research up through early 2015. Together, these three reviews support the notion that meditation promotes long-term structural and functional neurologic changes, but each note that more needs to be done to connect these neurologic findings to the clinical and behavioral improvements observed following mindfulness intervention.

What is missing from the current literature on the neuroscience of mindfulness is the integration of the findings from the neuroscience into a detailed theoretical framework from the psychological literature. Indeed, commenting on the review by Tang and colleagues (2015), van der Velden and Roepstorff (2015) call for a “tighter integration and collaboration between the
clinical and neuroscientific branches of research” (p. 429). Others have also hinted at the importance of such an integration: Fletcher, Schoendorff, and Hayes (2010) outlined a process-oriented approach (informed by psychological research) for how researchers might examine the neuroscience of mindfulness, and Chambers, Gullone, and Allen (2009) raised the idea that the neuroscience literature could elucidate how mindfulness supports emotion regulation. While other reviews have discussed emotion regulation in the context of the neuroscience of mindfulness (e.g., Hölzel, Lazar, et al., 2011), the present review is the first to extensively integrate the neuroscience of mindfulness into a theoretical and psychological framework of emotion regulation.

Here, for the first time, the wide variety of research findings on the neuroscience of mindfulness are placed into a consistent theoretical framework of emotion regulation. This is also the first review to address the issue of inconsistent terminology used to describe mindfulness practice, detailing how these inconsistencies obfuscate conclusions, and to suggest an alternative framework to clarify the current findings and guide future research.

The chapter begins by discussing the theory, process, and neurobiology of emotion regulation. A model is presented for how emotions are regulated in persons with varying levels of dispositional mindfulness and varying degrees of mindfulness training. The review then shifts to discuss the definition and scope of the term mindfulness, as it relates to levels of intentionality and practice. Novel terminology is outlined to help guide both the review and future research in the field. The review then discusses the neurobiology of dispositional mindfulness and how the brain changes during engagement in mindfulness training. Attention is paid to the time-course of functional neurobiologic changes and the findings on the neuroscience of mindfulness are organized by the terminology set forth in this review relating to differing degrees of
intentionality and extent of practice. Finally, an argument is made for how mindfulness affects psychological health by facilitating the ability to engage in voluntary devolution of the brain, and future directions for the field are discussed.

**Emotion Regulation**

**Theory of the Process of Emotion Regulation**

From a functionalist and evolutionary perspective, emotions play important and adaptive roles in behavior, including influencing decision making, priming an individual for “fight or flight” responses, and facilitating social communication (Darwin, 1872; Levenson, 1994). For many years, emotion was considered to be automatic and fixed (LeDoux, 1996), but it is now understood to be capable of being modulated; that is, emotion can be self-regulated (Gross, 2008).

The initial generation of emotion is thought to begin with the onset of an emotionally relevant stimulus (internal or external) that, when attended to, gives rise to appraisals of the stimulus that result in the emotional response (Gross, 1998; Gross & Thompson, 2007). The emotional response, in turn, has a recursive influence on the original emotionally salient stimulus, which also serves to affect future emotions. Emotion regulation, on the other hand, is defined as the collection of conscious or unconscious influences that an individual exerts on the generation, timing, experience, or expression of his/her emotion(s) (Gross, 1998). Gross and Thompson (2007) outline five psychological processes involved in emotion regulation, which each act at a different point along the course of emotion generation. There are both antecedent-focused processes, that is, strategies that are employed before the onset of the emotional response (namely, situation selection, situation modification, attentional deployment, and cognitive
change), as well as one response-focused process that is deployed after the generation of the emotion (response modification) (Figure 1, Part A).

Situation selection involves the selection (i.e., approach or avoidance) of people, places, or objects so as to modulate their emotional influence on the individual. Situation modification refers to the adaptation of a particular environment with the goal of regulating its emotional impact. Attentional deployment entails the alteration of a person’s emotion-focused attention, and the use of strategies such as distraction, concentration, and rumination. Cognitive change is a process aimed at altering the cognitive environment in order to enact emotional change; cognitive change processes can include denial, cognitive reframing, and reappraisal, among others. Finally, following the expression of a particular emotion, an individual might employ response modulation strategies to try to influence the physiological, experiential, or behavioral aspects of the emotional response. Response modulation strategies can vary widely, from the ingestion of alcohol or drugs to the employment of relaxation techniques or the acceptance of one’s emotions.

**Emotion Regulation Ability Facilitates Psychological Health**

While emotions are often adaptive psychological responses to the environment, they become problematic when they occur in the wrong context, with an inappropriate intensity, or with an improper duration (Gross, 1998). Emotion regulation processes serve to increase, decrease, or maintain emotions, and evidence exists that humans can successfully up-regulate (increase the neural activity/receptivity) or down-regulate (decrease the activity/receptivity) the neural architecture that supports their emotions (Parrott, 1993). Effective emotion regulation is thought to involve adaptable context-appropriate use of a variety of emotion-regulatory strategies in order to meet long-term psychological goals (Barrett, Gross, Christensen, & Benvenuto,
Figure 1. A model of how emotions are regulated in people with intrinsic dispositional mindfulness, those with beginning training in mindfulness, and experienced mindfulness practitioners. Adapted from the model originally outlined by Gross and Thompson (2007).
2001). Maladaptive emotion regulation, on the other hand, occurs when the regulatory processes do not have the desired effect on emotion, or when the short-term gain of the regulatory effect (e.g., to suppress anxiety) is outweighed by a long-term consequence of that regulation (e.g., decreased quality of life). Such faulty emotion regulation often involves overreliance on, or inflexibility with, a particular emotion regulation process (Werner & Gross, 2010). Gross and Levenson (1997) reviewed the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994) and found that problems with emotion regulation are linked to more than 50% of Axis I disorders and 100% of Axis II disorders. Emerging evidence also suggests that maladaptive emotion regulation can maintain, and perhaps even lead to, pathological behavior (Campbell-Sills & Barlow, 2007; Werner & Gross, 2010).

**The Neurobiology of Emotion Regulation**

Diekof, Geier, Falkai, and Gruber (2011) conducted a quantitative meta-analysis of nearly 50 studies from the past decade to ascertain the areas of the brain most commonly activated and deactivated during emotion regulation. The authors examined studies investigating fear extinction (a response-focused process whereby a previously learned fear-conditioned stimulus is presented and no longer reinforced), the placebo effect (an antecedent-focused process whereby the mere expectation that a stimulus will be less aversive than it is alters the perception of the aversive nature of that stimulus), and cognitive emotion regulation (an antecedent-focused process whereby there is effortful engagement in regulation of negative affect through reappraisal or other cognitive means). For higher-order emotion regulation (during placebo and cognitive emotion regulation studies but not fear extinction), they found increased activity in the anterior cingulate cortex (ACC) and insular cortex (IC). The ACC is thought to be involved in assessing the salience of emotional stimuli and also serves a functional
role in attention and motivation (Allman, Hakeem, Erwin, Nimchinsky, & Hof, 2001; Shackman et al., 2011). The IC is involved in interoception and emotion-laden sensory processing (Craig, 2009; Zaki, Davis, & Ochsner, 2012). The dorsal portion of the ACC is heavily connected to the amygdala and prefrontal cortex (PFC), and the ventral portion of the ACC is heavily connected to the amygdala and IC. Thus, the ACC is a key area in emotion regulation, as it can facilitate both top-down and bottom-up information processing (Allman et al., 2001; Carmichael & Price, 1996; Ghashghaei, Hilgetag, & Barbas, 2007). Top-down processing is a type of information processing that employs situational information to modify the perception of sensory stimuli and influence perception; bottom-up processing, on the other hand, originates with the pure sensory stimulus and does not rely on contextual information to influence perception.

Diekof et al. (2011) found that the ventromedial PFC (VMPFC) is a general regulator of emotional experience. VMPFC activation was seen consistently across the three separate types of emotion regulation studies: fear extinction, placebo, and cognitive emotion regulation. Congruently, they found a consistent diminishment of activity in the amygdala across all three emotion regulation strategies studied.

The VMPFC has bidirectional connectivity with the amygdala, allowing for down-regulation of emotional responses to negative stimuli (Ghashghaei & Barbas, 2002; Ghashghaei et al., 2007). Indeed, this modulatory function of the PFC is thought to fail in people with various forms of psychopathology such as anxiety and depression (Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003). For instance, common among the anxiety disorders is a state of heightened arousal following real or perceived threat and excessive negative affect (Barlow, 2002). This anxiety profile results from amygdala over-activation and dysfunction in the right dorsolateral PFC (Goldin, Manber, Hakimi, Canli, & Gross, 2009). The right dorsolateral PFC is
an area that activates to inhibit amygdala over-activation during emotion elicitation, particularly during the experience of negative affect. Evidence from lesion studies reveals that damage to the right PFC can cause anxiety (Davidson, 1998), and anxiety disorders are associated with dysfunction of this right frontal area (e.g., Goldin et al., 2009). Similarly, Goto, Yang, and Otani (2010) suggest that alterations in the synaptic structure of the emotional and attention pathways running through the PFC may be the common pathophysiological condition underlying psychiatric disorders as disparate as schizophrenia, drug addiction, and mood disorders. Thus, it appears that the damaged neuronal architecture that underlies these disorders is the same architecture that, when functioning normally, supports emotion regulation.

Given that mindfulness has been used to alleviate the symptoms of a wide array of psychological disorders, it raises the question as to why mindfulness works. Many have suggested (e.g., Chambers et al., 2009), and preliminary research supports that mindfulness is related to more effective emotion regulation strategies (Hill & Updegraff, 2012). Thus, the question arises: do the same neurologic networks that support emotion regulation also support mindfulness?

**Mindfulness Definition and Terminology**

Before we attempt to answer this question, we must first understand what is being studied as mindfulness. The word mindfulness originated as an English translation of the Pali word for the Buddhist tenant of sati, one of the seven factors of enlightenment (see Gethin, 2011 for a full discussion of the origins of this definition). A contemporary manual accompanying the translation of the Abhidhammattha Sangaha, a spiritual text from Theravada Buddhist tradition, explains that even though the word sati has its root in the verb “to remember,” it actually refers
to “presence of mind, attentiveness to the present, rather than the faculty of memory regarding the past” (Bodhi, 2003, p. 86).

For the Western, secularized field of psychology, mindfulness was originally defined as the nonjudgmental attention to experiences of the present moment (Kabat-Zinn, 1990). Others have since attempted to elaborate upon and further clarify this definition. In 2004, Bishop and colleagues suggested that there are two components to mindfulness: the regulation of attention to focus on present-moment experience, and an approach to all experience that is based in curiosity, openness, and acceptance.

Most important for the discussion of the neuroscience of mindfulness, however, is to have a clear understanding of what is being investigated as “mindfulness” in the studies reviewed and synthesized below. Without such an understanding, it would be impossible to make comparisons across studies and draw accurate conclusions.

The literature reviewed here includes investigations of a wide variety of experiences under the umbrella term of “mindfulness.” Some studies look at the functioning of the brain in experienced mindfulness practitioners engaged in intentional mindfulness practice (with researchers referring to this differentially as “mindfulness,” “meditation,” and/or “state mindfulness”). Other studies address how people experienced in mindfulness display mindfulness tendencies even when not engaged in formal mindfulness practice (with researchers differentially referring to this as “mindfulness,” “trait mindfulness,” and/or “dispositional mindfulness”). A final group of studies look at how attention to the present moment is processed in the brains of those without formal mindfulness instruction or during initial mindfulness training, calling these “naïve” subjects.
I propose that the neuroscience literature on mindfulness can be organized into a framework that differentiates between the degree of intentionality for engagement in mindfulness and the extent of mindfulness training (see Table 1 for a visual representation of this framework). It is my hope that this framework will not only elucidate the current status of the literature on the neuroscience of mindfulness, but that it will also provide a guide for how to approach future research in this field.

In this review, I will use “dispositional mindfulness” to refer to one’s tendency (either intrinsic or resulting from both unlearned and learned factors) to pay attention mindfully to one’s surroundings and experiences. Someone who is an “individual untrained in formal mindfulness” may exhibit dispositional mindfulness due to his/her intrinsic tendency to pay attention to present-moment experiences.

Similarly, novice, experienced, and expert mindfulness practitioners (see Table 1 for definitions) can display dispositional mindfulness by paying attention mindfully to their surroundings and experiences. For these practitioners, dispositional mindfulness is influenced by both intrinsic and learned factors. Novice, experienced, and expert mindfulness practitioners are differentiated here because they display distinct neurologic profiles, as reported below. As people become more experienced with formal mindfulness, they become more likely to display dispositional mindfulness.

Distinct from dispositional mindfulness is engagement in the deliberate practice of mindfulness (either meditation or other deliberate mindfulness-related practices that require training, such as mindful walking or mindful listening). These deliberate formal practices can, by definition, only be engaged in by people who have learned or been trained to engage in them (that is, by novice, experienced, and expert mindfulness practitioners).
### Table 1

*Mindfulness Terminology as Related to Degree of Intentionality and Extent of Practice*

<table>
<thead>
<tr>
<th>Degree of Intentionality</th>
<th>Extent of Formal Mindfulness Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dispositional mindfulness</strong></td>
<td>Individuals untrained in formal mindfulness</td>
</tr>
<tr>
<td>A person’s tendency to pay attention mindfully to his/her surroundings and experiences. This tendency, termed learned dispositional mindfulness, is influenced by both intrinsic factors and mindfulness training/experience.</td>
<td></td>
</tr>
<tr>
<td>Learned dispositional mindfulness begins in novice mindfulness practitioners.</td>
<td></td>
</tr>
<tr>
<td>Learned dispositional mindfulness is greater in experienced than novice practitioners.</td>
<td></td>
</tr>
<tr>
<td>Learned dispositional mindfulness is greatest in expert mindfulness practitioners.</td>
<td></td>
</tr>
<tr>
<td><strong>Engagement in deliberate practice of mindfulness</strong></td>
<td>A person without formal mindfulness training, by definition, cannot engage in deliberate formal practice of mindfulness.</td>
</tr>
<tr>
<td>A person’s intentional engagement in mindfulness meditation or other deliberate mindfulness-related practices that require training (e.g., mindful walking or listening). Novice practitioners have fewer than 8 weeks (26 hours) of formal training and 100 hours of personal practice.</td>
<td></td>
</tr>
<tr>
<td>A person’s intentional engagement in mindfulness meditation or other deliberate mindfulness-related practices that require training. Experienced practitioners have more than 8 weeks (26 hours) of formal training; they have more than 100 but fewer than 44,000 hours of personal practice.</td>
<td></td>
</tr>
<tr>
<td>A person’s intentional engagement in mindfulness meditation or other deliberate mindfulness-related practices that require training. Expert practitioners have more than 44,000 hours of personal practice.</td>
<td></td>
</tr>
</tbody>
</table>

Note: The 44,000 hour cut-off between experienced and expert practitioner is based on a single study (Brefczynski-Lewis, Lutz, Shaefer, & Levinson, 2007) and thus may need to be refined as new research is published.
Defining these categories as explicitly was done here is critical for the future of mindfulness research. Such clarity will facilitate accurate comparison of results across studies while maintaining assurance that researchers and reviewers are comparing the same type of mindfulness (e.g., dispositional versus deliberate practice) and the same type of practitioner (those untrained in formal mindfulness, novice mindfulness practitioners, experienced mindfulness practitioners, or expert mindfulness practitioners). Similarly, it will help us understand better the psychological and neurologic differences between these two types of mindfulness and the impact of the extent of mindfulness training.

**The Neurobiology of Dispositional Mindfulness**

Greater intrinsic dispositional mindfulness has been associated with greater psychological well-being and life satisfaction, and less incidence of depression and anxiety (Brown & Ryan, 2003; Chambers et al., 2009). Dispositional mindfulness is most often measured with one of two well-validated questionnaires. The Five Facet Mindfulness Questionnaire (FFMQ) is a 39-item measure designed to assess the extent to which a person experiences each of the following factors of dispositional mindfulness: non-reactivity to inner experience, non-judging of inner experience, acting with awareness, describing, and observing (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item measure that assesses mindfulness as a single factor of attention to and awareness of the present moment.

Those high in dispositional mindfulness (even without formal mindfulness training) appear to be able to regulate emotions by top-down attenuation of early sensory experience. Evidence for this comes from studies of the differential neural structure and function of the brains of those with varying degrees of intrinsic dispositional mindfulness. Murakami and
colleagues (2012) investigated the relation between brain structure and the five facets of mindfulness as measured by the FFMQ. They found that only one facet, describing, correlated with greater gray matter volume. The describing facet reflects one’s ability to label internal thoughts, feelings, and emotions with words (Baer et al., 2008). The higher people scored on the describing facet, the higher their gray matter volume in the right anterior IC and a region that spanned the right amygdala. Greater gray matter volume in the IC could relate to the higher interoceptive awareness experienced by people who are mindful. However, given that, at rest, the amygdala is under inhibitory control from the cortex, greater amygdalar volume likely reflects increased cognitive control of emotional responses (Murakami et al., 2012).

People high in dispositional mindfulness also appear to activate regions in the PFC to down-regulate the amygdalar response to negative emotion-inducing stimuli (Modinos, Ormel, & Aleman, 2010). When participants were asked to attend to a negatively valenced photo and actively reappraise the content so that it no longer elicited a negative response, those who were high in mindfulness were more successful at decreasing the reported negative emotion elicited by the images and displayed differential patterns of neural excitation. They also were able to recruit the dorsolateral PFC (DLPFC) and ACC during reappraisal, which, in turn, led to significant decreases in amygdalar activity upon viewing negative stimuli.

Electroencephalography (EEG) research has revealed that people high in dispositional mindfulness (as assessed by both the MAAS and the FFMQ acting with awareness subscale) had smaller late positive potentials (LPPs), which correspond with the emotional salience of visual stimuli (Brown, Goodman, & Inzlicht, 2013), than those low in dispositional mindfulness. Acting with awareness reflects one’s ability to stay focused and pay attention to what the person is doing in the present moment. In contrast, those high in neuroticism and negative affectivity
showed significantly higher LPPs in response to negatively arousing visual images. LPPs are event-related potentials that appear ~400-500ms after stimulus onset in the posterior and central midline. They are known to increase in accordance with more emotionally arousing visual stimuli (Cuthbert, Schupp, Bradlet, Birbaumer, & Lang, 2000). The fact that the LPPs of people high in dispositional mindfulness were significantly smaller in response to arousing negative visual images suggests that people with dispositional mindfulness skills modulate neural activity at an early step in the processing chain, before emotional content is attached to the stimuli.

People high in dispositional mindfulness might be accomplishing this down-regulation of the amygdala by engaging in cognitive reappraisal of emotional stimuli through active detachment of their experience of emotions from the emotional stimuli themselves. When those high in dispositional mindfulness have engaged in the exercise of labeling images of negative emotions such as fear or anger, they have shown a different pattern from people low in dispositional mindfulness (Creswell, Way, Eisenbeiger, & Lieberman, 2007). Dispositionally mindful individuals appear to be able to attenuate the amygdalar responses through activation of the medial PFC and right dorsolateral PFC. For people who are dispositionally mindful, but not for those low in mindfulness, there is a strong negative relationship between activity in the PFC and in the right amygdala, suggesting that labeling emotions allows mindful people to detach from the emotion, and thus attenuate the experience of affect arising from the stimulus (See Figure 1, Part B). Indeed, there is a negative correlation between dispositional mindfulness and alexithymia (Baer et al., 2006), further suggesting that people who are more dispositionally mindful are better able to identify their emotions, which might aid in their ability to detach from them.
The research described thus far has assessed mindfulness as a dispositional construct. This raises the question as to how the neurologic profile of those high in intrinsic dispositional mindfulness differs from that of individuals who have been trained in and practice mindfulness.

**Brain Changes Following Engagement in Mindfulness Training**

Mindfulness training can take on many forms, but typically involves engagement in mindfulness meditation exercises that teach an individual to engage in mindful behaviors. People trained in mindfulness are taught to willfully engage in moment-by-moment experience of sensations, thoughts, and emotions “observed as events in the mind, without over-identifying with them and without reacting to them” (Bishop et al., 2004, p. 232). In this way, the deliberate practice of mindfulness can “introduce a ‘space’ between one’s perception and response” (Bishop et al., 2004, p. 232). As practitioners become experienced, after many hours of deliberate mindful practice, they also develop a kind of “learned dispositional” mindfulness. That is, they become more mindful of the world around them (and have significantly higher scores on the FFMQ and MAAS) even when not meditating. For the purposes of this review, people with at least 8 weeks of mindfulness training were considered to be experienced mindfulness practitioners who could enter deliberate mindfulness practice at will. Notably, however, many studies reviewed here included practitioners with significantly more than this minimum experience of mindfulness practice (and when this was the case, it will be noted).

Mindfulness practitioners with an average of 14 years of experience with mindfulness meditation have displayed significantly improved orienting (measured by quicker reaction times on attention tasks), a higher degree of attentional processing efficiency (accuracy controlled for reaction time on attention tasks), and a trend toward better executive attention (measured by lower error rates on attention tasks) compared to controls (Van Den Hurk, Giommi, Gielen, ...
Speckens, & Barendregt, 2010), even when not actively engaged in mindfulness meditation. They also exhibit greater facility at engagement in interoception and enhanced sensory perception (Kerr, Sacchet, Lazar, Moore, & Jones, 2013). Mindfulness practitioners are also thought to have improved capacity to pay attention to the present moment and, therefore, engage less in “mind-wandering” and rumination (Brewer et al., 2011). An important question for this review is whether functional changes in the brain during mindfulness practice and structural changes in the brains of those people who regularly practice mindfulness support these behavioral differences in mindfulness skills like improved attention, interoception/sensory processing, and present-moment awareness.

**Neural Correlates of Improved Attention**

When experienced mindfulness practitioners were asked to mindfully perform the Stroop task, they made fewer errors than controls (Teper & Inzlicht, 2013; Wenk-Sormaz, 2005) and demonstrated less Stroop interference (Moore & Malinowski, 2009). These findings suggest that they were better able to focus their attention on the challenging task. Further, when mindfulness practitioners made errors on the Stroop task, their brains displayed a stronger error-related negativity (ERN) signal than did controls (Dehaene, Posner, & Tucker, 1994; Teper & Inzlicht, 2013). ERN is a well-documented event-related potential thought to originate in the ACC that is observed with EEG within 100ms of committing the error and is associated with unconscious detection of the error (Teper & Inzlicht, 2013). Most interestingly, even though the ERN was greater, the corresponding error positivity signal was smaller. The error positivity signal is thought to originate from the dorsolateral PFC (DLPFC; Kerns et al., 2004) and is typically seen after the ERN and thought to represent the conscious, emotional reaction to the error. Thus, it appears that mindfulness practitioners were not only better able to attend to and detect errors, but
were also better able to detach their experience of the error from any emotional reaction associated with making the error. Perhaps unsurprising, then, is the finding that improvement on the Stroop task (particularly improvement in response inhibition) following mindfulness training predicted self-reported improvement in changes in psychological well-being, depression, and anxiety. This suggests an important role for these attentional changes in mediating the psychological outcomes of mindfulness training.

Similarly, mindfulness engagement has been shown to improve sustained attention, allowing people to maintain attention for a longer period of time without increasing the number of errors committed (Semple, 2010). Importantly, people with 16 weeks of mindfulness training (3 hours of mindfulness meditation training with an instructor followed by 10 minutes of home practice individually each day) were also more cognitively efficient than controls when working on attentional tasks, requiring fewer neural resources (as measured by EEG signal strength) to recognize an object, particularly when incongruent stimuli were presented (Moore, Gruber, Derose, & Malinowski, 2012). Consistent with these findings of improved attentional capacity following mindfulness training, Lazar and colleagues (2005) found that experienced mindfulness practitioners with extensive engagement in deliberate mindfulness practice displayed greater cortical thickness in areas of the brain thought to be important for attentional control (PFC). Further, Hasenkamp and Basalou (2012) found that, in a group of mindfulness practitioners who all had at least 1 year of mindfulness meditation experience, the more experience they had mindfully meditating, the greater the functional connectivity between attentional regions and the medial frontal cortex. This altered functional activity was observed even in non-meditative states, suggesting a transfer of attentional state-related control to daily living after a year or more of mindfulness practice.
Interestingly, a study of expert mindfulness practitioners showed that those meditators with an average of 44,000 hours of practice displayed less activity in areas of the brain known to be involved in sustained attention than did both experienced meditators (with as many as 19,000 hours of practice) and novice practitioners learning meditation for the first time during the study (Brefczynski-Lewis, Lutz, Schaefer, & Levinson, 2007).

**Neural Correlates of Improved Interoception and Sensory Processing**

In addition to changes in attentional processing, mindfulness training also appears to recruit brain areas involved in sensory processing (dorsal right somatosensory cortex) and the incorporation of sensory information in the appropriate emotional context (right anterior IC); these areas showed increased gray matter in experienced mindfulness practitioners who had over 1,000 hours of mindfulness meditation practice (Lazar et al., 2005). Further the anterior IC was found to be significantly more activated and the dorsomedial PFC (DMPFC) significantly less activated when mindfulness practitioners engaged in interoception than when controls engaged in interoception, suggesting that, during deliberate engagement in mindfulness, practitioners were able to release the IC from the baseline (default mode) inhibition of the DMPFC to perform the task better (Farb, Segal, & Anderson, 2013).

Improvements in sensory capacity during mindfulness practice are also seen. For instance, Grant, Courtemanche, Duerden, Duncan, and Rainville (2010) found that experienced mindfulness practitioners had lower pain sensitivity than controls, as evidenced both by behavioral differences in the temperature required to produce moderate pain and in the thickness of the cortex in pain-related regions of the brain (dorsal ACC, bilateral secondary somatosensory cortex). Further, the cortical thickness of these regions correlated with amount of mindfulness practice.
Neural Correlates of Decreased Default Mode Network Activation

In recent years, a flurry of neuroscience studies have focused on understanding the activity of the human brain at rest, in its default mode (Raichle et al., 2001), rather than during active task performance (Whitfield-Gabrieli & Ford, 2012). The results of this literature reveal that there are two types of self-referential processing in which humans engage: present-moment self-related processing (e.g., somatic stimulus-dependent or interoceptive sensations) and narrative self-related processing, which is stimulus-independent and is most often past- or future-focused. The right somatosensory cortex and IC support somatic and interoceptive transient self-related processing of the present-moment state (Tang, 2007), whereas the medial PFC (MPFC) supports this narrative self-focus (Neisser, 1997; Northoff & Bermpohl, 2004). Transcranial magnetic stimulation applied to the PFC disrupted processing of self-related narrative information, but not other-related narrative information, supporting the idea that self-referential information is processed in this area (Guise et al., 2007). Not surprisingly, mindfulness was associated with increases in present-moment self-related processing, whereas mind-wandering and rumination (activities more common of the non-mindful) were associated with narrative self-related processing and their associated neurologic correlates (Farb et al., 2007).

The default mode network is the name given to a group of brain structures that are involved in narrative generation and are thought to support the default mode of human attention at rest (Raichle et al., 2001). The two main areas that appear to generate the default state of human attention include the MPFC and the posterior cingulate cortex (PCC), although the inferior parietal lobe, precuneus, and inferolateral temporal cortex have also been implicated (Raichle et al., 2001). Greater activation in the default mode network is seen during rumination and in psychopathological disorders such as anxiety and depression; it is associated with
narrative self-referential processing that is focused on the future or the past, not the present moment. Indeed, Bostanov, Keune, Kotchoubey, and Hautzinger (2012) found that experienced mindfulness practitioners were significantly more successful than wait-list controls at increasing event-related brain potentials that reflect the ability to maintain attention in present-moment rather than ruminative thinking. Similarly, mindfulness practitioners were found to have lower baseline frontal gamma activity than controls and increases in posterior gamma power during mindfulness meditation (Berkovich-Ohana, Glicksohn, & Goldstein, 2012). Gamma power over the frontal cortex at the midline is thought to correlate with the default mode of the brain, whereby one engages in self-reflective internal talk (i.e., mind-wandering). Frontal gamma power increases during rumination and is found to be higher at baseline in those with depression and anxiety. Posterior gamma power, on the other hand, is associated with greater sensory awareness and attention. These results are consistent with the idea that mindfulness meditation is associated with the ability to focus attention on present-moment sensory experiences (Berkovich-Ohana et al., 2012).

In an elegant study, Farb and colleagues (2007) revealed a functional dissociation between the cortical areas that support narrative-related self-focus and those that support momentary, experiential self-focus. In people without mindfulness experience, experiential focus was associated with small reductions in the activity of the MPFC, whereas in mindfulness practitioners, there was a significantly greater and more pervasive reduction in the activity of the MPFC, as well as an increase in the activity of the right lateral PFC, IC, and secondary somatosensory cortex. The MPFC and the right IC appeared to be functionally connected in the control group (such that reductions in the activity of the MPFC were also reduced IC activity and vice versa). Interestingly, however, in the mindfulness group, this link was decoupled, and
mindfulness practitioners reduced activity in the MPFC while increasing IC activity when engaging in experiential, interoceptive experience. In other words, in people who do not engage in deliberate mindfulness practice, narrative and momentary self-focus experiences are linked to one another. However, with mindfulness training, these two experiences can be unlinked. In this way, engagement in deliberate mindfulness practice helps to detach narrative-focused thought from interoceptive experience (Farb et al. 2007).

Brewer and colleagues (2011) found that mindfulness practitioners engaged in meditation had significantly less activation than controls in the MPFC and PCC than did controls previously untrained in formal meditation during their first practice of meditation, indicating that mindfulness practitioners are more adapt at “turning off” the default mode of narrative-generation during meditation. This ability may be functionally supported by the increased connectivity found between the ACC, PCC, and DLPFC in mindfulness practitioners.

When mindfulness practitioners were asked to complete a challenging cognitive task that included negatively valenced distractors, mindfulness practitioners, but not controls, showed greater activation in both ventrolateral areas of the PFC (VLPFC) and decreased activity in the amygdala when negatively valenced distractors were present, helping them to remain focused on the task and not get pulled into narrative self-processing (Froeliger, Garland, Modlin, & McClenon, 2012). This process led to mindfulness practitioners reporting less negative affect than controls. That is, mindfulness practitioners were better able to use the activation in the VLPFC to disrupt automatic affect generation in the amygdala and other mood generating areas of the brain, by selectively activating top-down control of the limbic system to reduce interference from emotional stimuli (Froeliger et al., 2012) (See Figure 1, Part D).
White Matter Changes

The microstructural properties of white matter can be imaged using sophisticated imaging and analysis tools that exploit the properties of water-diffusion in the brain. For instance, the extent of directional coherence of water diffusion in a specific area of the brain is related to the extent of coherence of the axonal tracts in that area (Boorman, O’Shea, Sebastian, Rushworth, & Johansen-Berg, 2007). Fractional anisotropy (FA) is a measure of this integrity of white matter tracts in the brain. Higher FA is associated with an increased concentration of white matter tracts, more myelination, and more coherently oriented fibers (Kang et al., 2013). Greater FA was found in the anterior corpus callosum of experienced mindfulness practitioners, indicating increased connectivity and interhemispheric integration between prefrontal regions of the brain, which may underlie their increased emotion regulation abilities (Luders et al., 2012).

FA was also found to be significantly greater in experienced mindfulness practitioners versus controls in the corticospinal tract, the temporal portion of the superior longitudinal fasciculus, and the uncinate fasciculus (Luders, Clark, Narr, & Toga, 2011). The corticospinal tract carries both motor and somatosensory information, and thus may be related to the increased gray matter seen in the somatosensory cortex of mindfulness practitioners (Grant et al., 2010). The superior longitudinal fasciculus is one of the main anterior-to-posterior projection pathways in the brain, connecting multiple areas in parietal, temporal, occipital, and frontal areas (Makris et al., 2005). The uncinate fasciculus contains projections between the ventral, medial, and orbitofrontal portions of the PFC and limbic areas including the amygdala and hippocampus (Kier, Staib, Davis, & Bronen, 2004; Schmahmann et al., 2007), and is consistent with findings of increased gray matter in these areas in mindfulness practitioners (Luders, Toga, Lepore, & Gaser, 2009).
Kang and colleagues (2013) found higher FA values in a white matter region adjacent to the MPFC and in the temporal pole in experienced meditators, a finding that correlated with greater cortical thickness in these regions. This suggests that mindfulness practice might facilitate cross-communication between these two structures and more efficient, controlled processing of emotional content.

People who participated in 1 month (11 hours) of a mindfulness meditation-based intervention called integrative body-mind training (IBMT, adapted from traditional Chinese medicine; Tang, 2007) experienced not only improvements in the efficiency of executive attention and alerting attention networks (Tang, 2009), but also increased fractional anisotropy in the white matter of the corona radiata, which connects the ACC to other neural areas (Tang et al., 2010). Interestingly, a follow-up study shed light on how and over what time course these white matter changes occur (Tang, Lu, Fan, Yang, & Posner, 2012). After 2 weeks of IMBT training (30 minutes per day for a total of 5 hours), there was a reduction in axial diffusivity (AD; a measure of axonal morphometry reflecting changes in axonal density and/or caliber) but no change in fractional anisotropy (FA; a more general and less sensitive measure of white matter integrity reflecting improved axonal performance) or in radial diffusivity (RD; a measure thought to reflect the character of myelin) in the anterior corona radiata. However, by 4 weeks (10 hours) of training, both RD and AD decreased while FA increased. Decreases in AD are thought to reflect the decreases in axonal space due to increases in the density or caliber of axons and are commonly seen in utero during brain development (Kumar, Nguyen, Macey, Woo, & Harper, 2012). Decreases in RD, on the other hand, suggest increases in myelination and help to increase the speed and synchronization of signals (Fields, 2008). FA increase can be interpreted as an overall measure of white matter efficiency and integrity. Thus, these findings suggest that as a
result of mindfulness training, the corona radiata, connecting the ACC to other cortical areas, initially increase in axonal number or diameter and then become more myelinated, such that by 4 weeks of training, the fiber pathway is faster and more coherent.

Standard, 8-week MBSR training has been shown to result in functional connectivity changes in the brain’s attentional and sensory processing areas. Kilpatrick and colleagues (2011) demonstrated that the brains of MBSR-trained participants responded differently to mindful awareness of sounds than did those of controls. Participants with MBSR training had greater connectivity between regions of the brain that process auditory material and areas that process the salience of auditory material. The authors also found white matter changes consistent with increased cross-modal inhibition between visual and auditory cortices, allowing for greater attentional focus due to less intrusion from the visual cortices while attending to sounds.

**Gray Matter Changes**

A 2011 study by Hölzel, Carmody, and colleagues demonstrated that reductions in perceived stress following 8-week MBSR training correlated positively with increases in gray matter density in the right basolateral amygdala. This area of the amygdala is known to be important for communicating sensory information from primary cortical areas to the central nucleus of the amygdala during the anxiety response, and is thought to be the area where the initial stress reaction is formed and relayed to other parts of the brain. Increases in gray matter in this area are consistent with an increase in top-down control of the amygdalar response.

**Time-course of Functional Changes**

Both novice mindfulness practitioners with as few as 3 hours of mindfulness meditation practice and experienced practitioners have been able to attenuate the emotional intensity of negatively valanced pictures shown to them by practicing mindfulness, but they appear to do so
via different neural mechanisms (Taylor et al., 2011). Initially, deliberate mindfulness practice has been shown to affect the brain by recruiting top-down control of the left amygdala through the PFC, therefore decreasing the emotional reactivity of the amygdala (Figure 1, Part C). With practice (> 1000 hours), experienced mindfulness practitioners’ brains no longer displayed decreases in emotional reactivity (that is, their amygdalae showed similar activity to control participants) when emotionally-valenced objects were presented, but in experienced practitioners there was a concomitant deactivation of the right MPFC and right PCC (Figure 1, Part D). In this way, experienced practitioners seem to be able to change their relationship with the sensory experience and become accepting of it, no longer using self-referent processes (internal thought) to attenuate the response of the stimuli (see also Chiesa, Serretti, and Jakobsen, 2013 for a review).

It appears that novice mindfulness practitioners very quickly learn mindfulness techniques and that neural changes are seen almost immediately. When novice practitioners were instructed to either “breathe in and out…focus on the sensation of breathing” or “let your mind take you wherever it goes as you normally would throughout the day,” differential patterns of neural activation were observed (Dickenson, Berkman, Arch, & Lieberman, 2013). Focused breathing was associated with activity in parietal and prefrontal structures (temporal parietal junction, DMPFC), ACC, and somatosensory areas (e.g., anterior IC), and the magnitude of the ability to recruit these areas during focused breathing was mediated by dispositional (baseline, intrinsic) mindfulness as measured by the MAAS. Not surprisingly, the mind-wandering condition, compared to focused breathing, had greater activity in default mode network areas (MPFC, PCC, and precuneus).
Interestingly, Zeidan, Martucci, Kraft, McHaffie, and Cognhill (2014) found that the extent to which mindfulness practitioners with 4 days of mindfulness meditation training were able to recruit the ACC, VMPFC, and anterior IC predicted how much anxiety relief they experienced while meditating. Participants with social anxiety in an MBSR program (versus controls who engaged in 8 weeks of aerobic exercise) found greater reductions in negative affect, which correlated with a shift in brain activity, including increases in areas including right VLPFC and right parietal areas, when completing a task that asked them to reappraise negative self-beliefs (Goldin, Ziv, Jazaieri, Hahn, & Gross, 2013). When people who had engaged in an 8-week MBSR course experienced sadness (evoked by watching clips from sad films), the neural patterns activated included more right-lateralized, visceral areas associated with primary sensory experience (right IC, right ACC, right VLPFC), whereas wait-list controls experiencing image-evoked sadness showed activity in more cortical and midline areas associated with rumination and self-reflection (MPFC areas, PCC, left DLPFC, left operculum including Broca’s area, and left midtemporal gyrus) (Farb et al., 2010).

These initial neurologic changes correlate with positive behavioral outcomes. After only 4 days of mindfulness meditation training, novice practitioners had significantly greater decreases in fatigue and anxiety and increased mindfulness than controls. Further, they had significantly greater visuospatial processing, working memory, and executive functioning (Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). Tang et al. (2007) found that just 5 days (20 min./day) of mindfulness training resulted in improved attention and reduced stress. These novice mindfulness practitioners had improved conflict scores in attentional tasks that presented information incongruent with the target; lower anxiety, depression, anger, and fatigue; increased “vigor” on a measure of mood states scale; and a decrease in stress-related cortisol.
Conclusions and Future Directions

Emotion regulation is a critical skill for the maintenance of psychological well-being. Mindfulness facilitates adaptive emotion regulation, and yields positive behavioral outcomes including increased attention and executive function skills, as well as improved quality of life and decreased incidence of psychological disorders.

The purpose of the present review was to evaluate the neural profile, both structural and mechanistic/functional, with regard to varying degrees of intentionality (dispositional versus deliberate engagement in mindfulness) as well as varying extents of formal mindfulness training (untrained in formal mindfulness, novice practitioner, and experienced practitioner) in order to elucidate how mindfulness alters the emotion regulatory structures and functions of the brain. While this literature is in its infancy and many findings await replication, early results are intriguing (Table 2).

The studies reviewed here suggest that people high in dispositional mindfulness display significantly greater gray matter volume in brain areas involved in emotional regulation of interoception and the attachment of affect to emotion-generating stimuli (the IC). They also show significantly different activations during effortful reduction of negative affect in regions of the brain known to regulate emotion (greater PFC and ACC activation and reduced amygdala activation), compared to those who are low in dispositional mindfulness. These changes appear to facilitate down-regulation of the amygdala early in the stream of sensory processing in those high in dispositional mindfulness, in some cases even before emotional content is attached to stimuli.
### Table 2

**How Mindfulness Works in the Brain as Related to Degree of Intentionality and Extent of Practice**

<table>
<thead>
<tr>
<th>Degree of Intentionality</th>
<th>Extent of Formal Mindfulness Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untrained in formal mindfulness</td>
<td>Novice mindfulness practitioner</td>
</tr>
<tr>
<td>Low intrinsic dispositional mindfulness</td>
<td>• increased integrity of connections through ACC</td>
</tr>
<tr>
<td>• rumination/mind-wandering</td>
<td>• increased gray matter of the right basolateral amygdala consistent with improved top-down control of the amygdalar response</td>
</tr>
<tr>
<td>• increased activity in default mode network (MPFC, PCC, precuneus)</td>
<td>• recruitment of right-lateralized areas aimed at cognitive reappraisal (right IC, right ACC, right VLPFC) of emotional response and less rumination following image-evoked sadness</td>
</tr>
<tr>
<td>High intrinsic dispositional mindfulness</td>
<td>• improved attention</td>
</tr>
<tr>
<td>• down-regulation of the amygdala through activation of the DLPFC and ACC</td>
<td>• improved attention</td>
</tr>
<tr>
<td>• engagement in cognitive reappraisal of negative affect</td>
<td>• increased interoceptive awareness</td>
</tr>
<tr>
<td>Untrained in formal mindfulness</td>
<td>Novice mindfulness practitioner</td>
</tr>
<tr>
<td>--------------------------------</td>
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</tr>
</tbody>
</table>
| Engaged in deliberate practice of mindfulness | • small reductions seen in default mode areas (e.g., MFPC) that lead to reductions in IC within first moments of training  
• Top-down control of the left amygdala through the PFC  
• decreased emotional reactivity of the amygdala  
• mediation of the magnitude of ability to recruit parietal, prefrontal, ACC, and somatosensory areas during initial training intrinsic by degree of dispositional mindfulness | • Increased FA in corona radiata support connectivity between ACC and other areas  
• Pervasive reduction in default mode areas (e.g., MPFC) with concurrent increase in right lateral PFC, IC, and secondary somatosensory cortex  
• Decoupling of link between MPFC and IC—allowing for detachment of narrative-focused thought from interoceptive experience  
• Cessation of engagement in top-down control of the amygdala  
• Return of amygdala to activity level similar to those untrained in formal mindfulness  
• Concurrently, deactivation of right MPFC and right PC, which supports acceptance of pure amygdalar response without adding narrative self-related thought to the | • data limited to a single study (Brefczynski-Lewis et al., 2007)  
• experts with over 44,000 hrs of experience display less activity in areas typically involved in sustained attention than both experience and novice practitioners |

(not applicable)
response
Experienced mindfulness practitioners, who have hundreds of hours of mindfulness meditation practice, appear more facile at voluntarily disengaging from the narrative focus of the resting state of the human mind, the default mode network (as evidenced by reductions in MPFC and PCC during mindfulness meditation). Instead, they are able to engage areas of the brain (IC, amygdala, somatosensory cortex) that support present-moment focused thought. Improved attentional control (increased VLPFC and ACC activity), interoceptive ability (increased IC activation), and sensory processing (increased gray matter in the dorsal somatosensory cortex), along with the increased tolerance of emotional experience through detachment from the default mode network (uncoupling of mPFC and IC), facilitate emotion regulation in experienced mindfulness practitioners. As novice mindfulness practitioners learn mindfulness techniques, they show distinct white and gray matter alterations as well as functional neurologic changes. These changes begin after as few as 2 weeks of training (5 hours) with an increase in the density and caliber of the axons. By 4 weeks (10 hours), not only are the density and caliber of the axons increased, but there is also an increase in mylenation and overall white matter efficiency and integrity. With more mindfulness practice, there is increased FA in tracts connecting anterior and posterior brain structures (superior longitudinal fasciculus), between the hemispheres (corpus callusum), as well as between prefrontal and limbic areas (unculate fasiculus; corona radiata) and in regions that carry somatosensory information (corticospinal tract), indicating a strengthening of connections. These changes likely help to facilitate more controlled, regulated, processing of emotional content and increased connectivity with somatosensory and interoceptive regions of the brain.

Mindfulness training, in as few as 3 hours, results in functional changes through the recruitment of PFC to serve as a top-down control of the amygdala. Additionally, mindfulness-
trained practitioners activate emotion regulatory areas (DMPFC, ACC) and those involved in interoception and somatosensory processing (IC), and de-activate default mode network areas (MPFC, PCC, and precuneus). Importantly, the extent to which novice practitioners recruit these areas (namely the ACC, VMPFC, and IC) predicts the reduction in negative affect (anxiety).

**Attention versus Attentional Effort**

Jensen, Vangkilde, Frokjaer, and Hasselbalch (2012) raise an important issue about the possibility of a confound in much of the mindfulness research that compares those receiving mindfulness meditation training to controls. They believe that attentional effort may differ between groups, resulting in different degrees of stress reduction. In this way, stress reduction (rather than mindfulness per se) might contribute to the behavioral differences seen between the two groups. In general, mindfulness research would benefit greatly from more carefully controlled experimental designs, specifically those with active, well-matched controls (see also Tang et al., 2015). A neuroimaging study designed to address this issue might involve scanning the following four groups of individuals at baseline and at the conclusion of the study period: those who receive mindfulness stress-reduction training, those who receive a non-mindfulness stress-reduction program, wait-list controls who receive no incentive to perform well at posttest, and wait-list controls who are incentivized to perform well at posttest.

**What Is Being Studied as Mindfulness?**

Future research on the neuroscience of mindfulness would also be well served to clearly define the degree of mindfulness intentionality (dispositional versus deliberate engagement in mindfulness meditation or practice) and the extent of mindfulness experience (untrained in formal mindfulness, novice practitioner, experienced practitioner) being studied. A framework was proposed in this review to help organize and clarify the literature, which often unnecessarily
obfuscates the type of mindfulness that is being studied. For instance, clarification is needed between studies that only assess the extent to which people untrained in formal mindfulness exhibit intrinsic dispositional mindfulness traits (e.g., by administering a baseline FFMQ or MAAS) versus those that assess how people change in their mindful approach to the world following mindfulness training (e.g., a change score on the FFMQ or MAAS following a mindfulness intervention, or the FFMQ or MAAS score of an experienced mindfulness practitioner). Further, such studies must also be differentiated from research aimed at examining the brains of mindfulness practitioners during deliberate engagement in mindfulness practice either early or late in training.

These subtle, and important, distinctions become muddled when they are all referred to solely as studies of “mindfulness.” It appears that more accurate descriptions of the type of mindfulness being assessed are warranted. As suggested in Table 1, the term *intrinsic dispositional mindfulness* should be used when assessing how much a person – before or without mindfulness training – exhibits a natural tendency to pay attention mindfully to his/her surroundings and experience (e.g., as measured by the FFMQ or MAAS or similar measure); *learned dispositional mindfulness*, on the other hand, can be used when assessing the extent to which a person with mindfulness training exhibits a tendency to pay attention mindfully to his/her surroundings following formal training. Importantly, learned dispositional mindfulness reflects both intrinsic (baseline) and learned tendencies. *Engagement in the deliberate practice of mindfulness* could be used to describe an individual’s intentional engagement in mindfulness meditation or other mindfulness-related practice that requires training (e.g., mindful walking or listening).
Finally, it is recommended that researchers and reviewers alike be explicit about the extent of mindfulness training and practice people have experienced previously and/or receive during the intervention. It is recommended that the term individual untrained in formal mindfulness practice be used to describe someone without any formal mindfulness training, the term novice practitioner refer to those individuals who are being trained for the first time during the study period, and experienced practitioner could refer to those individuals who have had at least 8 weeks (26 hours) of mindfulness training and greater than 100 hours of personal mindfulness practice (the amount typically conferred following a full course of the most commonly researched form of mindfulness training, MBSR) but fewer than 44,000 hours of practice (Brefczynski-Lewis et al., 2007). Expert practitioner is proposed to refer to those individuals with more than 44,000 hours of practice, as practitioners with this amount of experience have been shown to exhibit a unique neurologic profile (Brefczynski-Lewis et al., 2007). It is notable that the distinction between experienced and expert practitioner is based on research findings from a single study, and will need to be updated as research in this area is refined.

This terminology would not only improve clarity but also encourage further research on mindfulness dose effects. Finally, it is recommended that researchers be as explicit as possible (in terms of reporting both the number and length of training sessions provided) so as to allow the researchers of the study being conducted or future researchers engaging in meta-analyses to investigate the dose effect.

**Neuroscience of Clinically Effective Mindfulness Interventions**

The neuroscience of mindfulness would benefit greatly from more neuroimaging research on those mindfulness interventions that have the most empirical support in the clinical
psychology literature, namely MBSR and MBCT. Others, including van der Velden and Roepstorff (2015) have called for this as well, noting that they “find it remarkable that few neuroscientific investigations of mindfulness meditation have focused on the interventions that have shown the most clinical promise” (p. 439).

**Mindfulness Facilitates the Ability to Engage in Voluntary Devolution of the Brain**

This survey of the neuroscience of mindfulness and emotion regulation has revealed how mindfulness training facilitates long-term psychological health by encouraging primary sensory, present-focused, reflection and discouraging narrative self-focus. Building on Gross and Thompson’s 2007 model, this review reveals how mindfulness facilitates emotion regulation (see Figure 1). Those with high dispositional mindfulness tendencies, but no formal mindfulness training, likely engage in emotion regulation largely through down-regulation of the amygdala at the level of response modification. During early training in deliberate mindfulness practice, on the other hand, there is not only a down-regulation of the amygdala through response modification, but also a significant increase in activity in neurologic structures that facilitate attentional deployment. Additionally, there are early signs of alterations in the cognitive change step of emotion regulation, whereby default mode network areas decrease and present-moment focused sensory areas increase activity that facilitates a detachment of sensory experience from the emotional response. Thus, these practitioners are less likely to need to employ strategies that may have deleterious psychological consequences (e.g., the situation selection/modification strategy of avoidance or the response modification strategy of ingestion of mind-altering drugs).

Finally, as people become experienced in mindfulness, a critical shift occurs. There is a true decoupling of the default mode narrative-generation network from the primary sensory network, allowing mindful individuals to experience primary emotions in the present moment.
Whereas those early in mindfulness training engage both top-down regulation of the amygdala (a response modification process of emotion regulation), as well as detachment from the default mode (a cognitive change process of emotion regulation), experienced mindfulness practitioners engaging in deliberate practice of mindfulness are able to experience the pure response detached from additional narrative generation about the response. Mindfulness practitioners can experience negative emotions and sensations without adding further negative valence brought on by past experience or concern for the future, which is critical for psychological health.

As the field of the neuroscience of mindfulness progresses it will be important to understand the mechanisms by which mindfulness practice, over time, allows one to both fully experience emotions and to detach from any narrative self-reference relating to them. How much mindfulness experience is necessary to facilitate this detachment? What aspects of mindfulness practice are most important in driving these brain changes? These questions get at the heart of how mindfulness facilitates emotion regulation and psychological health. Answering them will allow us to understand explicitly how mindfulness encourages this neural “unlinking,” or willful travel back in evolutionary time to the primitive animal brain interested mainly in the present moment. And if psychologists could understand these mechanisms they could potentially devise ways to augment them.

In this way, the promise of the next chapter of research on the neuroscience of mindfulness is to help tailor mindfulness treatment and facilitate optimal psychological outcomes – to help people gain the mindfulness skills necessary to return, intentionally, to a place where fear can live, but worry cannot; where sadness can live, but depression cannot; where pain can live, but suffering cannot.
CHAPTER 2

The Effect of Mindfulness and Acupuncture on Psychological Health in Veterans

Mindfulness is a practice that originated from the teachings of Buddhism (Nhat Hanh, 1976) involving non-judgmental moment-to-moment awareness of both one’s physical and mental states (Kabat-Zinn, 1994). Contemporary clinical psychologists have adapted traditional mindfulness methods into secular, psychological interventions such as mindfulness-based stress reduction (Kabat-Zinn, 1982, 1990), mindfulness-based cognitive therapy (Segal, Williams, & Teasdale, 2002), acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 1999), dialectical behavior therapy (Linehan, 1993), and, more recently, integrative restoration (iRest®) yoga nidra (Miller, 2005).

Mindfulness-based interventions have been shown to decrease stress in both clinical and non-clinical populations (Chiesa & Serretti, 2009; Hofmann, Sawyer, Witt, & Oh, 2010). Additionally, they help to alleviate psychological issues such as anxiety and depression (Goyal et al., 2014; Hofmann et al., 2010), post-traumatic stress disorder (Kimbrough, Magyari, Langenberg, Chesney, & Berman, 2010), and substance abuse (Dakwar & Levin, 2009; Zgierska et al., 2010). Mindfulness skills can enhance one’s ability to cope with physical health problems and pain (Carlson, Speca, Faris, & Patel, 2007; Greeson, 2009; Grossman, Niemann, Schmidt, & Walach, 2004), and improve self-reported quality of life (Bedard et al., 2005).

The benefits of mindfulness-based interventions are numerous: they are low-cost, can be delivered in a group format, and the techniques learned can be practiced outside of therapy (Toneatto & Nguyen, 2007). They do not have the side effects of traditional medical treatments, are effective across a wide variety of psychological and physical health disorders, and can have lasting beneficial effects (Bedard et al., 2005; Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper,
Furthermore, once learned, mindfulness can be practiced at any time and in nearly any location.

For these reasons, mindfulness is a particularly attractive intervention for military Veterans, who often carry multiple diagnoses (Walker, 2010; Wilk & Hoge, 2011). Indeed, standard medical and psychological treatments, which typically target isolated diseases or diagnoses, at times may miss the more complex, multisystem dysfunction that has been documented in the Veteran population (Walker, 2010). Further, Veterans are increasingly requesting complementary and integrative medicine (CIM) services (Healthcare Analytics and Information Group [HAIG], 2011). As of 2011, 125 VA [Veterans Affairs] facilities (82%) provided and/or referred patients to CIM service providers. Of those, mindfulness meditation was the most commonly provided CIM across the VA facilities surveyed, and acupuncture was the most common treatment modality to which providers referred Veterans.

iRest is the only mindfulness intervention that was originally developed for the military population (Integrative Restoration Institute [IRI], 2014). Based on the practice of yoga nidra as taught by Saraswati (1998), iRest also includes elements of contemporary clinical psychological interventions including cognitive behavioral therapy and progressive muscle relaxation, among others (Miller, 2014). The first study of iRest was published in 2006; it assessed the feasibility of using iRest with military personnel suffering from PTSD (Engel et al., 2006). This study provided anecdotal evidence for the feasibility of the intervention, and demonstrated a trend towards a decrease in PTSD symptoms.

iRest was subsequently incorporated into the standard weekly treatment for soldiers receiving care at the Deployment Health Clinical Center at Walter Reed Army Medical Center (WRAMC), and is now offered at over 30 VA Medical Centers (VAMCs) and other military
settings in the United States (IRI, 2014) (see Appendix A). The War Related Injuries and Illnesses Study Center at the Washington, DC VAMC (WRIISC-DC) has maintained an ongoing CIM program for Veterans since 2007, which has included iRest in addition to other CIM approaches such as outpatient individual and group acupuncture. In the 2012-2013 fiscal year alone, WRIISC-DC provided 1463 total iRest sessions to 280 patients.

Despite the widespread use of iRest in the military, the research literature on the effectiveness of this intervention remains in its infancy, with only four outcome studies published to date in peer-reviewed journals. Stankovic (2011) conducted a qualitative feasibility study of iRest for treating combat-related PTSD, finding the intervention to be feasible and noting that all 11 participants who completed the program reported reductions in rage, anxiety, and emotional reactivity, and increases in feelings of relaxation, peace, self-awareness, and self-efficacy. iRest has been shown to be protective against relapse from chemical dependency for individuals in a residential substance abuse treatment program (Temme, Fenster, & Ream, 2012), to significantly decrease perceived stress, worry, and depression and to increase mindfulness skills in college students (Eastman-Mueller, Wilson, Jung, Kimura, & Tarrant, 2013), and reduce perceived stress in patients with chronic medical illnesses (Pritchard, Elison-Bowers, & Birdsell, 2010).

In addition to these studies of iRest published in peer-reviewed journals, a study reported on the iRest website found that five female Veterans with military sexual trauma who completed a 10-week iRest intervention had significant decreases in negative self-cognition and negative world cognitions, as well as a significant increase in self-esteem (Pence, Katz, Huffman, & Cojucar, 2014). Additional non-peer reviewed research with non-military populations (e.g., homeless adults, school counselors, and healthcare providers) revealed significant reductions in
stress, anxiety, depression, somatic symptoms, and fatigue after iRest interventions (Bhogaonker, 2012; Bingham, Peacock, Fritts, & Walter, 2014; Birdsall, Pritchard, Elison-Bowers, & Spann, 2011; Borchardt, Patterson, & Seng, 2014; IRI, 2014).

While this initial research literature is promising, most of the studies are limited in nature due to small sample size, use of nonclinical populations, and less than rigorous study designs. Surprisingly, only one qualitative study published in a peer-reviewed journal (Stankovic, 2011) and two studies published online (Engel et al., 2006; Pence et al., 2014) were conducted with the very individuals for whom the intervention was originally designed and is currently widely used – the military population. Although one peer-reviewed study (Temme et al., 2012) and one study published online (Stankovic, 2011) have addressed the effectiveness of iRest for individuals with psychological disorders (chemical dependency and PTSD, respectively), none have examined the effect of iRest for those suffering from clinical depression. Only two other studies have compared iRest to an active control (Borchardt et al., 2014; Temme et al., 2012). Finally, none of the published iRest studies describe in detail the training level of the instructors who led the programs, so it is impossible to judge the quality of the interventions that were provided.

The present study adds to the research literature on iRest by assessing the effectiveness of iRest in addition to another CIM intervention (acupuncture) as a complement to standard medical and psychological treatments to enhance positive mental health outcomes for Veterans. It was conducted with a large enough sample size to have adequate power, compared the additive benefit of iRest and acupuncture to acupuncture alone, and included people who were clinically depressed. Further, the treatment was administered by a licensed therapist who had received the highest level of iRest instructor training directly from the developer of the intervention. Acupuncture was chosen as the comparative sample because it is the most common CIM
intervention to which Veterans are referred at VA facilities across the country (HAIG, 2011), is currently used (as an adjunct to traditional medicine) to treat depression among Veterans (HAIG, 2011), and, like iRest, can be performed in a group format. While there is empirical support for the use of acupuncture to treat physiological concerns such as nausea, headaches, musculoskeletal pain, and fibromyalgia, less evidence exists for the use of acupuncture for the treatment of mental health disorders such as depression and anxiety (Hemple et al., 2014).

The goals of the current study were to ascertain: (1) if iRest in addition to acupuncture is effective at decreasing self-reported psychological symptoms in the Veteran population (2) whether iRest plus acupuncture is more effective than acupuncture alone for improving psychological health; (3) whether iRest plus acupuncture is equally beneficial independent of demographic factors, such as age, gender, or race/ethnicity; (4) whether Veterans who meet criteria for depression benefit more from iRest plus acupuncture compared to those who are not depressed; and (5) whether there is a dose effect of iRest, such that those Veterans who attend more iRest sessions display greater psychological benefits.

Method

Participants

Participants were male and female Veterans (at least 18 years of age) from all service branches who were referred to the Integrative Health and Wellness (IHW) Program of the WRIISC-DC as outpatients between August 1, 2012 and September 31, 2013. Exclusion criteria included current involvement in meditation or acupuncture, as well as self-reported pregnancy. Of the 328 Veterans who enrolled in treatment at the IHW Program during the study period, 226 consented to participate in the research. However, many of these Veterans who participated in IHW Program services were not administered posttest questionnaires between 8 and 12 weeks
due to limited human resources at the time of data collection. Thus, a total of 63 individuals met criteria for inclusion in this study.

Of the 63 eligible participants, the 17 men and 11 women who participated in at least one acupuncture treatment (either group or individual) and at least one iRest session between pretest and posttest 8 to 12 weeks later formed the treatment group. Over half (57%) of these Veterans identified as Black/African American, with 39% white, 7% American Indian/Alaskan Native, and 4% Asian; 4% also identified as Hispanic or Latino (Veterans could choose to identify with more than one race/ethnicity). Prior iRest experience was reported by 25% of the sample and prior acupuncture treatment by 46%, and their mean age was 51.5 (range = 22-86). Missing data were addressed by listwise deletion, as they were not assumed to be random. Thus, while everyone in this treatment group of 28 participants had some post-test data available, only those who had complete data for a given measure (i.e., they answered every question on that measure) were included in the analyses for that measure. Thus, the analyses reported here have treatment participant numbers ranging from 20-23.

The active control group consisted of 28 male and 7 female Veterans who attended at least one acupuncture session either (group or individual) between pretest and posttest 8 to 12 weeks later but did not participate in iRest during the study period. They had a mean age of 49.5 (range = 24-68). The majority of this group also was Black/African American (66%), with 26% White, 6% American Indian/Alaskan Native, and 3% Asian; 3% identified as Hispanic/Latino. Prior iRest experience was reported by 25% of the sample and prior acupuncture treatment by 46%. Due to missing data, analyses include 19 individuals for each measure. See Appendix B, Table B1 for the complete demographic characteristics of participants in both conditions.
No significant differences were found between the treatment and active control groups on any demographic variables (see Appendix B, Table B1). Additionally, these conditions did not differ significantly in the total number of acupuncture sessions attended during the study period, \( M = 4.61 \) and \( 3.71 \) respectively, \( t(61) = 1.20, p = .233 \).

**Procedure**

Providers at the Washington, DC VAMC were given brochures (see Appendix C) to hand out to potential participants, advertising the benefits for patients of participation in the IHW program, and also could directly refer Veterans. Interested participants were required to attend a 1-hour orientation session offered weekly, which provided education regarding IHW Program treatment options (iRest, individual acupuncture, group auricular acupuncture, and an integrative health education group) as well as opportunities to participate in research. Although all Veterans receiving IHW Program services were required to fill out questionnaires on a routine basis for clinical purposes, only those who gave written informed consent to participate in the research project (see Appendix D) allowed these questionnaires to be analyzed for research purposes. During the second half of the Orientation Session, Veterans filled out a questionnaire booklet, which included measures of demographic information, self-reported medical and psychological symptoms interfering with daily life, depressive symptoms, perceived stress, and the impact of the psychological sequelae of chronic pain.

Following the orientation, Veterans were encouraged to attend drop-in group iRest sessions at their convenience. Drop-in sessions were offered four times a week (of which one session each week was for women only) in a group room at the WRIISC-DC. Posttest questionnaires were provided to Veterans who attended drop-in sessions in the 8th week.
following the orientation session, or if they were not present at the 8th, then at the 12th week. When possible, Veterans were called via telephone in advance of the posttest date as a reminder.

**Measures**

**Demographic Questionnaire (DQ).** Questions on the 20-item DQ (see Appendix E) were developed specifically for the present study and asked the Veteran’s age, gender, race and ethnicity, education, marital status, employment status, service branch, military status and pay grade, combat exposure, and deployment locations. Additionally, Veterans were asked if they had ever previously participated in iRest or acupuncture treatments.

**Measure Yourself Medical Outcome Profile-2 (MYMOP-2).** The MYMOP-2 (Paterson, 1996) was designed to assess symptoms that bother each individual the most (see Appendix F). The MYMOP-2 has been shown to be sensitive to clinical change over time (Hull, Page, Skinner, Linville, & Coeytaux, 2006; Paterson, 1996) and has strong convergent validity with other measures of health-related functioning (Hull et al., 2006). After the individual chooses one or two symptoms (physical or psychological), the severity of these symptoms during the last week is rated on a Likert scale from 1 (“as GOOD as it can be”) to 6 (“as BAD as it can be”). Subsequent questions ask about an activity of daily living that is impaired or prevented by the problem, overall well-being, duration of the first symptom, and medications the person may be taking for the problem. When the MYMOP-2 is administered again at posttest, respondents are asked to report on the same symptoms they originally listed as most important to them. There is no total score on the MYMOP-2; each individual item is analyzed separately.

The current study focused on the MYMOP-2 question that asked Veterans to rate “how bad” their chosen symptoms were over the last week. Only data from participants who listed a psychological symptom were included in the MYMOP-2 analyses; if two psychological
symptoms were listed, then the first symptom was used. Veterans who reported at least one such symptom (e.g., stress, flashbacks, anger, depression) and who completed this measure again between 8 and 12 weeks after pretest ($n = 20$ for the treatment group and $n = 8$ for active control group) were included in the MYMOP-2 analyses of psychological symptom severity. Appendix G provides the list of self-reported symptoms that met criteria for mental health concerns and those that were excluded.

**Beck Depression Inventory-II (BDI-II).** The BDI-II (Beck, Steer, & Brown, 1996) is a 21-item, self-report measure that assesses current depressive symptoms consistent with DSM-IV (American Psychiatric Association, 1994) diagnostic criteria for major depressive disorders. Items are rated on 4-point Likert scales, with total scores ranging from 0 to 63. Internal consistency reliability for the BDI-II in medical and psychiatric samples is strong, and the measure has good test-retest reliability (Beck et al., 1996). In addition, the BDI-II correlates strongly with other measures of depression, providing evidence of convergent validity (Strauss, Sherman, & Spreen, 2006). Any Veteran who endorsed a 2 (“I would like to kill myself”) or 3 (“I would kill myself if I had the chance”) on the question concerning suicidal thoughts or wishes was immediately referred to VAMC clinical services for further evaluation and provided with the phone number for the Suicide Prevention Hotline.

**Perceived Stress Scale (PSS-10).** The PSS-10 is a widely-used 10-item measure (Cohen & Williamson, 1988) that assesses the degree to which a person appraises situations in his/her life in the previous month to be unpredictable, uncontrollable, and/or overwhelming (see Appendix H). Questions are answered on 5-point rating scales from “Never” to “Very Often,” with total scores ranging from 10 to 50. The PSS-10 has adequate and well-replicated internal

**Pain Disability Questionnaire (PDQ).** The PDQ is a 15-item measure (Anagnostis, Gatchel, & Mayer, 2004) that uses 0-10 rating scales to assess the extent to which chronic pain is interfering with daily activities. The PDQ has been found to exhibit high validity, reliability, and responsiveness in patients exhibiting chronic musculoskeletal pain (Anagnostis et al., 2004). For the present study, the only items of interest were those with psychological content that assess the extent to which the person feels more depressed, tense, or anxious than before the pain began (item 14: “depression/tension due to pain”), and the extent to which there are emotional problems caused by the pain that interfere with family, social, and/or work activities (item 15: “emotional interference with life activities”).

**Medical record data.** With approval from the Washington, DC VAMC’s Internal Review Board and informed consent, limited data were collected from the Veterans’ medical records in order to confirm demographic variables such as sex, age, race, and ethnicity. Additionally, these records were used to track the number and type of participants’ appointments in the IHW Program, and to note if/when they had received previous IHW Program services.

**Interventions**

**Integrative Restorative (iRest) Yoga Nidra.** iRest is a mindfulness meditation program developed by Richard Miller, originally as an adjunctive treatment for military PTSD (IRI, 2014; Miller, 2005). Through guided meditations, iRest seeks to facilitate relaxation, focused attention, experience of joy, observation of opposite feelings and emotions, welcoming of the sensations of one’s body and mind in a non-judgmental way, witnessing the part of one’s self that is always present, and the integration of the skills learned in meditation to daily life. These
goals are achieved through a 10-stage process in each session (IRI, 2014) (see Appendix I). In addition to 1.5 hour drop-in group classes, audio recordings of the meditation exercises were provided to Veterans to facilitate daily self-practice outside of the scheduled sessions.

iRest group sessions were conducted by an experienced iRest instructor, a Licensed Clinical Social Worker with over 30 years of clinical experience, including 7 years working directly with the DC VAMC Veteran population. She was a Registered Yoga Teacher as well as a certified iRest teacher, having completed Level III training under the tutelage of the founder of iRest.

**Acupuncture.** Two types of acupuncture interventions were offered to Veterans through the IHW program: individual traditional Chinese acupuncture (C. Lee et al., 2011) and group auricular acupuncture (Asher et al., 2010). Veterans included in this study participated in both types of acupuncture treatments (typically one or two individual 1-hour acupuncture treatment sessions followed by regular drop-in group sessions). Individual traditional Chinese acupuncture was performed based on the Worsley-5 element model and included an assessment and customized acupuncture regimen for each Veteran’s physical and mental health concerns; the number of acupuncture points, size of the acupuncture needles, and duration of needle insertion thus varied widely between patients. Auricular acupuncture is a widely recognized and utilized method of practice that uses points on the outer ear that have been mapped that correspond to the body’s anatomy as an inverted homunculus, and has been used to treat both physical and mental health concerns (Robson, 2004). Auricular acupuncture performed at the IHW center was designed to restore balance and regulation to the sense of inner disorganization created by chronic or acute mental and/or physical stress. This was accomplished by stimulating five points explicitly designed to bring balance to the autonomic nervous system. Since the same five points
were used for each Veteran, this type of acupuncture could be performed efficiently in a group setting.

All acupuncture was performed by one of two VA credentialed licensed acupuncturists with master’s degrees in acupuncture. One provider was a medical doctor with a specialized interest in acupuncture for the treatment of chronic pain, and the other had over 20 years of specialty experience in using acupuncture in the treatment of traumatic stress.

Other Methodological Details

See Appendix J for more methodological information relating to human subjects concerns and the conduct of a power analysis.

Results

How Many iRest Sessions Did Veterans Attend?

Utilization of the iRest drop-in sessions ranged from a single session to as many as 11 over the 8-12 week study period ($M = 3.93, Mdn = 3.00$). The greatest frequency of Veterans attended only a single iRest session during the study period (25% of the sample), 17.9% attended two sessions, 14.3% three or five sessions, while 7.1% of patients completed six, seven, or 10 sessions. The highest number of sessions attended (11) was completed by only one Veteran (3.6%), the same number as attended four sessions. No Veterans attended eight or nine sessions. Figure B1 in Appendix B provides a complete graphic view of this frequency analysis.

Did Veterans Who Participated in iRest in Addition to Acupuncture Achieve Significant Psychological Benefits?

Paired-samples $t$-tests revealed that there was a significant change from pretest to posttest 8-12 weeks later on all of the psychological outcome variables for those who participated in both iRest and acupuncture (see Table 3). Veterans showed a significant decrease in the severity of
their reported psychological symptoms on the MYMOP-2 as well as a significant decrease in symptoms of depression (as measured by BDI-II scores). Veterans also experienced significantly less perceived stress (total PSS score). Finally, analysis of the PDQ revealed improvements in the effect of chronic pain on Veterans’ psychological well-being, in that they were significantly less likely to experience depression/tension due to pain and emotional interference with life activities.

**Did Those Veterans Who Received iRest in Addition to Acupuncture Improve More on Measures of Psychological Health Than Those Who Received Acupuncture Alone?**

When paired-samples t-tests on pretest to posttest scores were conducted for the active control group, no significant improvement in psychological symptom severity, depression, depression/tension due to pain, and emotional interference with life activities over time was found for Veterans receiving only acupuncture (see Table 3), although the treatment group had shown significant change on all four measures. While both the treatment and active control conditions demonstrated a significant decrease in stress over time, there was a medium-to-large effect size for the treatment group (Cohen’s $d = 0.45$) compared to a small effect size for the controls ($d = 0.18$).

At baseline, there were no significant difference between groups (see Table 3). Initial 2 (condition) x 2 (time) mixed-model repeated measures ANOVAs did not reveal significant interactions on any outcome measures (see Appendix B, Table B2). Although mean change scores were larger, the treatment group (who received iRest and acupuncture) did not show greater improvement compared to the active control condition who received only acupuncture. Due to the small number of participants who listed a psychological symptom as one of their two main symptoms interfering with daily life, the analyses comparing the effect of psychological
### Table 3

_Between and Within Group Mean Comparisons on Outcome Measures_

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<tr>
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<th>Treatment group&lt;sup&gt;a&lt;/sup&gt;</th>
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<th>Active control group&lt;sup&gt;b&lt;/sup&gt;</th>
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<th>Pretest comparison between groups</th>
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<tr>
<td>MYMOP-2 severity&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>2.39*</td>
<td>7</td>
<td>4.43</td>
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<tr>
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<td>22.05</td>
<td>2.97**</td>
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<td>19.78</td>
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<tr>
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<td>4.55</td>
<td>2.52*</td>
<td>19</td>
<td>6.26</td>
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<td>PDQ emotional interference&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>5.57</td>
<td>4.30</td>
<td>2.10*</td>
<td>19</td>
<td>6.37</td>
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*Note.* MYMOP-2 = Measure Yourself Medical Outcome Profile – 2; BDI-II = Beck Depression Inventory-II; PSS-10 = Perceived Stress Scale – 10 item version; PDQ = Pain Disability Questionnaire. <sup>a</sup>Treatment group = Veterans receiving iRest and Acupuncture during the study period.  
<sup>b</sup>Active control group = Veterans receiving only Acupuncture during the study period.  
<sup>c</sup>MYMOP-2 severity of psychological symptom.  
<sup>d</sup>Depression/tension due to pain (PDQ item 14).  
<sup>e</sup>Emotional interference with life activities (PDQ item 15).  
Due to the small number of participants the MYMOP-2 analysis, comparison between the active and control groups could not be interpreted due to lack of power.

* *p < .05. ** *p < .01.
symptom severity across the study period between the active and control groups were not able to be interpreted due to lack of power.

**Was iRest Plus Acupuncture Equally Beneficial for Veterans Independent of Factors Such As Age, Gender, or Race?**

Sequential multiple regressions revealed that there were no significant moderation effects for age, gender, race, education level, marriage status, pay grade, previous acupuncture experience, or previous iRest experience on any of the outcome variables (see Appendix B, Table B3). In the first step of the sequential regression, both pretest score and the demographic variable in question were entered as predictors of the posttest score. In the second step, the interaction between the demographic variable and pretest score was added to the equation. In all cases, the addition of the interaction term did not lead to a significant increase in $\Delta R^2$, indicating that there was no significant moderation effect of any of the demographic variables on psychological outcome measures.

**Did Veterans who Met Criteria for Depression at Pretest Benefit More from iRest and Acupuncture Than Those Who Did Not?**

The BDI-II pretest scores of Veterans in the treatment condition did not correlate significantly with the amount of change in depression they experienced over the study period, $t(21) = .31, p = .17$. Similarly, a repeated-measures ANOVA revealed that Veterans who met criteria for depression at pretest (with BDI-II scores of 14 or higher) did not experience greater reductions in depressive symptoms over the course of treatment than those who did not meet criteria for depression at pretest, $F(1,19) = 1.50, p = .24$. However, the reduction in depression symptoms translated to clinically meaningful change, with significant decreases in the number of people meeting criteria for mild, moderate, and severe depression from pretest to posttest. $\chi^2(4,$
While at pretest moderate depression was the most frequent category, at posttest no depression was the most frequent (see Figure 2).

**Was There a Dose Effect of Treatment with iRest?**

The number of iRest sessions attended was not related to change scores on measures of psychological health, including psychological symptom severity $r(7) = -.01, p = .97$, depressive symptoms $r(21) = -.11, p = .68$ (see Appendix B, Figure B2), perceived stress $r(23) = .06, p = .79$, depression/tension due to pain $r(20) = .19, p = .42$, or emotional interference due to pain $r(20) = .21, p = .37$. A reverse power analysis revealed that it would have taken a sample size of 1002 Veterans to see a significant dose effect on the symptoms of depression at $p < .05$ (with the effect size of $f^2 = 0.01$) and similar sample sizes would have been required to see a dose effect for the other psychological symptoms as well.

**Discussion**

The present study extends the previous mindfulness literature by comparing iRest plus acupuncture to an acupuncture-only control group in the Veteran population, and by including patients who were clinically depressed at pretest. The main finding of the current study suggests that Veterans who participated in iRest in addition to acupuncture achieved significant psychological benefit as measured by decreased psychological symptom severity, symptoms of depression, perception of stress, depression/tension due to pain, and emotional interference with life activities. In contrast, those who received only acupuncture showed significant improvement only in perceived stress, and with a smaller effect size than that of the treatment group.

The improvements seen in the treatment group are consistent with previous research showing iRest to be effective in decreasing perceived stress (Bhogaonker, 2012; Birdsall et al., 2011; Eastman-Mueller et al., 2013; Pritchard et al., 2010), negative affect (Bhogaonker, 2012;
Figure 2. Percentages of Veterans receiving iRest and acupuncture who met criteria for depression at pretest and posttest based on Beck Depression Inventory-II criteria.
Borchardt et al., 2014; Temme et al., 2012), and symptoms of anxiety and depression (Bhogaonker, 2012). The current findings are also consistent with similar literature showing the effect of MBSR training on psychological outcomes in Veterans. MBSR has been found to reduce anxiety, depression, and suicidal ideation in the Veteran population (Serpa, Taylor, & Tillisch, 2014) and to improve mood in Veterans with PTSD (Kearney, McDermott, Malte, Martinez, & Simpson, 2013; Omidi, Mohammadi, Zargar, & Akbari, 2013). Early pilot research on MBCT in the Veteran population reveals promise for treatment for psychological conditions such as PTSD (particularly in reducing avoidance symptoms; King et al., 2013). While iRest, MBSR and MBCT all can be offered in group formats, iRest has the advantage of being conducive to drop-in sessions, as each stage of iRest is covered at every session.

This was the first study of iRest to test the moderating effect of a wide variety of demographic characteristics. Importantly, Veterans were found to be equally likely to benefit from iRest plus acupuncture treatment, regardless of age, gender, race, education level, marriage status, pay grade, or previous iRest or acupuncture experience. This is likely because iRest was designed to be broadly applicable, and each Veteran is instructed to tailor the intervention to his or her own personal, present-moment, experience. Similarly, individual acupuncture treatments were tailored to each patient and group acupuncture treatments were designed to address widespread treatment concerns. This finding is particularly important for the future implementation of iRest plus acupuncture interventions across the VA system, as it suggests that this treatment can be equally beneficial to Veterans experiencing symptoms of depression regardless of demographic background.

Individual studies in the mindfulness literature (including the literature on MBSR) rarely include analyses of most demographic differences on outcome. However, a recent meta-analysis
revealed no difference in clinical outcomes based on gender or age (Khoury et al., 2013). Further, many studies have demonstrated significant therapeutic outcomes following mindfulness interventions for people of various races, genders, and other demographic variables (see Praissman, 2008 for a review).

Although there were significant changes in overall BDI-II scores for Veterans in the treatment group, pretest depression scores were not significantly related to the amount of improvement in depression. Veterans who met criteria for depression at pretest, compared to those who did not, did not experience greater improvement in symptoms of depression. This is important because it suggests that even those Veterans who were sub-threshold for clinical depression at pretest demonstrated improvement in depression symptoms. That is, iRest plus acupuncture appears to improve mood not only in those who have the greatest room for change, but also regardless of the initial level of symptoms. This finding is consistent with other mindfulness literature that reveals that mindfulness interventions can reduce symptoms of depression in both non-clinical and clinically depressed populations (Keng, Smoski, & Robins, 2011).

It is equally important to note that there was a statistically and clinically significant change in the percentage of Veterans meeting criteria for each category of depression from pretest to posttest. Initially, the greatest frequency category of depression experienced by Veterans was “moderate depression,” and at posttest the greatest frequency category was “no depression.” Because acupuncture alone did not produce clinically significant change in depression, it seems likely that iRest added to acupuncture was driving this effect, perhaps through its targeting of emotion regulation. iRest helps people identify an image of a safe place to which they can return at will (stage 3), increase present moment awareness of the body and
breath (stages 4 and 5), observe present-moment feelings/beliefs and note that opposite feelings and beliefs can co-exist (stage 6 and 7), experience the feeling of pure joy (stage 8), understand the part of them that is constant and unchanging moment to moment (stage 9), and integrate these practices in daily life (stage 10) (IRI, 2014). If future research confirms this hypothesis, a follow-up dismantling study aimed at understanding which of the stages of iRest is most important for reducing psychological symptoms in the Veteran population would be warranted.

Analyses of the dose effect of iRest revealed that the amount of change in all measures of psychological health in the treatment group was independent of the number of sessions of iRest the Veterans attended. This may be due to the fact that all 10 stages of iRest are addressed at every iRest session. Thus, some people may have been able to translate the information they learned in just a single session of iRest into meaningful psychological change, whereas others may have required further repetition of the information provided in additional iRest sessions. If this is the case, then understanding what factors lead to the ability of some Veterans to gain psychological benefit from just one or two sessions while others require more sessions will be important to investigate.

It is also possible that no dose effect was found because the iRest instructor in the current study encouraged Veterans to practice the mindfulness techniques at home and provided CDs of iRest meditations for use outside of the VA. Although this was not specifically assessed, it might be that even those who attended fewer sessions practiced these techniques at home, and that home-practice had a mediating effect on psychological outcome. The literature on the effect of home practice in facilitating positive outcomes in other mindfulness interventions has yielded mixed results. For instance, a study of MBCT found that home practice during mindfulness training correlated with change in depression and anxiety at a 1-year follow-up in people with
bipolar disorder (Perich, Manicavasagar, Mitchell, & Ball, 2013), and the amount of home practice during MBSR for the treatment of chronic pain negatively correlated with changes in psychological distress, somatization symptoms, and self-reported psychological health (Rosenzweig et al., 2010). On the other hand, a meta-analysis of 209 studies on mindfulness-based therapies did not show a significant effect of home practice hours on psychological outcome (Khoury et al., 2013). More broadly, a meta-analysis on the effect of homework in general cognitive behavior therapies for the treatment of depression and anxiety suggests that homework compliance correlates with positive outcomes with a small-to-medium effect size (Mausbach, Moore, Roesch, Cardenas, & Patterson, 2010).

No other previous studies of iRest specifically examined dose effects, although significant positive psychological outcomes have been found not just in studies of 10 weeks of iRest (Pence et al., 2014) but also in studies with as few as four sessions (Borchardt et al., 2014). Four to six sessions of iRest improved negative mood states and quality of life in a sample of homeless individuals (Bhogaonker, 2012), and four sessions of iRest were enough to produce significant reductions in negative affect and increases in positive affect in a college sample (Borchardt et al., 2014). Similarly, studies of MBSR show that that intervention can be effective in low doses (< 6 hours of training) for reducing perceived stress and increasing mindfulness (Klatt, Buckworth, & Malarkey, 2009). A meta-analysis of MBSR did not find a significant correlation between mean effect size for stress reduction and the number of hours of MBSR training (Chiesa & Serretti, 2009), although the authors noted that the majority of the empirical literature was conducted using the standard 26-hour/8-week treatment. Research on whether or not iRest requires fewer sessions than other mindfulness interventions in order to be effective is
warranted, given that every iRest session includes instruction on integrating mindfulness into daily life and the program is not sequential.

It would also be interesting for future research to investigate whether or not the duration of the psychological benefits of iRest differs based on the number of iRest sessions attended, for instance, if more sessions lead to more lasting effects. Studies on the dose effect of psychotherapy in general have shown that while fewer sessions are required to reduce symptoms of distress, more sessions are required to see measurable, lasting, changes on more characterological symptoms (Kopta, Howard, Lowry, & Beutler, 1994).

There was also no moderating effect of previous iRest experience on changes in outcome variables, indicating that even those who had previously participated in iRest sessions were able to achieve similar improvements in psychological symptoms as those new to the treatment. Unfortunately, Veterans were not asked how many previous sessions they had attended, and this omission should be addressed in future studies. Additionally, it would be useful to know whether or not they had participated in other mindfulness interventions, and whether or not they practiced mindfulness or meditation techniques independently on a regular basis.

One limitation of the present study was that degree of dispositional mindfulness was not specifically assessed. Future iRest research should include a well-established mindfulness measure, such as the Five-Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006), to assess whether change in mindfulness mediates improvement in psychological health following iRest. Further, the design of this pilot research, in which Veterans were free to choose the services they participated in, limited the strength of the interpretations that could be drawn from the results. Thus, although this study has strong external validity, future research should focus on emphasizing internal validity. The study was
also limited by the human resources available at the time of data collection, so that complete 
posttest data for each measure could not be obtained on all subjects who met inclusion criteria 
for the study.

While no statistical differences in demographic characteristics were found between the 
treatment and control conditions, it is possible that those who chose to participate in iRest in 
addition to acupuncture (and thus sought out more types of treatment) were more motivated to 
change. It is also possible that merely the greater number of overall treatment sessions for those 
who received iRest plus acupuncture compared to acupuncture alone influenced the 
psychological outcomes. For instance, the increased number of contact hours with both care 
providers and other Veterans seeking treatment for similar symptoms in these group 
interventions may have been beneficial enough to improve psychological outcome. Future 
studies should address this issue by implementing randomized assignment and including a 
measure of expectations for change (e.g., the Credibility/Expectancy Questionnaire; Devilly & 
Borkovec, 2000). Finally, the design of the current study (which compared the effect of iRest in 
addition to acupuncture to acupuncture alone) did not allow for conclusions to be drawn about 
the effect of iRest in comparison to iRest plus acupuncture and acupuncture alone. Thus, we do 
not know if iRest plus acupuncture is more or less effective than iRest alone, only that the 
combination treatment is more effective than acupuncture alone. Future research aimed at such 
dismantling the relative importance of iRest and acupuncture are warranted.

The present study, conducted within the flagship VA Integrative Health and Wellness 
(IHW) program, found that the concurrent use of acupuncture and iRest was effective in 
producing clinically significant change in depression. Further, the combination of iRest and 
acupuncture was more likely than acupuncture alone to significantly improve psychological
health, including severity of psychological symptoms, depression, depression/tension due to pain, and emotional interference with life activities. Given the pervasiveness of psychological distress and depression in the Veteran population and the efficiency with which these group treatments can be provided, this research lends strong support for the expansion of IHW programs that offer iRest and acupuncture across more VA hospitals and treatment centers. Doing so could provide an effective and efficient means of reducing depression symptoms and increasing engagement with activities of daily life in the Veteran population.
Appendix A. Military Facilities that Offer iRest as of April 2013

American Urgent Care Center, Warrior Transition Unity, Landstuhl, Germany
Brockton Veterans Center, Brockton, Massachusetts
Brooke Army Medical Center, San Antonio, Texas
Camp Lejeune Naval Hospital - Mental Health Clinics, Jacksonville, North Carolina
Canadian Forces Base Borden, Ontario, Canada
Central Western Massachusetts Veterans Affairs Health Care System (formerly Northampton Veterans Affairs Medical Center), Leeds, Massachusetts
Charles George Veterans Affairs Medical Center, Asheville, North Carolina
Evanston Veterans Center, Evanston, Illinois
Fort Belvoir Community Hospital, Fort Belvoir, Virginia
Gulf Coast Veterans Health Care System, Biloxi, Mississippi
Hill Country Community Mental Health and Developmental Disabilities Center, Kerrville, Texas
James A. Haley Veterans Affairs Medical Center, Tampa, Florida
Montgomery County Veterans Center, Norristown, Pennsylvania
Naval Hospital Camp Pendleton, Marine Corps Base Camp, San Diego, California
Repatriation Hospital, Melbourne, Australia
Rockford Veterans Center, Rockford, Illinois
Sacramento Veterans Center, Sacramento, California
Semper Fi Odysessy Camp, Boswell, Pennsylvania
Spinal Cord Injury Unit – Veterans Affairs Hospital, West Roxbury, Massachusetts
Steadfast House, Asheville, North Carolina
Veterans Affairs Eastern Colorado Health Care System, Colorado Springs, California
Veterans Affairs Greater LA Healthcare System, Sepulveda Ambulatory Care Center, North Hills, California
Veterans Affairs Long Beach Healthcare System, Long Beach, California
Veterans Affairs Medical Center, Washington, District of Columbia
Veterans Affairs Northern California Healthcare System, Martinez Campus, Martinez, California
Veterans Center - Veteran Counseling and Guidance, Rohnert Park, California
Veterans Place of Washington Blvd, Pittsburgh, Pennsylvania
Veterans Village, San Diego, California
W.G. Hefner Veterans Affairs Medical Center, Salisbury, North Carolina
Walter Reed National Military Medical Center, Bethesda, Maryland
William Beaumont Army Medical Center, FT Bliss, El Paso, Texas

Note: Data retrieved from http://www.irest.us/projects/veterans/settings on February 2, 2015
Appendix B. Additional Tables and Figures

Table B1

Demographic Characteristics of the Treatment and Active Control Conditions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatment group</th>
<th>Active control group</th>
<th>Group differences ((\chi^2) or (t) analyses)</th>
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</tr>
<tr>
<td>Age</td>
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</tr>
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<td>Mean</td>
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</tr>
<tr>
<td>Standard deviation</td>
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\[ \chi^2 (1, N=63) = 0.49, p = .603 \]

\[ \chi^2 (1, N=63) = 1.32, p = .286 \]

\[ \chi^2 (3, N=63) = 2.88, p = .410 \]

\[ \chi^2 (7, N=63) = 1.83, p = .401 \]

\[ \chi^2 (8, N=63) = 2.34, p = .674 \]

\[ \chi^2 (6, N=63) = 3.260, p = .515 \]
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\[ \chi^2 (8, N=63) = 9.22, p = .0560 \]

\[ \chi^2 (1, N=63) = 2.25, p = .134 \]

\[ \chi^2 (2, N=63) = 6.89, p = .132 \]

\(^a\) Frequencies can add up to more than the full sample size, as respondents were allowed to choose more than one option.
Table B2

*Mixed-model Repeated Measures ANOVAs Comparing Psychological Outcomes Between Treatment and Active Control Conditions*

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<thead>
<tr>
<th>Variable</th>
<th>df</th>
<th>F (Interaction)</th>
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<tr>
<td>MYMOP-2 severity of psychological symptoms</td>
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</tr>
<tr>
<td>BDI-II</td>
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<td>PSS-10</td>
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<td>1.95</td>
</tr>
<tr>
<td>PDQ depression/tension due to pain (PDQ #14)</td>
<td>1,51</td>
<td>1.14</td>
</tr>
<tr>
<td>PDQ emotional interference due to pain (PDQ #15)</td>
<td>1,51</td>
<td>0.14</td>
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*Note.* Treatment group = Veterans who received iRest and Acupuncture during the study period. Active Control group = Veterans who received only Acupuncture during the study period. MYMOP-2 = Measure Yourself Medical Outcome Profile – 2; BDI-II = Beck Depression Inventory-II; PSS-10 = Perceived Stress Scale–10 item version; PDQ = Pain Disability Questionnaire.
Table B3

Moderation Effects of Demographic Variables on Outcome Following iRest and Acupuncture

<table>
<thead>
<tr>
<th>Variable</th>
<th>MYMOP-2 severity of psychological symptom</th>
<th>BDI-II</th>
<th>PSS-10</th>
<th>PDQ depression/tension</th>
<th>PDQ emotional interference</th>
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<td>Education level</td>
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<tr>
<td>At least some college vs. no college</td>
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<td>Race</td>
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<td>.03</td>
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</tbody>
</table>

Note. MYMOP-2 = Measure Yourself Medical Outcome Profile – 2; BDI-II = Beck Depression Inventory-II; PSS-10 = Perceived Stress Scale–10 item version; PDQ = Pain Disability Questionnaire; Depression/Tension = depression or tension due to pain; Emotional Interference = emotional interference with life activities. All analyses used sequential multiple regression. In the first step of the regression, both pretest score and the demographic variable in question were entered as predictors of the posttest score. In the second step, the interaction between the demographic variable and pretest score was added to the equation. $df = 1$. The numbers of participants for each measure were as follows: 9 for the MYMOP-2; 22 for the BDI-II; 23 for the PSS; 20 for both PDQ items.
Figure B1. Number of iRest sessions attended by Veterans
Figure B2. Scatterplot of change in Beck Depression Inventory-II (BDI-II) scores over time as a function of the number of iRest sessions attended between pretest and posttest. Negative values indicate a reduction in depression over the study period; positive values indicate an increase.
Appendix D. Informed Consent and HIPPA Authorization

A Pilot Study of the Integrative Healthcare and Wellness (IHW) Program
Matthew Reinhard, Psy.D. DCVA 688

PURPOSE

The Integrative Healthcare and Wellness (IHW) Program offers meditation, acupuncture, and health education for Veterans. Research has shown that meditation, acupuncture, and health education may enhance standard medical care. These treatments may promote improved health for Veterans with chronic physical and mental health conditions. The purpose of this study is to evaluate the helpfulness of the IHW Program in improving physical and mental health for Veterans.

This study is not sponsored by any outside agency and is only being conducted here at the DC VA Medical Center. Dr. Reinhard, Director of the War Related Illness and Injury Study Center at the DC VA Medical Center, is the Principal Investigator for this study.

PROCEDURES

If you consent to participate in this study, you will be asked to complete questionnaires that ask questions about your physical and mental health. Once these questionnaires are filled out, you will be able to schedule and attend the specific IHW Program services that fit your personal needs. These services include yoga, individual acupuncture, group acupuncture, and a health education group. You will not be required to attend any specific IHW Program service; you will be able to choose the treatment that fits with your needs and that works with your personal schedule.

You will be asked to fill out these questionnaires six more times (4, 8, and 12 weeks from today and 6, 9, and 12 months from today). These questionnaires are a standard component of the IHW Program and all Veterans are asked to complete these questionnaires, even if they are not part of the research study. However, if you consent to participate in this study, you agree to allow your responses on the questionnaires to be used for research purposes.

Additionally, if you consent to participate in research, Dr. Amanda Hull or another member of the research team will review your electronic medical records to gather information relevant to the research study, such as the number and type of appointments you have had in the IHW Program.

RISKS

Possible risks associated with participation in this study include loss of confidentiality, time commitment, and potential physical pain and psychological distress.

In order to lessen the risk of loss of confidentiality, electronic data will be de-identified and stored on the secure drive. Paper data will be de-identified and stored in locked filing cabinets, in locked offices that are behind the locked research area of the DCVAMC.

Time burden includes the time it takes to fill out questionnaires throughout your enrollment in the IHW Program; however, the time burden is no greater than participation in the clinical portion of the IHW Program.

Pain is a potential risk in acupuncture. Acupuncture, on rare occasions, may cause side effects including mild bruising, slight bleeding, fainting, and temporary pain and discomfort.
During an acupuncture session, if you decide that you are no longer interested in the acupuncture or if you experience discomfort, pain, bleeding or other distressing health effects, the acupuncture needles will be withdrawn promptly. Additionally, the appropriate medical attention will be available to you.

Risk for psychological distress will be reduced by providing additional mental health resources if needed (e.g., contact information for mental health services at the DCVAMC). If any unexpected psychological issues come up while you are enrolled in the IHW Program, a referral to the appropriate health care services will be made.

If you are an employee of the VA, you are considered a more vulnerable subject in research due to the potential impact on evaluations, promotions, and job security. With regards to these issues, the primary risk of the study is loss of confidentiality. Every precaution will be taken to assure that all information you provide to the research staff will be kept confidential. Data for this study will be presented in aggregate (as a group). If data is presented for an individual participant, it will be carefully presented in an anonymous way in which that individual is not personally identifiable. You are under no obligation to participate in the study. If you choose not to participate, it will in no way impact your employment with regards to evaluations, promotions, or job security. You may withdraw your consent from the study at any time.

**BENEFITS**

Taking part in this study may not help you personally. Your participation might lead to knowledge that might help others, including other veterans.

**OTHER TREATMENT AVAILABLE**

If you do not take part in this study, and you are a patient at the VA Medical Center, it will not affect the usual care you receive at the VA Medical Center. If you decide to withdraw from the study, you will continue in your other medical care as usual, including participation in the IHW Program. If you withdraw from the IHW Program before the end of the study, you will be asked to complete a brief exit interview so we can better understand why you are discontinuing IHW Program Services.

**PRIVACY & CONFIDENTIALITY**

VHA will maintain the confidentiality of your records. If information is shared with others, the VHA will require that your records will be kept confidential. Federal and local regulations may require review of our medical and research records by representatives of the Government Accountability Office (GAO), the VA Office of Human Research Protections (OHRP), Office of Research Oversight (ORO), VA Office of the Inspector General (OIG), and the Institutional Review Board of this Medical Center. Refer to the accompanying HIPPA authorization for further information regarding Privacy and Confidentiality. Despite all of our efforts and precautions, there is always a possibility that some of your information can be used or disclosed by the authorized recipient in a way that will no longer be protected by law. Please ask Dr. Hull if you have questions or concerns.

**RESEARCH RESULTS**

1. We will let you and your physician know of any important discoveries made during this study, which may affect you, your condition, or your willingness to participate in this study.
During this study you will be asked questions concerning depression, anxiety, and other psychiatric distress. If you report that you are feeling suicidal or homicidal, your treating providers will be notified, including your primary care physician, your referring provider and the Mental Health Clinic.

If results of this study are reported in medical journals or at meetings, you will not be identified by name, by recognizable photograph, or by any other means without your specific consent.

We will maintain your privacy and the confidentiality of the research record and no information by which you can be identified will be released or published without your authorization unless required by law. Dr. Hull will have possession of all data from the clinical questionnaires. Other research staff members will have access to them but they will be stored in a secure location in accordance with the record control schedule. At that time they will be destroyed.

SPECIAL INFORMATION
1. You are not required to take part in this study; your participation is entirely voluntary.
2. You can refuse to participate now or you can withdraw from the study at any time after giving your consent. This will not interfere with your regular medical treatment or your participation in the IHW Program.
3. You will not be offered direct compensation (i.e., money) for participating in the research component of the IHW Program.
4. Eligibility for medical care is based upon the usual VA eligibility policy and is not guaranteed by participation in a research study.
5. The VAMC will provide necessary medical treatment if you are injured as a result of your participation in this study unless you were injured because you did not follow the instructions that you were given.
6. Additional compensation may or may not be payable in the event of physical injury arising from this study under applicable federal law. Further information about compensation may be obtained from the Medical Administration Service at this VA medical center.
7. If you would like, you may talk to someone unaffiliated with the research to discuss problems, concerns, and questions, including questions about your rights. If you have problems, concerns or complaints, or think you have been injured you can contact the Associate Chief of Staff for Research & Development, Dr. Marc Blackman, at 202-745-8133 or the Chairman of the Human Studies Committee, Dr. James Finkelstein, at 202-745-8373. You can also call them if you want more information, want to offer a suggestion, or want to provide input.
8. If you are a patient, a copy of this consent form will be placed in your medical record.

AFFIRMATION FROM THE PARTICIPANT
Dr. Hull has explained the study to me and answered all of my questions. I have been told of risks or discomforts and possible benefits of the study. I have been told of other choices of treatment available to me.

I understand that I do not have to take part in this study, and my refusal to participate will involve no penalty or loss of rights to which I am entitled. I may withdraw
from this study at any time without penalty or loss of VA or other benefits to which I am entitled.

The results of this study may be published, but my identity will not be revealed unless required by law.

In case there are medical problems or questions, I have been told I can call Dr. Hull at (202)745-8000 x7241 during the day. After hours, if I need immediate medical assistance I should call the VA Medical Center hospital operator at (202)745-8000 and ask for the Emergency Room psychiatrist on call to obtain advice or call the Emergency Room directly at (202)745-8360. If any medical problems occur in connection with this study the VA will provide emergency care.

I understand the explanation of my rights as a research subject, and I voluntarily consent to participate in this study. I understand the explanation of what the study is about and how and why it is being done. I will receive a signed copy of this consent form

Participant's Signature ____________________________ Date __________________

I have informed the participant of the intent, nature benefits and risks of the research project. I judge that he/she understood my explanation and that his consent was given freely.

Consent Informant Signature ____________________________ Print Name __________________ Date __________________
WASHINGTON DC VA MEDICAL CENTER
RESEARCH

HIPAA Authorization

Written Permission for Release of Protected Health Information
for Research Purposes

Title of Study: A Pilot Study of the Integrative Healthcare and Wellness (IHW) Program

You have just signed the consent form to participate in Integrative Healthcare and Wellness (IHW) Program research study. As part of this study, we will be collecting information about you and may share the information with others. Since your health care information is private, the Washington DC VA Medical Center (DC VAMC) has rules to protect your privacy and confidentiality. The laws provide rules to use and share information only with your permission. We will also protect the information as required by law. This form lists who can see and use your information. It explains what we will do to keep your information private. By signing this form, you are allowing us to use, collect, and share this information for research.

Who will share, receive, and/or use the information?
In order to perform this research study, DC VAMC, and the people and organizations listed below may use or share your information:

- Local research staff including the research team, research employees assisting with data analysis, and all other research & healthcare staff who will take care of you.
- Federal oversight agencies including: Veterans Health Administration (VHA) Office of Research Oversight, Office of Inspector General, Food and Drug Administration, Government Accountability Office, and the DC VAMC Institutional Review Board (IRB) which is responsible for the protection of human research subjects.

Information may be shared with you or your personal representative.

What personal health information will be shared and used?
Personal Health information may include all of the information in your clinical record. For some patients this may include information regarding Sickle Cell Disease; alcohol use and abuse; drug use; and AIDS/HIV infection or testing. If you may be in one of these groups and are concerned about the use or the disclosure of this information, please discuss this with Dr. Hull.

The information will include the following data that might identify you: name, date of birth, social security number, personal and family history, admission date, discharge date, appointment dates, dates of clinical services associated with the IHW Program, and a participant identification number assigned for the study.

We will use and share your information only as described in this form and in our Notice of Privacy Practices and solely for the purposes of conducting this research and analyzing, the data collected for the specific purposes and objectives of the study.
People outside the VHA, DC VAMC who receive your information may not be covered by this promise and may not legally be required to protect your information in the same as our facility.

By signing this document, you will authorize the Veterans Health Administration (VHA) to permit Dr. Hull and members of her research team to collect, use, and share the Protected Health Information (PHI) selected in the table on page 2.

Your Rights
You can refuse to sign this form. You can revoke this authorization at any time. To do this you can write to Dr. Hull or you can ask a member of the research team to give you a form to revoke authorization. If you revoke the authorization, you cannot continue to be in the study. Dr. Hull and the research team may continue to use any information that has already been collected and combined with information from other participants. However, no new information will be collected. If you refuse the authorization or revoke the authorization, you will continue to receive all the medical care and benefits for which you are eligible. Staff may posttest by contacting you if there is a medical reason to do so.

How Long Will My Permission Last?
The authorization to use your information will last until the end of the research study unless you revoke it in writing.

Participant Authorization:
I have read this form. I have been given the chance to ask questions and my questions have been answered. If I have more questions, I have been told that I can ask a study team member or contact the Associate Chief of Staff for Research & Development, Dr. Marc Blackman, at 202-745-8133 or the Chair of the Institutional Review Board, Dr. James Finkelstein, at 202-745-8373. I agree to the release of my protected health information as described in this form. I will receive a copy of this authorization after I sign it.

____________________________________________  _____________________
Participant’s Signature                      Date
Appendix E. Demographic Questionnaire

Please answer some general questions about yourself. (Please answer according to most recent service)

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. First Name:</td>
<td>Last Name:</td>
</tr>
<tr>
<td>2. SSN:</td>
<td>-</td>
</tr>
<tr>
<td>3. Age:</td>
<td>4. Date of birth:</td>
</tr>
<tr>
<td>5. Sex:</td>
<td>- Male - Female</td>
</tr>
<tr>
<td>6. Today’s Date:</td>
<td>/</td>
</tr>
<tr>
<td>7. Race:</td>
<td>- American Indian or Alaskan Native - Asian - Black or African-American - Native Hawaiian or Pacific Islander - White - Unknown - Other:</td>
</tr>
<tr>
<td>8. Ethnicity:</td>
<td>- Non Hispanic or Non Latino - Hispanic or Latino - Unknown</td>
</tr>
<tr>
<td>9a. Education: Please circle the <strong>highest</strong> year of school you completed:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9b. Education: Please select the highest educational degrees obtained:</td>
<td></td>
</tr>
<tr>
<td>- High School diploma/GED</td>
<td>- Technical/trade school</td>
</tr>
<tr>
<td>- Bachelor degree</td>
<td>- Master’s degree</td>
</tr>
<tr>
<td>- MD</td>
<td>- Other:</td>
</tr>
<tr>
<td>10. Marital Status:</td>
<td></td>
</tr>
<tr>
<td>- Now Married</td>
<td>- Widowed</td>
</tr>
<tr>
<td>- Separated</td>
<td>- Never Married</td>
</tr>
</tbody>
</table>
11. Employment Status: (Check all that apply)
   - [ ] Employed Full-time
   - [ ] Employed Part-time
   - [ ] Unemployed
   - [ ] Student
   - [ ] Homemaker
   - [ ] Retired
   - [ ] Other: _______
   - [ ] Applying for Disability Benefits
   - [ ] Receiving Disability Benefits

12. Service Branch:  
   - [ ] Air Force
   - [ ] Army
   - [ ] Coast Guard
   - [ ] Marine Corps
   - [ ] Navy

13. Military Status Prior to Deployment:
   - [ ] Regular/ Active Duty
   - [ ] Selected Reserves-Reserve-Unit
   - [ ] Selected Reserves- Reserve-AGR
   - [ ] Selected Reserves- Reserve-IMA
   - [ ] Selected Reserves-National Guard-Unit
   - [ ] Selected Reserves-National Guard-AGR
   - [ ] Ready Reserves-IRR
   - [ ] Ready Reserves-ING

14. Military Pay Grade:
   - [ ] E1-E3
   - [ ] E4-E6
   - [ ] E7-E9
   - [ ] O1-O3
   - [ ] O4-O6
   - [ ] O7 or higher
   - [ ] W1-W3
   - [ ] W4-W5

15. Type of Military Areas served: (Check all that apply)
   - [ ] Combat zone
   - [ ] Other land area
   - [ ] Sea duty
   - [ ] Don't know
   - [ ] Other: ____________________________

16. Deployment Locations: (Check all that apply)
   - [ ] WWII
   - [ ] Korea
   - [ ] Vietnam
   - [ ] Lebanon
   - [ ] Panama
   - [ ] Grenada
   - [ ] Operation Desert Storm/Desert Shield
   - [ ] Kosovo
   - [ ] Bosnia
   - [ ] Croatia
   - [ ] Somalia
   - [ ] OEF
   - [ ] OIF
   - [ ] Operation New Dawn
   - [ ] Other: ____________________________
17. Did you serve in combat zone?

- [ ] Yes, I was deployed to a combat zone(s)
- [ ] No, I was never deployed to a combat zone
- [ ] No, I was never deployed to a combat zone, but I was deployed to another area/peace keeping operation

18. Date of discharge/ separation from the military: / / 

19. Have you ever received acupuncture for any reason?  
   [ ] Yes  [ ] No

   **If YES:** Please provide the date of last visit: / / 

   And Condition treated for:

20. Have you ever participated in an iRest class for any reason?  
   [ ] Yes  [ ] No

   **If YES:** Please provide the date of last visit: / / 

   And Condition treated for:

Thank you for filling out this questionnaire.
Appendix F. Measure Yourself Medical Outcome Profile - 2

Choose one or two symptoms (physical or mental) which bother you the most. Write them on the lines. Now consider how bad each symptom is, over the last week, and score it by checking the circle below your chosen number.

As **GOOD** as it can be → As **BAD** as it can be

1. SYMPTOM 1

[ ] 1  [ ] 2  [ ] 3  [ ] 4  [ ] 5  [ ] 6

2. SYMPTOM 2

[ ] 1  [ ] 2  [ ] 3  [ ] 4  [ ] 5  [ ] 6

Now choose one activity (physical, social or mental) that is important to you, and that your problem makes difficult or prevents you doing. Score how bad it has been in the last week.

3. ACTIVITY

[ ] 1  [ ] 2  [ ] 3  [ ] 4  [ ] 5  [ ] 6

4. Lastly, how would you rate your overall feeling of well-being during the last week?

[ ] 1  [ ] 2  [ ] 3  [ ] 4  [ ] 5  [ ] 6
5. How long have you had Symptom 1, either all the time or on and off?

- 0-4 Weeks
- 4-12 Weeks
- 3 Months-1 Year
- 1-5 Years
- Over 5 Years

6. Are you taking medication FOR THIS PROBLEM?  

- Yes
- No

**If Yes:** 1. Please write in name of medication, and how much a day / week: ____________

Is cutting down this medication:

- Not important
- A bit important
- Very important
- Not applicable

**If No:** Is avoiding medication for this problem:

- Not important
- A bit important
- Very important
- Not applicable
Appendix G. Criteria Used to Determine Inclusion in MYMOP-2 Analyses

OVERALL CRITERIA:

1) Consent to research
2) Complete initial assessment
3) Complete a posttest at either 8 weeks or 12 weeks
4) Report a symptom on the MYMOP that is indicative of mental illness and likely not a symptom chiefly of physical injury (including TBI), chronic pain, or sleep issues.

THE FOLLOWING SELF-REPORTED SYMPTOMS WERE INCLUDED:

- Stress
- Nightmares
- Flashbacks
- Anxiety
- Depression/Obsessions
- Mental/Anger
- PTSD/Depression
- Mental Anxiety
- Depression
- Anxiety/Fear
- PTSD
- Depression
- Emotional Issues
- Stress/PTSD
- Irritable/Angst
- Nervousness
- Anger/Resentful
- Depression/Bipolar
- Sadness
- Thoughts
- Welfare/Mental
- Stress/Headache
- Anguish
- Frustrated/Tired
- High Alert Watch
- Unhappy
- Guilt
- Moods
- Schizoaffective disorder

- Mental instability
- Brain fog
- Guarding
- Insomnia
THE FOLLOWING SELF-REPORTED SYMPTOMS WERE NOT INCLUDED:
Lack of energy
Restless sleep
Fatigue
Tired all the time
Migraines
Any physical symptom (back pain, shoulder pain etc.)
Appendix H. Perceived Stress Scale

Please complete this brief questionnaire about stress in your life.

The questions in this scale ask you about your feelings and thoughts during the **LAST MONTH**. In each case, you will be asked to indicate by checking *how often* you felt or thought a certain way.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Almost</th>
<th>Fairly</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>3.</td>
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<tr>
<td>4.</td>
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</tr>
</tbody>
</table>

1. In the last month, how often have you been upset because of something that happened unexpectedly?

2. In the last month, how often have you felt that you were unable to control the important things in your life?

3. In the last month, how often have you felt nervous and “stressed”?

4. In the last month, how often have you felt confident about your ability to handle your personal problems?

5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?

7. In the last month, how often have you been able to control irritations in your life?

8. In the last month, how often have you felt that you were on top of things?

9. In the last month, how often have you been angered because of things that were outside of your control?

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Thank you for filling out this questionnaire
Appendix I. The Ten Stages of iRest

There are 10 distinct stages of iRest Yoga Nidra (IRI, 2014). Prior to the first stage, participants are encouraged to find a comfortable position, connect with the present moment, and begin to feel relaxed.

- **Stage 1 (Setting an Intention):** develop a specific intention or goal for the day’s practice
- **Stage 2 (Heartfelt Desire):** identify their heartfelt desire or wish (e.g., to be at peace).
- **Stage 3 (Inner Resource):** identify an image of a place where they feel safe and at peace so that they can return there at any time during the practice.
- **Stage 4 (Body Sensing):** engage in a traditional body-scan in which participants focus their attention to various parts of their body, noticing the sensations that arise in each part.
- **Stage 5 (Breath Sensing):** engage in a traditional breathing meditation in which participants pay attention to the rhythms and sensation of the breath.
- **Stage 6 (Opposite Feelings and Opposite Emotions):** observe not only feelings and emotions that are present, but also the knowledge that opposite feelings and emotions can co-exist simultaneously.
- **Stage 7 (Opposite Beliefs):** integrate contrary information, this time in the form of contradictory beliefs about one’s self (e.g., that the beliefs, “I’m worthy of love” and “I’m unworthy of love” can co-exist).
- **Stage 8 (Joy):** identify a time when they felt pure joy, and facilitate experience of an inner smile.
• Stage 9 (Witnessing and Pure Awareness): become aware of the part of one’s self that is constant through all of the experiences of their life and notice that that part is always at peace.

• Stage 10 (Integration): return to a wakeful state and integrate the above stages of iRest meditation into daily life.
Appendix J. Additional Methodological Details

**Human Subjects Concerns**

This study involves analysis of archival data. It does not involve interaction with individuals and does not use individually identifiable information. Thus, it does not constitute human subjects research under Code of Federal Regulations Title 45: Public Welfare, Part 46: Protection of Human Subjects. Veterans in the original study from which the data were originally collected gave informed consent (Appendix D) and were provided with an explanation of the minimal risk (e.g., breach of confidentiality, time burden, potential pain from acupuncture, and psychological distress) and potential benefit (e.g., possible relief from pain and psychological distress, and contribution to CIM research).

In order to minimize the risk of breach of confidentiality, electronic data were de-identified and stored on a drive at the DC VAMC. Paper data were also de-identified and stored in locked filing cabinets, in locked offices within the locked research area of the DC VAMC. Participants were informed of the time expectations for the study prior to participation, which included filling out questionnaires throughout their participation in the IHW Program. Potential risk of pain from acupuncture was minimized by close monitoring of the Veterans during administration and performance of the procedure by seasoned, licensed professionals. Clean needle technique and strict universal blood and body fluid precautions were adhered to at all times. Potential risk for psychological distress was minimized by providing additional health resources (e.g., contact information for mental health services at the DC VAMC) and facilitation of IHW Program services provided by licensed professionals. Any unforeseen psychological issues identified during assessment resulted in an immediate referral to the appropriate health
care service line. Participants were not offered compensation (i.e., money) for participating in
the research component of the IHW Program.

**Power Analysis**

There is currently limited research investigating outcomes associated with participation in
a wellness clinic. Hull et al. (2006) examined the clinically meaningful change associated with a
complementary and alternative medicine intervention. Statistically significant improvement
from pretest to posttest was found on the MYMOP-2 (pretest $M = 4.7$, $SD = 0.9$; posttest $M =
3.4$, $SD = 1.2$), with a power of 95.8% (alpha level of 0.01, two-tailed paired $t$-test, 20
participants, effect size of .87). Thus, the full treatment ($n = 28$) and active control samples ($n =
35$) in the present study had sufficient power. However, the MYMOP-2 data from the active
control group ($n = 9$) and the treatment group ($n = 7$) may not have had sufficient power, and
these data were interpreted with this in mind.
Appendix K. Letters of Permission

---

**permission to publish MYMOP as an appendix in dissertation?**

Charlotte Paterson <Charlotte.Paterson@bristol.ac.uk>
To: Megan Wheeler

Wed, May 6, 2015 at 6:03 AM

Please do add MYMOP as an appendix - looks a really interesting study.
Best wishes
Charlotte

Dr Charlotte Paterson  
Honorary Research Fellow  
School of Social and Community Medicine  
University of Bristol

07786397412  
Charlotte.Paterson@bristol.ac.uk  
www.charlotteacupuncture.co.uk

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**permission to publish PSS-10 as an appendix in a doctoral dissertation**

Chloe Detrick <c.detrick@andrew.cmu.edu>

Tue, Jul 7, 2015 at 9:16 AM

Hi Megan,

You are fine to publish the PSS-10 in the dissertation format online. The only time you would need permission to publish is if you are adapting the PSS portion of your dissertation for journal articles.

Best,

Chloe

Chloe Detrick  
Research Assistant to Sheldon Cohen  
Carnegie Mellon University  
Department of Psychology
References


