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Final Paper

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While mindfulness has existed for hundreds of years, it has only recently been applied to the treatment of mental illnesses. It is commonly referenced in popular culture as a ‘cure’ to a wide variety of ailments, both mental and physical, but does it live up to the headlines regarding its potential as a treatment for depression? This question will be addressed through some background on depression and mindfulness as a practice. Following this basic background information, clinical findings and finally the neurobiology behind mindfulness-based therapies as a treatment for depression will be explored. Overall, mindfulness-based therapies show promising clinical results and seem to affect areas of the brain that correlate with areas associated with depressive disorders.

Depression is one of the most common mental illnesses in the United States. As of 2021, about 8.3% of Americans, or 21 million adults, had a major depressive episode in the last year (SAMHSA 2021). People experiencing depression will often feel hopeless, sad, empty, and/or anxious. Loss of interest in hobbies and activities, also known as anhedonia, is another commonly experienced symptom. Depression is known to cause changes in appetite and amount/quality of sleep, as well as causing concentration issues and fatigue. At the more severe end of the spectrum, it can lead to self-harming tendencies and suicidal ideation (NIH, 2024).

Mindfulness is a very broad term for a variety of techniques and practices which originated from Buddhist philosophies in India. There are two main pillars of mindfulness: the

Observer Self and Attention. The Observer Self, or *sakshibhava* in Hindu, is a state of awareness and witnessing of one's own mind. This refers to the ability to see thoughts and feelings from an outside perspective and to separate the self from the mind. The attention component, *dhyana*, can refer to a number of similar meanings depending on the time period in which the term was used. These can include attention, meditation, focus, or awareness, referring to the ability to attentively observe the mind with consistency and without distraction. The combination of the Observer Self and attention aspects is the most basic understanding of mindfulness in practice (Singh, 2023).

There are a number of talk therapy and psychopharmacological treatments that have been proven effective for most people in treating depression, but mindfulness is still commonly brought up in popular culture as a helpful tool in combating not only depression, but other mental and physical ailments. There are two mindfulness-based therapies (MBTs) which have become quite popular in the field of clinical psychology which are often used as treatments for depression. The first is called Mindfulness-Based Cognitive Therapy (MBCT), and it was developed specifically to prevent relapses of depressive episodes, although its uses have since been expanded. The premise of this therapy is that rather than teaching a client to avoid or regulate their negative emotions and thoughts, clients are taught simply to notice the thoughts that they experience separate from the self or any thought patterns that they might have (Piet & Hougaard, 2011). The second, Mindfulness-Based Stress Reduction (MBSR), was developed broadly to help clients manage stress, but has also since been used to treat a number of other physical and psychological conditions including depression. The goal of this therapy is to teach clients tools based in mindful practices such as meditation which will help ground them and alleviate stress (Niazi & Niazi, 2011).

Mindfulness is a practice that shows promising results not just in treating mental illnesses such as depression, but in coping with chronic conditions and other disabilities. A meta-analysis conducted in 2010 included four articles studying the effects of mindfulness on people with diagnosed depressive disorders, with every single one yielding a significant, large effect size. Practically, this means that various mindfulness techniques can effectively decrease symptom presentation in people with depressive disorders (Hoffman et al., 2010). A systematic review published a year prior found that mindfulness-based practice experimental groups, specifically MBCT and MBSR, showed results that were better than the control groups overall in every single included study (Chiesa & Serretti, 2009). This systematic review also addressed studies on mindfulness based therapies in relation to anxiety, substance use disorders, psychological symptoms of cancer, blood pressure, chronic pain, rheumatoid arthritis, and fibromyalgia. Alongside its effectiveness in treating depressive symptoms, MBTs were also shown to be successful at improving symptoms of all of these disorders (Chiesa & Serretti, 2009). Overall, there is strong clinical backing for the value of mindfulness-based therapies in treating depressive symptoms.

For the most part, the clinical results are backed by the neurobiology of depression and mindfulness. EEG studies have shown that mindfulness increases alpha and theta waves broadly throughout the cortex (Chiesa & Serretti, 2009). Alpha waves are present during times of creativity and relaxation, and are currently being studied for the purpose of treating major depressive disorder (MDD) through stimulating the brain to produce alpha oscillations (Alexander et al., 2019). Theta waves are associated with visualization and dreaming, and have also been correlated with abstract joy when present in the left prefrontal cortex (Chiesa & Serretti, 2009).

Neuroimaging has shown links between mindfulness and the pathophysiology of major depressive disorder. Mindfulness-based interventions have modulatory effects on the prefrontal cortex (PFC), basal ganglia, the anterior and posterior cingulate cortices (ACC and PCC), and the parietal cortex (Vignaud et al., 2018). Another study found that the rostral anterior cingulate cortex (rACC) and the dorsomedial prefrontal cortex (dmPFC) were activated in mindfulness, which fits with the results of the previous study which explored mindfulness-based therapies (Chiesa & Serretti, 2009).

The significance of these results lies within the fact that there is great overlap between these indicated areas and those often associated with major depressive disorder. These areas of the brain are heavily associated with emotion regulation, attention, and self-awareness (Vignaud et al., 2018). There is some evidence (though inconclusive) that a reduction in the volume and/or hypoactivity of the ACC is correlated with MDD (Pizzagalli et al. 2001, Ibrahim et al. 2022). Alongside the ACC, the PFC is another leading area of research in depressed patients. A number of structural and functional abnormalities in the PFC have been observed in those with depression or those at a higher risk for depression (Pizzagalli & Roberts, 2021). It is therefore logical that stimulation of the ACC and PFC through mindfulness-based therapies could be directly helpful in rebuilding some of the abnormalities in these two brain areas.

Functional connectivity, or the neural connectedness between and within different networks in the brain is salient to understanding the way that mindfulness works in relation to depressive disorders; more specifically, the default mode network and the salient network. The default mode network refers to the areas of the brain that are engaged when a person is not focusing on a particular task, but is simply letting their mind wander; the three most prevalent of which are the PCC, precuneus, and hippocampus. The salient network, most notably consisting

of the ACC and the insular cortex, is the areas of the brain which are responsible for deciding what information is most important to focus on at any given time. The functional connectivity within the default mode network and between the salient network and the default mode network are both increased through mindfulness (Yang et al., 2016). The default mode network is hypothesized to play a role in ruminative thinking when its functional connectivity is increased with certain areas of the brain, meaning it is possible that mindfulness could facilitate more positive functional connectivity with differing areas of the brain (Hamilton et al., 2015). Dysfunction within the salience network has been correlated with a number of psychological issues including but not limited to depression (Schimmelpfennig et al., 2023). The combination of these findings suggests that depressive symptoms can likely be caused, at least in part, by dysfunctional or inadequate connectivity between and/or within the default mode network and the salient network.

Mindfulness is proven to be more than just a fad when it comes to treating depressive symptoms. Originating as a Buddhist practice in India, mindfulness is based on the premises of the Observer Self and attention. Over the years, several psychological therapies based in mindfulness have been developed, the most common of which are Mindfulness-Based Cognitive Therapy and Mindfulness-Based Stress Reduction. Both of these therapies have yielded significant clinical results in treating depressive symptoms, among other ailments. EEG studies have shown that mindfulness increases brain waves which are currently being studied for their potential as a treatment for depression through direct stimulation. Neuroimaging illustrates that many of the areas affected by mindfulness-based therapies are those which are most heavily associated with major depressive disorder. Finally, functional connectivity studies reveal that the default mode network and the salient network are two active components of the mindfulness

practice, and are also theoretically implicated in certain depressive symptoms. Overall, there is a large body of evidence that supports mindfulness-based therapies as a viable cynical option for treating depression, and neurobiological reasoning backs up these findings.

I affirm that I have adhered to the Honor Code on this assignment.

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