

IMPACTS OF MINDFULNESS AND PHYSICAL ACTIVITY ON DEPRESSION

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### Abstract

Depression will be the leading cause of disease burden across the world regardless of age, gender, or income. Physical activity and mindfulness are non-pharmacological treatments that have been shown to decrease depressive symptoms. However, research studying the correlation between dispositional mindfulness and physical inactivity on depression is limited. The purpose of this study was to explore health status and healthy behaviors and determine the predictors of depression severity. A non-experimental cross-sectional study was conducted with 179 adult participants. They completed self-reported questionnaires using a web-based or paper-and-pencil survey in two private clinics located in Austin and Corpus Christi, Texas. The study questionnaires included the Patient Health Questionnaire (PHQ-9), International Physical Activity Questionnaire (IPAQ), Five Facet Mindfulness Questionnaire- Short Form (FFMQ-SF), and the 4-item Behavior Risk Factor Surveillance System (BRFSS). Descriptive statistics, bivariate Pearson's correlations, and hierarchical multiple regression procedures were utilized. More than half of the participants (59.2%) had mild to severe depressive symptoms over the past two weeks. The participants also reported an average of 2.8 days and 5.6 days of poor physical and mental health during the past month, respectively. The significant predictors for depression severity were mindfulness ( $\beta = -0.45$ ;  $p < 0.001$ ) and sitting minutes per day ( $\beta = 0.18$ ;  $p = 0.005$ ). Providers may consider routine depression screening and implementation of mindfulness-based therapies and physical activity to minimize predictors of depression severity.

*Key words:* depression, dispositional mindfulness, physical activity, meditation, health status.

Depression can have devastating effects on an individual's ability to function in daily life by adversely impacting physical health, psychosocial well-being, family relationships, and economic factors. Depression is a mental disorder characterized by persistent sadness and a loss of interest in activities that are normally enjoyable, accompanied by an inability to carry out daily activities, for at least two weeks (World Health Organization [WHO], 2018). Although not completely understood, a combination of genetic, biological, environmental, and psychological factors may cause depression (National Institute of Mental Health [NIMH], 2018). Family history, traumatic or major life events, physical illness, and certain medications appear to be common causes that trigger the mental illness (WHO, 2018; NIMH, 2019). Complications of depression include suicide, high medical cost, and adverse effects on quality of life. Common treatment modalities include psychotherapy, pharmaceutical modalities, and non-pharmacological treatments such as brain stimulation (NIMH, 2019). Depression has far-ranging consequences on the individual and in society.

Approximately 16.2 million adults in the United States, or 6.7% of all adults, have had at least one major depressive episode (NIMH, 2019). More than one-third of those diagnosed with major depressive disorder (MDD) did not receive treatment. The economic burden of MDD and associated comorbidities increased from \$173.2 billion to \$210.5 billion between 2005 and 2010 (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Despite major research, advancements in pharmaceutical treatment options, and increased awareness among medical professionals, depression remains a leading cause of disability and is often not prioritized in the primary care setting.

Primary care providers manage chronic disease, mental health, and provide imperative preventative lifestyle education. Individuals suffering from mental health disorders, like

depression, are more likely to seek help from their general practitioner than in any other medical setting (Wagley, 2017). The relationship of chronic disease, physical activity and inactivity, health status, mental awareness, and depression continue to be an area of interest for researchers due to the prevalence of the mental illness. Research has suggested that individuals presenting with risk factors for developing chronic health conditions, such as sedentary behavior and physical inactivity, are subsequently at risk for depression (Patten et al., 2018; Centers for Disease Control and Prevention [CDC], 2018). Furthermore, chronic disease is associated with a higher incidence of depression (Patten et al., 2018). These variables are commonly managed in the primary care setting, highlighting the need for further research in depression prevention and treatment. As the occurrence of depression remains unchanged despite numerous treatment options (CDC, 2018), lifestyle factors must be further investigated to gain insight on tangible, low risk, and effective interventions. Addressing mental and physical health is of paramount importance.

## **Literature Review**

### **Depression and Physical Activity**

Numerous studies have shown that the use of physical activity is useful in promoting mental wellbeing across the lifespan (American College of Obstetricians, 2015; Department of Health and Human Services, 2018; Schneider & Wissink, 2018; Pascoe & Parker, 2018). Of those individuals diagnosed with MDD, physical exercise has been shown to significantly reduce depression symptoms and may be as effective as other interventions, including pharmacological and psychological therapy (Cooney et al., 2013; Silveria et al., 2013). Despite equivalency among the aforementioned interventions, a Cochrane meta-analysis review of 37 studies determined that the use of physical activity did not appear to be any more effective than

psychological or pharmacological therapies (Cooney et al., 2013). Yet, the combined use of physical activity with pharmacological and/or psychotherapy modalities may have a synergistic effect on relieving depression symptoms.

A randomized, single blind study found that 4 weeks of aerobic activity significantly improved the functional capacity of its participants resulting in a decrease of the required dosage of their selective serotonin reuptake inhibitor (SSRI) (Siguera et al., 2016). This finding could be explained by additional research that shows physical activity can elicit significant structural changes in the brain and increased neurogenesis, while drugs like SSRIs are thought to have an effect on neuron plasticity and neurogenesis through different pathways (Micheli, Ceccarelli, D'Andrea, & Tirone, 2018). However, unlike physical activity, SSRI use is coupled with possible adverse reactions such as weight gain, sleep disturbances, poor libido, and risk of dependence. Regardless of the mechanism and treatment modality, it appears that physical activity as a monotherapy and adjunctive therapy for depression may be an effective and low risk intervention (Cooney et al., 2013; Siqueira et al., 2016). This is especially relevant because physical activity is beneficial in the prevention of chronic disease, which has a positive correlation with depression in adults (Pattern et al., 2018).

The type and duration of physical activity appears to have effects on the manifestations of depression. Aerobic and anaerobic exercise both have benefits for the treatment of the disease. An increase in intensity and duration of the exercise seems to have a positive effect on reduction of depressive symptoms (Schneider & Wissink, 2018). Silveira et al. (2013) determined that aerobic physical training was more effective than strength training in reducing symptoms of depression, yet this relationship diminishes with those of increased age or suffering from more severe symptoms. These findings are further supported through a large, cross-sectional study of

over 99,000 adults that showed individuals who engaged in 2-3 times the recommended activity expenditure had the strongest reduction in rates of depression (Kim et al., 2018). As the benefits of physical activity have been supported, the risks associated with a sedentary lifestyle have also been shown to have a negative effect on the incidence of depression.

### **Depression and Physical Inactivity**

Physical inactivity and sedentary behavior have recently been exposed to have a significant correlation with depressive symptoms, although it is difficult to discern the direction of the relationship. According to the WHO (2018b), the United States ranks among the highest worldwide in individuals 18 years and older who do not partake in sufficient physical activity. Stubbs et al. (2016) highlights that the Western society has become more sedentary, largely due to technological advancements, less labor-intensive jobs, conveniences, and screen-based leisure time. In Western societies, low physical activity has been associated with lower socioeconomic status. Conversely, in low to middle income countries, low physical activity is associated with a higher socioeconomic status. Ultimately, physical inactivity is correlated with increased depression (Stubbs et al., 2016), suggesting that promoting physical activity is a universal and safe recommendation that can be utilized worldwide.

Depression associated with physical inactivity spans the lifespan, affecting adolescents and the geriatric population alike. People over the age of 60 who are physically inactive are shown to have a higher incidence of depression (Wassink-Vossen et al., 2014). Physical inactivity also affects the younger population. In a study that evaluated over 60,000 adolescents found that being sedentary for greater than three hours per day placed the child at increased risk for developing depressive symptoms (Vancampfort, Stubbs, Firth, Damme, & Koyanagi, 2018). In a study that evaluated the quality of life expectancy (QALE) among depressed individuals, Jia,



Zack, Gottesman and Thompson (2018) found that physical inactivity was one of the strongest predictors of a decreased QALE. Physical limitations may contribute to the aforementioned findings, which highlights the need for alternative interventions as well as more research to evaluate the relationship of a purposeful sedentary lifestyle and depression.

The prevalence of sedentary lifestyles is increasing worldwide. The WHO estimates that 23% of adults and 81% of adolescents are not physically active enough (2018a). The highest rates of inactivity are in the Americas and the Eastern Mediterranean Region (WHO, 2019). Understanding that physical activity has a relationship with depression allows researchers to study the relationship between health status, often through use of body mass index (BMI), and incidence of depression. A sedentary lifestyle, or individuals who sit for extended periods of time for most days have been shown to have an increased risk of obesity as well as cardiovascular disease mortality (CDC, 2017a). Not only does this have implications in prevalence of chronic disease, it is influencing psychological well-being.

### **Depression and Health Status**

The prevalence of depression has been shown to be elevated in the presence of chronic medical conditions (Patten et al., 2018). Depression is a common comorbidity in parkinson's, cancer, diabetes, cardiovascular, and other chronic diseases (CDC, 2012). For example, researchers have found that depression is not only more common in patients with cardiac disease, but it is actually a risk factor for cardiac morbidity and mortality (Huffman, Celano, Beach, Motiwala, & Januzzi, 2013). Huffman et al. (2013) also noted that 31-45% of patients with coronary artery disease suffer from clinically significant depressive symptoms. Obesity is a major contributing risk factor in developing many of these diseases and is associated with poor mental health (CDC, 2017a). Similar to obesity, depression has been found to increase the risk

of cardiovascular disease, type 2 diabetes, hypertension, general function impairment, and increased mortality (Preiss, Brennan & Clarke, 2013). It could be theorized that a sedentary lifestyle leading to obesity and chronic disease, is a risk factor for developing depression, yet literature has not found concrete evidence of this. Fezeu et al. (2015) found in a study of 3,455 participants that the relationship between obesity and depression was not bidirectional. Depression was identified as a risk factor for obesity, yet obesity was not a risk factor for developing depression (Fezeu et al., 2015). In support of this, Jia et al. (2018) found that BMI did not affect the quality of life between obese and non-obese patients with depression. Conversely, a meta-analysis of 15 studies exposed a reciprocal relationship between obesity and depression stating that each is a risk factor for the other (Luppino et al., 2010). This is further supported by a 12-year longitudinal study that found obesity was a significant risk factor for new onset MDD (Zhang, Woud, Becker, & Margraf, 2018). Despite the conflicting study results, patients who are obese and suffer from depression are shown to have more severe symptoms, chronicity of disease, and take longer to respond to therapy (Woo, Seo, McIntyre, & Bahk, 2016). This is an important finding to consider when addressing overweight and obese patients in the primary care setting, especially those who are presenting with any symptoms of depression. Although obesity and depression may be risk factors for each other, there are multifactorial variables that individually contribute to each state. Primary care providers must consider that gender, education, psychological characteristics, or social stigma can directly influence obesity and depression (Preiss, Brennan, & Clarke, 2013).

### **Depression and Mindfulness**

Mindfulness-based therapies (MBT) remain a clinical research interest for the treatment of depression. Mindfulness is a state that allows the individual to be present in moment,

acknowledging emotions, thoughts and sensations to pass through the mind without judgement (Schneider & Wissink, 2018). Studies have primarily focused on MBTs in the treatment of depression rather than a prevention method. Specific techniques and practices have been developed to help individuals achieve a state of mindfulness, such as mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT), mindfulness-based relapse prevention (MBRP), yoga, and meditation (Wang et al., 2018). The meditation techniques learned in these classes are encouraged to be practiced at home to facilitate mindfulness in everyday life (Parsons, Crane, Parsons, Fjorback, & Kuyken, 2017).

Mindfulness based therapies have been shown to effectively decrease symptoms of depression, stress, and anxiety in both healthy individuals and those with diagnosed depression, as well as, improve physical health outcomes in patients who are overweight or obese (Khoury et al., 2015; Khoury et al., 2013; Winnebeck et al., 2017; Rogers, Ferrari, Mosely, Lang, & Brennan, 2016). The common tool of MBSR teaches the individual how to meditate by focusing their attention to their breath and body while allowing thoughts and distractions to come through the mind without judgment. MBSR has been shown to help patients who are suffering from chronic disease and pain, as well as, psychological complaints related to disease processes (Guendelman, Medeiros, & Rampes, 2017). A systematic review and meta-analysis of 115 randomized controlled studies that found MBSR and MBCT provided significant improvement for depressive and anxiety symptoms, physical functioning, stress, and quality of life in patients with and without chronic disease (Gotink et al., 2017). A meta-analysis that reviewed 27 studies, inclusive of 2,742 participants, concluded that MBRP and MBCT were beneficial for patients with recurrent or treatment resistant depression (Clarke, Mayo-Wilson, Kenny, & Pilling, 2015). Even more promising, a study that evaluated the use of MBCT and standard

pharmacotherapeutics therapy discovered that the combination therapy had synergistic and significant effects of improving quality of life and self-compassion in treatment resistant individuals (Cladder-Micus et al., 2018). Practicing mindfulness is a low-risk intervention to treat or augment therapy for the treatment of depression, yet the mechanism of action is somewhat unclear.

Brain function and neural plasticity related to the practice of mindfulness has been studied to better understand the results of these interventions. Mindfulness may have an impact on increasing positive affect, decreasing negative affect, and reducing negative automatic emotional responses (Khoury et al., 2013). Even brief mindfulness practices have demonstrated to be effective in a significant reduction of depression symptoms, as well as, useful in buffering negative responses in acutely depressed patients, further reducing symptoms. This was demonstrated by Winnebeck et al. (2017) in a study that evaluated the effectiveness of MBSR over a period of two weeks, which included three group training sessions and instructions for daily meditative practice. To account for these responses, a number of studies have evaluated different areas of the brain and shown that MBTs impact regions that influence emotional regulation and response pathways (Guendelman et al., 2017) Although the mechanisms are complex and still being investigated, mindfulness training appears to have positive influences on areas of the brain that impact depression manifestation and support a state of mindfulness.

Dispositional mindfulness as a personality presentation remains less researched yet may have implications in depression. It is influenced by many factors and impacted by an individual's emotional regulation constructs and neuronal pathways of the brain (Guendelman et al., 2017). Dispositional mindfulness is linked to better emotional life outcomes, yet it is a difficult state to objectively measure due to complex psychological and biological factors (Guendelman et al.,

2017). A recent meta-analysis of 11 studies by Wang et al. (2018) found that although mindfulness was successful in decreasing symptoms of depression, the results were more impactful at short-term post-treatment, rather than long-term follow up. This indicates that more research is needed to understand how MBTs influence dispositional mindfulness, and how these variables influence the incidence and severity of depression. Although MBT shows benefit for treating depression, it is unclear if practitioners should recommend these interventions to enhance dispositional mindfulness to prevent depression and promote positive mental health.

### **Depression Screening in Primary Setting**

According to the U.S. Preventive Services Task Force (USPSTF), it is recommended that the general adult population, including pregnant and postpartum women, be screened for depression regardless of their risk factors (Siu et al., 2016). It is rated a grade B on the suggestions for practice, indicating there is high certainty that the net benefit is moderate to substantial and the screening should be offered or provided to the patient. This is supported by convincing evidence that clinically depressed adults treated with antidepressants and/or psychotherapy had decreased clinical morbidity (Siu et al., 2016). One approach from the USPSTF recommends screening all patients during their routine visits with a valid and reliable tool and to further evaluate if the score is above a specified threshold. A more selective approach, called a case-finding, recommends evaluating only those whose clinical presentation triggers a suspicion of depression, including insomnia, fatigue, chronic pain, recent life changes or stressors, poor self-rated health, or unexplained physical symptoms (Siu et al., 2016). The choice in the screening tool should be based off its diagnostic accuracy in the population being screened and the feasibility of its administration, which includes factors, such as the number of

questions, scoring, ease of interpretation, and reading level required (Williams, Pignone, Ramirez, & Perez Stellato, 2002).

The cost of not adequately screening and treating for depression far outweighs the burden of clinical time constraints when educating a person on lifestyle modifications that have been shown to have benefits for the treatment of depression. Physical activity, meditation, and physical and mental health status have been studied and shown to have a positive relationship to depressive symptoms (Cooney et al., 2013; Stubbs et al., 2016; Preiss, Brennan, & Clarke, 2013; Khoury et al., 2013). However, the results are often conflicting in nature and severity. Many of the studies only evaluate interventions for patients who have already been diagnosed with major depressive disorder. In addition, many of the large studies are researching people with vast differences in regard to education, culture, age, and socioeconomic status among different countries. Although useful in understanding the prevalence of depression, understanding the incidence of non-clinical depression and relationship to autonomous lifestyle choices can help primary care providers better understand useful interventions, tactics, and tools to prevent and treat the complex disease process. The purpose of this study was to explore health status and healthy behaviors and to determine the predictors of depression severity among adults in the community.

## **Methods**

### **Design and Participants**

The research design was a non-experimental, cross-sectional study using surveys. A non-probability, convenience sampling method was used. The eligibility criteria included adults aged 18 years and older; male or female, English literacy and ability to read and fill out the survey.

### **Instruments**

The tools that were utilized in this project included: Patient Health Questionnaire (PHQ-9), International Physical Activity Questionnaire Short Form (IPAQ-SF), Behavioral Risk Factor Surveillance System (BRFSS) and Five Facet Mindfulness Questionnaire Short Form (FFMQ-SF). Along with these tools, demographic variables such as age, gender, ethnicity, educational background, weight and height were collected.

Patient Health Questionnaire-9 (PHQ-9) is a 10-question screening tool used to evaluate depression severity (El-Den, Chen, Gan, Wong, & O'Reilly, 2018). The first nine questions in the questionnaire are in reference to the past two weeks and individuals rate each question on a scale ranging from 0 (not at all) to 3 (nearly every day). The summation scores range from 1 to 27, higher score indicating more severe depressive symptoms. A score of 0-4 indicates minimal or no depressive symptoms that require no treatment. A score of 5-9 indicates mild depressive symptoms while a score of 10-14 with moderate symptoms, requires clinical judgment to determine the necessity of treatment. A score of 15-19 and 20-27 indicates moderately severe or severe depressive symptoms, respectively and both criteria require active treatment with psychotherapy, medication, or a combination (Chin, Choi, Chan, & Wong, 2015). The tool is shown to have satisfactory sensitivity and specificity values. The sensitivity of the PHQ-9 ranged from 28% to 95% and specificity ranged from 61% to 98%, respectively (El-Den et al., 2018).

International Physical Activity Questionnaire (IPAQ-SF) assesses vigorous, moderate and sedentary activity in everyday life (Craig, et. al, 2003). It is reported to have acceptable measurement properties for use in many settings and is available in many different languages. This questionnaire asks seven questions related to intensity that span over the past 7 days. Vigorous activity is described as a physical activity that makes breathing harder than normal, moderate is physical activity that makes breathing somewhat harder than normal and sedentary is

time spent sitting (Misra, Upadhyay, Krishnan, Sharma, & Kapoor, 2014, Craig, et. al, 2003). The scoring uses metabolic equivalents (METs) or minutes per week spent exerting physical activity. METs are a measurement of the rate at which an individual uses energy while performing a specific physical activity. It is measured in terms of low, moderate and high. Energy expended at rest is assigned 1 MET, walking is 3.3 METs, moderate activity is 4 METs, and vigorous activity is 8 METs (Craig, et. al, 2003). The higher participants score on the questionnaire, the more time they spend being physically active, so the total METs per week will be higher. The reliability was also at an acceptable level with 75% of the correlation coefficients observed above 0.65, ranging from 0.32 to 0.88 (Craig, et. al, 2003). The validity of the IPAQ-SF was also reported. The criterion validities of the long and short forms were almost equivalent, but there was a wider range of correlation values associated with the long form (Craig, et. al, 2003).

A selected four questions from the Behavioral Risk Factor Surveillance System (BRFSS) were used to attain a better understanding of participants health status (CDC, 2018a). This questionnaire was utilized to collect individual's health background from the past 30 days. Numerous studies have reported that BRFSS is a valid and reliable source for attaining information on health status (CDC, 2017b). The first question inquiries about general health status, ranging from poor to excellent. The second question involves physical health which includes physical illness and injury. The third question inquiries about mental health which includes stress, depression and problems with emotions. The last question asks about poor physical or mental health that kept an individual from doing usual activities, such as self-care, work or recreation (CDC, 2018a). For each question, participants reported the number of days their health was affected by the aforementioned variables in the past 30 days.



The 15-item Five Facet Mindfulness Questionnaire-Short Form (FFMQ-SF) captures the five facets of mindfulness with three questions for each of the following domains: Acting with awareness, non-judging, nonreactivity, describing, and observation (Gu et al., 2016). Acting with awareness subscale involves focusing one's current activity; non-judging of inner experience subscale involves accepting thoughts and emotions without criticism; non-reactivity to inner experience subscale is the ability to detach from thoughts and emotions without getting too involved or carried away by them; describing subscale is the ability to describe one's experiences; and lastly, observing subscale is the awareness of internal and external experiences (Gu et al., 2016). The response options on a 5-point Likert format on each question ranges from 1 (never or very rarely true) to 5 (very often or always true). The scores in each domain range from 7 to 15 with a higher summations score indicating a greater level of mindfulness. Validity of the FFMQ- SF was found to be highly similar to those of the long form when comparing pre- and post- mindfulness behavioral cognitive therapy as the total facet scores for both versions of the questionnaire (Gu et al., 2016). The internal consistency reliability estimates for the FFMQ-SF are similar to the tool's long form, where Cronbach's alpha ranges from 0.69 to 0.83 for each of the domains (Gu et al., 2016). Additionally, when all five facets loaded significantly onto an overall mindfulness factor, four facets (minus observing) loaded significantly onto an overarching mindfulness factor with clinically significant results (Gu et al., 2016).

### **Data Collection Procedures**

A self-reported survey was utilized through an online survey platform, Qualtrics Insight Survey and Research Tool, hosted by Texas State University. Potential subjects were recruited through social media or email that contains a hyperlink to the online survey. Potential subjects

who met the inclusion criteria were also invited to participate in a paper-and-pencil survey in two private clinics located in Austin and Corpus Christi, Texas.

### **Ethical Considerations**

The study proposal was reviewed and approved by the Institutional Review Board at Texas State University. A waiver of informed consent was granted since minimal risks were involved in completing the study questionnaire. The cover letter included a full disclosure of the research study, risks, benefits and alternatives. If participants chose to partake, the completion of a web-based survey or paper-pencil survey indicated their consent to participate. Participants were reminded that their participation was entirely voluntary, and they had option to withdraw at any time without penalty.

### **Data Analyses**

Descriptive statistics of means, standard deviations, frequencies, and percentages were calculated to describe the demographic characteristics. Bivariate Pearson's correlations were performed to examine the relationship between depression and other variables. To examine mindfulness and physical activity as predictors of depression severity, the demographic variables were entered in the first step of the hierarchical multiple regression model. The entry of the mindfulness and physical activity was followed in the second step as predictors above and beyond the demographic variables. The assumptions of normality, linearity, and homoscedasticity in the multiple regression model were met. The level of significance was set at  $p < 0.05$  and SPSS version 25 (IBM Corp, Armonk, NY, USA) was used for all data analyses.

## **Results**

### **Demographic Characteristics**

A total of 176 participants completed self-reported questionnaires from October 2018 to November 2018. A majority of the participants were female (79.9%), non-Hispanic Caucasian (72.1%), and had a college degree (80.4%). The mean age was 39 years old and more than half were either overweight or obese (57.6%) (Table 1).

### **Health Status, Mindfulness, and Physical activity**

Fourteen percent of the participants reported that their general health as fair or poor (Table 2). More than half of the participants (59.2%) had mild to severe depressive symptoms over the past two weeks. The participants reported an average of 2.8 days and 5.6 days of poor physical and mental health during the past month, respectively. They also had an average of 2.9 days of poor daily activities during the past month because of the poor physical and mental health. Regarding physical activity, the median MET-minutes per week were 13,584 minutes with the interquartile range (IQR) ranging from 3,891 to 29,106 minutes. The median sitting minutes per day were 300 minutes, with interquartile ranging from 180 to 480 minutes (Table 2).

The mean score of total FFMQ was 3.55 out of the possible maximum score of 5.0. The highest mean subscale score was 3.88 for Non-judging of inner experience, while the lowest mean subscale was 3.33 for Non-reactivity to inner experience subscale. The Cronbach's alphas of internal consistency reliabilities of subscales ranged from 0.54 to 0.84. (Table 3).

### **Predictors of Depression Severity**

Table 4 showed the results of bivariate Pearson's correlations between depression severity and various demographics and lifestyles. Depression severity had statistically significant negative correlations with mindfulness ( $r = -0.52$ ;  $p < 0.001$ ) and college graduate ( $r = -0.21$ ;  $p = 0.005$ ). In contrast, depression severity had significant positive correlations with sitting minutes ( $r = 0.16$ ;  $p = 0.031$ ), BMI ( $r = 0.21$ ;  $p = 0.005$ ), and high school graduates ( $r = 0.25$ ;  $p = 0.001$ ).

In the first step of the hierarchical multiple regression model, the entry of demographic variables including age, female gender, college graduate, and BMI accounted for 16.8% of variance in depression severity ( $R^2 = 0.168$ ). The entry of mindfulness and sitting minutes per day into the second step increased  $R^2$  by 0.221, indicating a 22.1% variance in depression severity was influenced by mindfulness and sitting minutes per day above and beyond the demographic variables. The statistically significant negative predictors of depression severity were mindfulness ( $\beta = -0.45, p < 0.001$ ) and age ( $\beta = -0.14, p = 0.035$ ), whereas sitting minutes per day was a statistically significant predictor of depression severity ( $\beta = 0.18, p = 0.005$ ).

### **Discussion**

In the current study, over half of the sample surveyed expressed some symptoms of depression. Attempts were made to theorize a relationship between depression severity and lifestyle features including mindfulness, physical activity or inactivity, and obesity. Interestingly, a mindful disposition was strongly, inversely correlated with depression severity which was determined using the FFMQ-SF, in which, participants were categorized as mindful by identifying with characteristics of mindfulness including: acting with awareness, observing, describing, non-judging of inner experiences and non-reactivity to inner experiences. Depression severity was positively correlated with a sedentary lifestyle as represented by number of minutes sitting per day. Confoundingly, BMI had a weak positive correlation with, but it was not a significant predictor of depression severity. Another predictor of depression severity was age; with increasing age, participants reported more depression symptoms. College graduates had significantly lower ratings of depression than high school graduates, suggesting that advanced education may be inversely related to depression risk and severity.

By far the most compelling results appreciated from this study were those measuring the relationship between mindfulness and depression which displayed an inverse relationship that was strongly statistically significant. Using the multiple regression model, a mindful disposition was a negative predictor of depression severity. This disposition has been described as a multidimensional construct reflecting focus and quality of attention, distinguishable from mindfulness that has been learned or cultivated (Rau & Williams, 2016). It combines features of the personality traits, conscientiousness and neuroticism, including self-discipline, impulse control, and emotional stability (Rau & Williams, 2016). It has further been explained as a mindset with a state of awareness and attention that is accepting, non-judgmental, unadulterated, and one that is unfiltered by one's own cognitive apparatus and framework of value judgements (Mayer, Polak & Remmerswaal, 2019).

The relationship between meditation and mindfulness-based therapies, like cognitive behavioral therapy, have been well studied in the context of mental health treatment; however, there is limited research on whether a mindful disposition could be taught for the prevention of depression. The results of this study reproduced very similar results to a recent, observational study completed in the Netherlands which examined a mindful disposition using the FFMQ-SF and the Beck Depression Inventory (Mayer et al., 2019). They, too, found that a mindful disposition was predictive of less depressive symptoms and recommended more research exploring mindfulness-based treatments for psychopathologies (Mayer et al., 2019).

This study also found that physical inactivity, measured by minutes sitting per day, was positively correlated with increases in depression scores, meaning the more time spent sitting per day may be related to depression severity. Although limited, there are a few studies that have also suggested a sedentary lifestyle is linked to depression across the lifespan. Adults over 60

years old who are physically inactive are shown to have a higher incidence of depression (Wassink-Vossen et al., 2014). Adolescents, as well, who were sedentary for greater than three hours per day were found to be at higher risk for development of depressive symptoms (Vancampfort et al., 2018). Prior research has also shown that physical inactivity is one of the strongest predictors of decreased quality of life (Jia et al., 2018). These are important findings as there are many ways to clinically intervene to decrease minutes sitting per day, such as activity prescriptions for standing desks, frequent breaks, walking or exercising during lunch, utilizing the weekends for outdoor activities and engagement in sports or classes. These recommendations may be less daunting for patients because, rather than having to adopt a whole new exercise routine, they can be encouraged to make small changes that have the potential to make significant differences in mood.

Likely, due to the complex wording of the IPAQ, the results of minutes of physical activity per week were outlying and not statistically significant. However, there is much literature showing that physical exercise reduces depression symptoms and may be as effective as other interventions, including pharmacological and psychological therapy (Cooney et al., 2013; Silveria et al., 2013).

Although there was a positive relationship between BMI and depressive symptoms scores, BMI was not a significant predictor in the hierarchical multiple regression model. Previous research has been contradictory here, with some revealing disproportionately higher rates of obesity in the depressed, yet obesity has not shown to be a consistent risk factor for depression. As the rates of obesity and depression both continue to climb with tremendous velocity, there is question of an associative relationship, yet there are many confounding variables that makes assessing this interplay challenging.

**Limitations**

There are several limitations in this study. First, this cross-sectional study limited capacity to draw conclusions about the causal direction of mindfulness and physical inactivity over a period of time to depression severity. Second, the study included a majority of female, Caucasians, and highly educated individuals which could be considered selection bias. Results were limited to adults with a higher education status and the diversity in our study was limited to specific population which might not be representative of the vast majority of the population in the United States. Additionally, many of our participants were recruited through social media which could also be considered selection bias. Third, outcomes were based on self-reported questionnaires rather than formal clinical diagnoses, resulting in potential participant bias. It is unknowns whether these patients suffered from MDD as some of the participants may have not met the diagnostic requirements for clinical diagnosis. Fourth, participants also overestimated their weekly physical activity as evidenced by the extremely high MET-minutes per week. Objective measures of physical activity with activity trackers and exercise diaries would most likely provide more accurate measures of these variables and should be considered for use in future studies. Lastly, most of our participants were from Central and South Texas, which could have limited generalizability of the study findings to other populations.

**Implications for Practice**

In line with the recommendation of the USPSTF, clinicians may strongly consider routine screening for depressive symptoms in all adult patients. For mild depression, it would be prudent to prescribe mindfulness-based practices in conjunction with interventions for physical activity (standing desk, nature walks, cycling/walking to work) to prevent progression to moderate or severe depression. For those who are overweight or obese, interventions for weight

loss in the form of dietary and lifestyle habits may aid in improved mood and prevent progression or worsening of depression. For moderate to severe depression, physical activity and mindfulness strategies, such as, mindfulness meditation, yoga, and deep breathing should be considered for all patients to potentially prevent or delay necessity of medication, or to augment existing treatment regimens, and to provide holistic care. Clinicians should consider providing information and resources related to mindfulness therapies for the successful adoption of this useful tool for the prevention and treatment of depression.

Lack of knowledge and training in mindfulness may be to account for the underutilization of mindfulness interventions in primary care. However, it seems that the barriers to utilize mindfulness-based therapies are much lower than most treatments that could be recommended for patients. With easily obtained training and educational resources, patients can practice mindfulness in their life for little cost or harm. It is the simple, daily practice of enjoying the moment, accepting thoughts and experiences without judgement, and practicing awareness and appreciation for the present: Birds chirping, a cool breeze, the smell of cut grass. Many questions are raised when looking to recommend mindfulness-based therapy for promoting dispositional mindfulness in patients. Clinicians and patients need information on which type of mindfulness therapy would be best implemented, how often and how long should one practice, how long is expected to see improvements, and what resources are available to aid in adoption of the new habit.

### **Conclusions**

These study findings indicate that dispositional mindfulness and an active lifestyle correlate with less symptoms of depression. Based on these results, randomized controlled trials are recommended to examine mindfulness-based protocols that clinicians may recommend and



implement for the prevention of moderate to severe depression alone or in combination with a physical activity prescription.

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Table 1. Sample characteristics ( $N=179$ )

	<i>n</i> (%)
Age, mean (range), year	39 (22-88)
Gender	
Male	36 (20.1)
Female	143 (79.9)
Ethnicity	
Non-Hispanic Caucasian	129 (72.1)
Hispanic	42 (23.5)
African American	3 (1.7)
Asian/Pacific Islander	5 (2.8)
Other	0 (0)
Education	
High school graduates or less	13 (7.3)
Some college	22 (12.3)
College graduate	144 (80.4)
Body Mass Index (BMI) <sup>†</sup>	
Underweight	2 (1.1)
Normal weight (18.5–24.9 kg/m <sup>2</sup> )	72 (40.2)
Overweight (25.0–29.9 kg/m <sup>2</sup> )	56 (31.3)
Obese ( $\geq 30$ kg/m <sup>2</sup> )	47 (26.3)

*Note.* Values are expressed as *n* (%) unless otherwise indicated.

Percentages may not add up to 100% because of missing data or rounding.

<sup>†</sup>Body mass index (BMI) category per CDC Adult BMI calculator.

Table 2. Health status ( $N=179$ )

	<i>n</i> (%)
General health status	
Poor	3 (1.7)
Fair	22 (12.3)
Good	70 (39.1)
Very good	65 (36.3)
Excellent	19 (10.6)
Depression	
None-minimal (0-4)	73 (40.8)
Mild (5-9)	77 (43.0)
Moderate (10-14)	19 (10.6)
Moderately severe (15-19)	5 (2.8)
Severe (20-27)	2 (1.1)
Days of poor physical health/month, mean (SD)	2.8 (5.6)
Days of poor mental health/month, mean (SD)	5.6 (6.6)
Days of poor daily activities/month, mean (SD)	2.9 (5.2)
Physical activity, MET-minutes/week, median (IQR)	13584 (3891, 29106)
Sitting minutes/day, median (IQR)	300 (180, 480)

*Note.* Values are expressed as *n* (%) unless otherwise indicated.

Percentages may not add up to 100% because of missing data or rounding.

Depression severity by PHQ-9 scores; PHQ-9 mean (SD) score = 6.05 (4.0)

MET, Metabolic equivalent; IQR, Interquartile range.

Table 3. Five Facet Mindfulness Questionnaire (FFMQ) subscales ( $N=179$ )

Subscales	M $\pm$ SD	Cronbach's alpha
Observing	3.57 $\pm$ 0.78	0.54
Describing	3.65 $\pm$ 0.81	0.73
Acting with awareness	3.36 $\pm$ 0.71	0.67
Non-judging of inner experience	3.88 $\pm$ 0.84	0.84
Non-reactivity to inner experience	3.31 $\pm$ 0.92	0.70

*Note.* M, Mean; SD, standard deviation;  
FFMQ total mean score= 3.55 $\pm$ 0.47; possible maximum score = 5.0

Table 4. Correlations with depression severity ( $N=179$ )

	coefficient
Age	-0.14
Female	0.12
High school graduate	0.25**
College graduate	-0.21**
BMI	0.21**
MET-minutes/week	0.02
Sitting minutes/day	0.16*
Mindfulness	-0.52***

*Note.* Correlations by bivariate Pearson's; \*  $p < 0.05$ ; \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$   
 MET, Metabolic equivalent;

Table 5. Hierarchical multiple regression analysis for predicting depression ( $N=179$ )

Depression Severity			
Predictors	B	$\beta$	$p$
Step 1			
Constant	4.88		
$R^2 = 0.168$			
Step 2			
Constant	19.8		
Age	-0.04	-0.14	0.035
Sitting minutes/day	0.003	0.18	0.005
Mindfulness	-0.77	-0.45	<0.001
$R^2\Delta = 0.221$			
$F\Delta (2, 153) = 27.66 (p < 0.001)$			

*Note.* Age, female gender, college graduate, and BMI were included in Step 1. Mindfulness and sitting minutes/day were entered into Step 2.