

OBESITY AND SEDENTARY LIFESTYLE AS PREDICTORS OF
ANXIETY AND DEPRESSION

By

Caitlin Boykin

Sandra Seidel

Ginger Webre

A capstone project submitted to the St. David's School of Nursing at
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Science in Nursing
May 2019

Supervising Faculty:

Son Chae Kim, PhD

COPYRIGHT

by

Caitlin Boykin

2019

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair Use

This work is protected by the Copyright Laws of the United States (Public Law 94-553, section 107). Consistent with fair use as defined in the Copyright Laws, brief quotations from this material are allowed with proper acknowledgement. Use of this material for financial gain without the author's express written permission is not allowed.

Duplication Permission

As the copyright holder of this work I, Caitlin Boykin, refuse permission to copy in excess of the "Fair Use" exemption without my written permission.

Abstract

There is a high prevalence of psychological distress and obesity with subsequent chronic disease in the United States. The aim of this study was to explore the relationships among obesity, physical activity, and health status and to determine predictors of psychological distress among adults in a community setting. A cross-sectional study using a web-based survey was conducted among 226 adults aged 18 years or older. The questionnaire was a self-report tool utilizing the four items from the Behavioral Risk Factor Surveillance System, 14-items Hospital Anxiety and Depression Scale, International Physical Activity Questionnaire- SF, and demographic data. Descriptive statistics, Kendall's Tau test, and multivariate logistic regression procedures were performed. Two-thirds of participants were either overweight or obese, and one-fifth reported poor or fair health status. Positive predictors of anxiety and depression were sedentary lifestyle or sitting more than 360 minutes per day (OR=2.21 vs OR=2.11, respectively), obesity (OR=1.96 vs OR=2.50) and Caucasian ethnicity (OR=3.41 vs OR=3.99). The odds of anxiety and depression were nearly double for those who are sedentary or obese. Providers could encourage maintaining a healthy weight and sitting less than six hours per day. Periodic screening for psychological distress may be beneficial.

Keywords: Anxiety, body mass index, health status, depression, physical activity

Psychological distress is a prevalent and serious medical condition in the United States. Anxiety is the most common mental illness affecting 40 million adults, and people with anxiety are three to five times more likely to go to the doctor and six times more likely to be hospitalized (Anxiety and Depression Association of America [ADAA], 2016). The Centers for Disease Control and Prevention (CDC) (2017) report that 3.4% of adults are experiencing serious psychological distress, and as a result are more likely to have chronic obstructive pulmonary disease, heart disease, and diabetes. In 2005-2010, 7.2% of adults, aged 20 years and older, reported having symptoms of depression over the past two weeks (CDC, 2015). During 2011-2014, 12.7% of persons aged 12 and older, reported antidepressant medication use within the past month (CDC, 2017). Maintaining a healthy weight through healthy dietary practices and physical activity are recommended to decrease psychological distress and prevent the occurrence of chronic diseases. However, only one in five adults meets the 2008 Physical Activity Guidelines, and inactive adults have a higher risk for early death, heart disease, stroke, and depression (CDC, 2014).

Obesity and sedentary behavior result in many other diseases and health complications that threaten the futures of approximately one-third of the adults in the United States (CDC, 2017). Obesity is a leading cause of preventable death and is associated with heart disease, stroke, type two diabetes, and certain types of cancer. The estimated annual medical costs related to obesity in the United States in 2008 were \$147 billion, and on average, people who are obese spend \$1,429 more annually on their health care (CDC, 2017). Only one in five adults meets the 2008 Physical Activity Guidelines, and inactive adults have a higher risk for early death, heart disease, stroke, and depression (CDC, 2014).

Furthermore, in 2010, 17.4% of Texas residents considered themselves having fair or poor self-rated health (CDC, 2015). It was found that there is still a knowledge gap regarding the relationship between psychological distress and obesity. Primary care providers are responsible for the medical treatment of individuals with anxiety and depression who develop secondary chronic conditions. Practitioners and their patients' would benefit from further research on the relationship between sedentary lifestyle, obesity and psychological distress. Due to the prevalence of psychological distress and obesity in the United States, the comorbidities, and the resulting high health costs that come accompany these illnesses, the dearth of studies performed on the relationship between psychological distress and health status point to a need for further investigation.

Literature Review

Risk Factors of Psychological Distress

Psychological distress is defined as a state of emotional suffering typically characterized by symptoms of depression and anxiety (Arvidsdotter, Marklund, Kylan, Taft & Ekman, 2016). Determining what factors may increase the risk of experiencing psychological distress is important information that may be beneficial to primary care providers. A study among 880 participants in Pakistan aimed to identify possible risk factors that lead to psychological distress (Husain et al., 2014). Women were found to have higher levels of psychological distress than men. Additionally, participants with lower levels of education were associated with higher levels of psychological distress. On the contrary, those participants who lived in urban, rather than rural areas, had lower levels of psychological distress (Husain et al., 2014). Another important demographic to consider as a risk factor for psychological distress is race and ethnicity. A study involving 29,142 participants, of which 25,645 were non-Hispanic White and

3,497 were non-Hispanic Asian-Americans, was conducted to determine differences in psychological distress among these different Asian sub-groups. It was found that Koreans had the highest psychological distress level, followed by non-Hispanic Whites, Chinese, Filipinos, Vietnamese, and Japanese, respectively (Park, Choi & Wenzel, 2018).

Psychological Distress and Health Status

In a study involving 563 Mediterranean participants, the researchers found that participants who were both extremely underweight, and extremely overweight/obese showed the worst psychological status (Martinez et al., 2014). The authors recommended that patients who are in either extreme weight category be considered for psychological screening. The relationship between body perception and psychological distress in 494 obese subjects was studied prospectively in Turkey (Son, 2017). The results showed that as the obese participants lost weight, their levels of anxiety decreased and the authors suggested that practitioners provide individual nutrition and exercise plans, as well as psychological support.

A study showed a positive association between obesity and poor physical quality of life among a study of 89,332 participants (Nigatu, Reijneveld, de Jonge, van Rossum, & Bültmann, 2016). The mental quality of life scores were lower in participants who were obese with major depressive disorder or anxiety than those without these conditions. A qualitative study conducted in Mexico among nursing and physical education students aged 18 to 25 years aimed to investigate the relationship between anxiety, self-concept, and BMI (Linares-Manrique et al., 2016). Study findings indicated a negative association between BMI and physical self-concept (Linares-Manrique et al., 2016).

A prospective cohort study of 25,000 men and women investigated the association of anxiety and depression symptoms with weight changes over an average of an 11-year time span

(Brumpton, Langhammer, Romundstad, Chen, and Mai, 2013). In both genders, anxiety and depression were found to be influencing factors in weight gain, with a higher weight gain in those who were of female gender. Participants with anxiety and depression also had an overall increase in incidence of obesity (Brumpton et al., 2013). In another study concerning the effects of depression and anxiety disorders on cardiac disease and metabolic risk factors conducted by Kinley et al. (2015), results showed that the presence of anxiety disorders is associated with an increase in metabolic risk factors and cardiac disease in the sample population.

A study on 2,000 Colombian geriatric patients was conducted to determine an association between depressive symptoms, having multiple chronic diseases, and self-reported health status (Camargo-Casas, Suarez-Monsalve, Zepeda, Garcia-Pena & Cano-Gutierrez, 2018). The study findings showed that participants with depressive symptoms and a chronic disease were more likely to report health status. Based on the study findings, the authors recommended screening for depression in older adults who present with multiple chronic conditions and feelings of poor health (Camargo-Casas et al., 2018). Similarly, Weiss et al. (2016), performed a study on 298 women, ranging from 19 to 90 years old, to determine an association between anxiety and depression symptoms. Results indicated that a woman's level of anxiety was the strongest predictor of her likelihood of having severe depression (Weiss et al., 2016).

Deng and Paul (2018) studied 5,949 middle-aged and older Chinese adults to determine a relationship between depressive symptoms, functional health status, physical activity, and the availability of recreational facilities. Their results indicated that difficulties performing functional health tasks were associated with a high occurrence of depressive symptoms. In addition, the researchers found that high levels of physical activity were associated with high

levels of depressive symptoms (Deng & Paul, 2018). However, it is possible that physical activity at different levels may reveal different associations with depression.

Clinical Practice Guidelines on Physical Activity

There have been many clinical practice guidelines created and updated to assist clinicians in decreasing obesity and increasing physical activity in the United States. The U.S. Department of Health and Human Services (USDHHS) released the second edition of The Physical Activity Guidelines for Americans in 2018. These guidelines are meant to provide guidance for the public on the importance of being physically active and eating healthy to reduce the risk of acquiring chronic conditions such as diabetes, hypertension, or hyperlipidemia. The guidelines are meant to be utilized by communities, educators and health professionals (USDHHS, 2018). They are categorized by age group and provide the appropriate type of exercises and amount of time that should be spent doing each exercise. According to the guidelines, adults should participate in moderate to intense physical activity for at least 150 to 300 minutes per week or vigorous-intense activity for at least 75 to 150 minutes per week (USDHHS, 2018). Additionally, adults should do muscle strengthening exercises of at least moderate intensity for 2 days or more each week (USDHHS, 2018). The guidelines recommend that adults sit less and move more, as it may lead to some health benefits. These guidelines may be used by practitioners in primary care to recommend adequate physical activity to their patients to prevent chronic conditions.

Impacts of Physical Activity or Sedentary Behaviors on Psychological Distress

A cross-sectional study was conducted on 135 participants who exercised regularly for at least one month and on a group of 134 participants who did not perform any physical exercise in that same month (Khanzada, Faizan & Jameel, 2015). The results showed that those who did

participate in exercise had lower levels of anxiety and depressive symptoms, however, there was no significant association between perceived stress and physical exercise. Additionally, the study found that females are more likely to experience psychological distress compared to males (Khanzada et al., 2015).

A randomized control trial was performed on 57 participants, aged 18-35 years old, who were placed into three groups with varying amounts of exercise (Blough & Loprinzi, 2018). The results showed that after one week of increased sedentary behavior, depressive symptoms increased. After resuming physical activity for one week, the depressive symptoms returned to baseline. The authors recommended developing relapse prevention strategies to help participants maintain daily engagement of physical activity (Blough & Loprinzi, 2018). Additionally, returning to physical activity as soon as possible after a period of sedentary behavior may stave off symptoms of psychological distress. A systematic review of eight studies supported the positive effect that physical activity has on anxiety levels in older adults, but there is still insufficient evidence to recommend a specific physical activity program (Mochcovitch, Deslandes, Freire, Garcia, & Nardi, 2016).

A systematic review of nine studies reported a positive relationship between sedentary behavior and risk of developing anxiety (Teychenne, Costigan, & Parker, 2015). Some of the sedentary behaviors that may have an impact on the development of anxiety included sitting time, TV watching, computer use, and screen time (Teychenne et al., 2015). In a study on chronic disease and mood and anxiety disorders in Canada, 51% of the 2678 respondents stated they were not using exercise to manage their mood disorder and/or anxiety (Pelletier, Shanmugasagaram, Patten, & Demers, 2017). Over half of those individuals not exercising listed their physical condition as the main obstacle to regular exercise, and of those who were

exercising once or more weekly, encouragement of physical exercise by a health care provider was found to be the most influential determinant to manage their mood disorders and/or anxiety (Pelletier et al., 2017).

A cross-sectional study was conducted to determine associations between mental health and the negative impact on overall health among 1,889 participants (Siddiqui, Lindblad & Bennet, 2014). Those suffering from anxiety and/or depression demonstrated a lower physical activity rate. Of those surveyed, 1018 participants (53.9%) reported anxiety and/or depression, and of those 718 participants (70.5%) reported physical activity of less than 150 minutes per week, compared to 382 participants (43.8%) who did not have anxiety and/or depression. Although both groups resulted in findings classified within the same category of overweight according to BMI, those with anxiety and/or depression yielded a slightly higher average BMI of 28.15 kg/m² while those without psychological distress demonstrated BMI average of 28.05 kg/m². Concluded findings showed those suffering from anxiety and/or depression demonstrated a lower physical activity rate and higher BMI.

Adamson, Yang & Motl (2016) studied 3,045 adults to determine a relationship between compliance with physical activity guidelines (USDHHS, 2008), sedentary behavior, and depressive symptoms. The results showed that increased sedentary time as well as a lack of meeting the USDHHS physical activity guidelines was associated with increased risk of depression among adults (Adamson et al., 2016). Utilizing the Behavioral Risk Factor Surveillance System (BRFSS), a total of 276,442 participants were analyzed to determine an association between four health behaviors (smoking, physical inactivity, heavy alcohol drinking, and obesity) and health-related quality of life (Jia, Zack, Gottesman, & Thompson, 2018). Approximately 43.5% of depressed adults were physically inactive, and physical

inactivity was associated with a decreased life expectancy and health-related quality of life. Additionally, obesity was associated with a decreased health-related quality of life (Jia et al., 2018).

In a cross-sectional study of 99,846 adults, Kim et al. (2018) utilized the Center for Epidemiologic Studies Depression Scale (CES-D) and the International Physical Activity Questionnaire (IPAQ) to determine a relationship between physical activity and depressive symptoms. Their results indicated that individuals who engaged in 2–3 times the recommended minimum (1200–1800 MET-min/week) showed the strongest association with reduced depression (Kim et al., 2018). Exercise has been shown to treat depression, however, the optimal intensity and mode has not been established yet. A study examined the relationship between exercise performed at three levels of intensity with similar frequency and duration, and the severity of post-treatment depression (Helgadottir, Hallgren, Ekblom & Forsell, 2016). The results of this study indicated that exercise, performed at any intensity, can be at least equally effective in the treatment of mild to moderate depression compared to the usual treatment of anti-depressants and counseling.

Although there have been many studies conducted to determine an association between psychological distress, obesity, and sedentary behavior, the strengths of association among these variables have not been fully examined. Additionally, there is a need to determine the strength of the association between modifiable predictors and the prevention of psychological distress. For example, patients' BMI and participation in physical activity are modifiable predictors that primary care providers can recognize, and then educate on making lifestyle changes to prevent psychological distress. Therefore, the aims of this study were to explore the relationships among

obesity, physical activity, and health status and to determine the predictors of the psychological distress among adults in a community setting.

Methods

Participants and Design

A cross-sectional study was performed using an online survey study via Qualtrics from October 2018 to November 2018. Inclusion criteria were adults aged 18 years or older; male or female; and able to read and understand English.

Instruments

The questionnaire was a self-report tool using aspects of the following instruments: four question items on health status from the Behavioral Risk Factor Surveillance System (BRFSS), 14-items Hospital Anxiety and Depression Scale (HADS), seven items of International Physical Activity Questionnaire- Short Form (IPAQ-SF), and demographic data. Demographic data collection included collection of the participants' age, gender, ethnicity, education, weight, and height.

The Hospital Anxiety and Depression Scale (HADS) is a widely used tool that measures anxiety and depression and determines the frequency of occurrences of anxiety and depression over a one-week period (Zigmond & Snaith, 1983, Christodoulou et al., 2010). The tool has seven questions about anxiety and seven questions regarding depression. It uses a rating system, scores ranging from 0 to 3, with a higher score indicating higher frequency of occurrence. The total score for each subset is 21 points with the scores of 0-7 indicating normal while the score of 8-21 indicates a clinical case (Christodoulou et al., 2010; Stern, 2014). This questionnaire is popular for use in clinical settings because it aids in the evaluation of anxiety and depression with easy-to-interpret findings, and it takes only 2-5 minutes to complete (Stern, 2014). HADS

demonstrates a satisfactory internal consistency reliability with Cronbach's α coefficients of 0.83 and 0.84 for anxiety and depression, respectively (Michopoulos et al., 2008).

The BRFSS is a health-related survey utilized to ask U.S. residents about their health-related risk behaviors and events, chronic health conditions, and use of preventive services (CDC, 2018). In this survey, three questions asked about the number of days the participant was experiencing poor mental health, poor physical health and days of poor daily activities over the past 30 days. The poor physical health was defined as physical illness and injury, and poor mental health was defined as stress, depression, and problems with emotions. Poor daily activities were defined as an inability to perform usual activities, such as self-care, work, or recreation. The fourth question asked about the participants perceived health status with the response options, ranging from poor to excellent.

The International Physical Activity Questionnaire- Short Form (IPAQ-SF) is used to acquire data on health-related physical activity. The research survey utilized four questions of the IPAQ-SF. First, participants were asked about the number of days spent partaking in at least ten minutes of vigorous physical activities within the past seven days. Vigorous activities were defined as activities that take hard physical effort and make a person breathe much harder than normal. In the same format, the second question asked participants about time spent participating in moderate physical activity that make a person breathe somewhat harder than normal. The third question asked about the amount of time spent walking within the past seven days. Walking was defined as time spent walking at work, at home, to travel from place to place, and any other walking done solely for recreation, sport, exercise, or leisure. Finally, the fourth question asked participants about the amount of time spent sitting on a weekday within the past seven days. Sitting was defined as the time spent at work, at home, while doing course

work, during leisure time, time spent at a desk, visiting friends, reading, or sitting or lying down to watch television. The scoring of the questionnaire is based on MET minutes.

MET minutes represent the amount of energy expended when carrying out a physical activity. A MET is a multiple of your estimated resting energy expenditure; one MET is what is expended when at rest (Forde, n.d.). To get a continuous variable score from the IPAQ (MET minutes a week), walking is considered to be 3.3 METS, moderate physical activity to be 4 METS and vigorous physical activity to be 8 METS. To calculate MET minutes per week, the MET value given for each intensity level of physical activity is multiplied by the number of minutes the activity was carried out and again by the number of days that activity was completed (Forde, n.d.). Then the MET minutes achieved in each category (Low, moderate, and high) are added up for a total MET minutes of physical activity in one week (Forde, n.d.). Previous studies supported test-retest reliability and convergent validity of the IPAQ (Frehlich, Friedenreich, Nettel-Aguirre & McCormack, 2018, Kim, Park & Kang, 2013).

Data collection procedures

A recruitment email containing the URL link to the questionnaire was sent out to potential participants using social media. When the potential participants clicked the URL link, it routed them to a study site on Qualtrics. They were instructed to review the cover letter and fill out the questionnaire.

Ethical considerations

This web-based survey study involved the administration of an anonymous survey. A waiver of signed informed consent was requested because no more than minimal risks were involved. No personal-identifiable information was collected. Participants were reminded that their participation in the study is entirely voluntary, completion of the survey indicated their

consent, and that they could refuse to participate by not answering the questions or withdraw from the study any time without any penalty.

Data analyses

To summarize demographic characteristics and key variables of the study, means, standard deviations, medians, interquartile ranges, frequencies, and percentages were calculated. The dependent variable of psychological distress in this study was measured by anxiety and depression. They were coded as dichotomous variables based on the HADS anxiety and depression scores, respectively (8-21=1; 0-7=0). The obesity based on Body Mass Index (BMI) categories was coded as a dichotomous variable ($\text{BMI} \geq 30 \text{ kg/m}^2 = 1$; $\text{BMI} < 30 \text{ kg/m}^2 = 0$). Sedentary lifestyle was also coded as a dichotomous variable (sitting minutes/day $\geq 360 = 1$; sitting minutes/day $< 360 = 0$). Bivariate correlations by Kendall's tau test among dichotomous variables were performed to examine the correlations among obesity, physical activity, anxiety, and depression. The variables that had statistically significant correlations with anxiety and depression were entered into multivariate logistic regression models to examine the predictors of anxiety and depression. SPSS version 25 (IBM Corp, Armonk, NY, USA) was used for all data analyses and the level of significance was set at $p < 0.05$.

Results

Demographic characteristics

Table 1 depicts the demographic characteristics of the participants. Of the 226 participants, most of them were female (85%) and Non-Hispanic Caucasian (86.7%). A majority were college graduates (67.3%) and the mean age was 44 years old. About two-thirds (66.9%) had a BMI in the overweight or obese range and 43.3% were obese.

Health Status

About one-fifth of the participants (20.8%) reported that their general health as poor for fair. More than half (58.8%) reported mild to severe symptoms of anxiety, whereas one-quarter (26.1%) had symptoms of depression. On average, participants reported 3.8 days of poor physical health per month, and 8.8 days of poor mental health per month (Table 2). In addition, on average, participants reported 4.4 days of poor daily activities per month. The median amount of physical activity for the sample surveyed was 10,812 MET/week. The median sitting minutes per day was 360 minutes (IQR= 240-555).

Predictors of Anxiety and Depression

Table 3 shows the results of bivariate correlations between anxiety and depression and other variables by Kendall's tau tests. Findings revealed that anxiety had a significant positive correlation with sitting more than 360 minutes per day ($r = 0.19, p = 0.007$). In contrast, anxiety demonstrated a negative correlation with age ($r = -0.21, p < 0.001$) and with being a high school graduate or less ($r = -0.14, p = 0.032$). Depression had a positive correlation with being of Caucasian ethnicity ($r = 0.14, p = 0.037$), having some college education ($r = 0.20, p = 0.003$), obesity ($r = 0.19, p = 0.006$) and sitting more than 360 minutes per day ($r = 0.16, p = 0.020$). Having graduated from college yielded a negative relationship with depression however ($r = -0.15, p = 0.023$).

A multivariate logistic regression procedure showed that Caucasian ethnicity (odds ratio [OR]=3.41; 95% confidence interval [CI] 1.37-8.52; $p=0.009$), sitting more than 360 minutes per day (OR=2.21; 95% CI 1.21-4.05; $p=0.010$), and obesity (OR=1.96; 95% CI 1.05-3.68; $p=0.036$) were positive predictors of anxiety (Table 4). In contrast, age was a negative predictor (OR=0.94; 95% CI 0.92-0.97; $p<0.001$).

In a multivariate logistic regression aimed at predicting depression, Caucasian ethnicity (OR=3.99; 95% CI 1.10-14.5; $p=0.036$), obesity (OR= 2.50;95% CI 1.27 – 4.91; $p=0.008$), some college education (OR=2.15; 95% CI 1.04 – 4.44; $p=0.038$), and sitting for 360 minutes or more daily were all positive predictors (Table 5). Age was also a negative predictor of depression, as it was for anxiety (OR=0.97; 95% CI 0.94 – 0.99; $p=0.014$).

Discussion

Anxiety is a common mental health disorder that is very prevalent in the U.S. population. This study supports that statement, as over half of the participants surveyed were found to have symptoms of mild to severe anxiety. Additionally, many people do not meet the Physical Activity Guidelines created by the Department of Health and Human Services (2018), which recommend adults sit less and move more. This study found that if adults sit more than six hours per day, the odds of having anxiety is 2.21 times as much as those adults who sit less than six hours per day. This highlights an opportunity for primary care providers to suggest a less sedentary, and more active lifestyle. Generally speaking, the less sedentary a person is, the lower the risk of being overweight or obese. This study found that the odds of having anxiety is 1.96 times higher in an adult who is obese versus normal weight or overweight. Similarly, Brumpton et al. (2013) found that participants with anxiety and depression also had an overall increase in incidence of obesity. Therefore, primary care providers can suggest a more active lifestyle which may prevent sedentary behaviors and therefore obesity, and may decrease the risk of patients developing psychological distress.

In this study, the odds of having anxiety was 3.41 times higher in Caucasians than in other ethnicities. Similarly, non-Hispanic Whites were the second highest racial group to experience psychological distress in a previous study (Park et al., 2014). It would be prudent of

medical providers to consider their patients' race and ethnicity when deciding if screening for depression is appropriate. Another non-modifiable risk factor that was studied was age. The results showed that as adults' age by one year, the odds of having anxiety decreases by 6%. In contrast, there was no association between age and risk for psychological distress in a previous study (Husain et al., 2014). Interestingly, in a study of 123 patients with stage three gastric cancer, an association between age and psychological distress was found (Palgi, Ben-Ezra, Hamama-Raz, Shmueli & Shrira, 2014). The results showed that the patients aged 60-69 years had the lowest levels of psychological distress, whereas those aged 70 and older had the highest level. Further research may be necessary to determine the strength of age as non-modifiable predictor of psychological distress.

In 2010, the CDC reported that 7.2% of adults were experiencing symptoms of depression, and depression is one of the main reasons patients seek medical care. Around one-quarter of the participants in this study reported that they were experiencing symptoms of mild to severe depression. Similar to participants with anxiety, if adults sit more than six hours per day, the odds of having depression is two-fold. Again, primary care providers can suggest a decrease in sedentary behaviors to reduce the risk of depression. Depression and participants' age was analyzed, and it was found that age was only a negative predictor; as adults' age by one year, the odds of having depression decreases by 3%. Similar to anxiety, Caucasian ethnicity was a significant positive predictor of having depressive symptoms. Being of Caucasian ethnicity increased the odds of having depression by almost 4 times. In addition, those adults who were obese were 2.5 times more likely to have depression than those who were not obese. Primary care providers may focus on screening for depression in what this study indicates as high risk groups: younger adults who are overweight or obese, and of Caucasian ethnicity.

Similarly, after completion of the study by Martinez et al. (2014), the researchers recommend screening for psychological distress in patients who are extremely overweight or obese.

In this study, adults who have had some college education have a 2.15 times higher risk for depression. This was contradictory to the study by Husain et al. (2014). They found that less educated adults are more likely to have symptoms of psychological distress. Similarly, in a study by Krause (2018) analyzing the relationship between level of education and psychological distress of 3,010 participants, the results showed that participants with higher levels of educational attainment tend to report fewer symptoms of depression. Further research may be required to determine the strength of the relationship between educational level as a modifiable risk factor, and symptoms of depression. In a previous study by Kim et al. (2018), individuals who engaged in 1200-1800 MET minutes per week received the greatest antidepressant effect. However, in this study there seemed to be an overestimation of MET minutes per week resulting in no meaningful relationship between psychological distress and the amount of physical exercise (MET-minutes) per week.

Limitations

There are several limitations in this study. First, the study findings of predictors of obesity, sitting minutes, and Caucasian ethnicity should not be taken as cause-and-effect relationships for anxiety and depression in this cross sectional study. Second, sample recruitment through social media may have introduced selection bias. For example, there was a high proportion of Caucasian participants (86.7%) as well as those who were college graduates (67.3%). Third, utilization of the IPAQ may have resulted in an overestimation of METs per week, as participants reported an average of 10,812 METs. This number is extremely high and did not allow an association between physical activity and psychological distress. Additionally,

the way the questionnaire was written may have resulted in inaccuracies when interpreting and answering questions. This could have been prevented with a pilot study to allow for changes in wording that participants may not have fully understood to allow for greater accuracy in results. Finally, the study was conducted only in Texas and through personal contacts and may not be reflective of the generalized population.

Implications for Practice

The positive correlation between sitting for more than six hours per day and an increase in anxiety and/or depression is a crucial finding of this study, and it has many implications for the practice of primary care providers. Since two-thirds of patients with mental health disorders do not actively seek treatment for their mental health issues, it is essential that providers assess and screen all patients for psychological distress, such as anxiety and depression (Ng, How, & Ng, 2017). This is especially imperative for those patients in high risk categories. This study shows that there is a positive correlation between incidence of obesity and presence of psychological distress, particularly in middle-aged, Caucasian, females. Therefore, primary care providers should consider screening this specific patient population for depression and anxiety.

Since 2016, the U.S. Preventative Services Task Force (USPSTF) recommends screening for depression in the general adult population, however there is limited evidence on the optimum timing or interval for screening. It is generally recommended to screen adults who have not been previously screened and to consider screening in when known risk factors and comorbid conditions are present (USPSTF, 2016).

The Practice Guidelines for the Treatment of Patients with Major Depressive Disorder, developed by the American Psychiatric Association (APA) in 2010, summarize specific approaches to treatment of individuals with major depressive disorder for primary care

practitioners. The guidelines include a summary of recommendations for pharmacological and psychotherapeutic management of the patient in the acute phase, continuation phase, and maintenance phase (APA, 2010). These guidelines specifically recommend physical exercise as a reasonable addition to the treatment plan of those with major depressive disorder, as long as there are no contraindications (APA, 2010).

Mild depression and anxiety may be treated with a variety of nonpharmacological interventions, such as psychotherapy, cognitive behavioral therapy, acupuncture, light therapy, yoga, meditation, and relaxation therapies. This study indicates a relationship between psychological distress and sedentary behaviors, which may lead clinicians to consider encouraging patients who present with these risk factors, and those who are in the overweight-obese BMI category to increase the amount of time spent participating in physical activity, as recommended by the APA (2010).

In the Peltier et al. study (2017), it was shown that primary care providers encouraging patients to increase their physical activity had the greatest impact on the patients' ability to manage their mood disorders. Another study showed that individuals who engage in 1200-1800 MET minutes per week received the greatest antidepressant effect (Kim et al, 2018). Walking is considered a mild exercise and is calculated to be worth 3.3 METs per minute. Suggesting that these patients engage in walking for one hour a day, 7 days a week, could be an appropriate nonpharmacological treatment for anxiety and depression in individuals with sedentary behaviors.

Previous studies on this subject, bolstered by the results of this current study, show a link between sedentary behaviors and an increase in incident anxiety and depression. Providers should assess all patients that have not yet been assessed and all patients in high risk categories

for mental health disorders and sedentary behaviors. Primary providers have been shown to have the greatest impact on patients increasing exercise to control mild depression and anxiety, so health care providers should encourage these patients to engage in at least seven hours of light exercise per week to control symptoms of mild depression and anxiety.

Conclusions

There is a high prevalence of psychological distress and obesity with subsequent chronic disease in the United States. A predictive relationship between those with anxiety and/or depression, a sedentary lifestyle, and obesity, is supported by the findings of this study. Reduction of risk for development of chronic disease is a primary focus for primary care providers and understanding the interrelatedness of these multifactorial diseases is essential in providing quality care and improved health outcomes for at-risk populations. Inclusion of routine screening for anxiety and depression, and evaluation of sitting time in a day, can aid in identification of those at risk for obesity and possible life threatening chronic disease. Identification of these patients may allow providers to focus on modifiable risk factors and reduce negative health impacts early in their treatment plan. Early identification of those with anxiety and/or depressive symptoms may reduce occurrence of obesity and chronic disease through provider encouragement of increased physical activity, less sitting time, and maintenance of a healthy body weight.

References

- Adamson, B. C., Yang, Y., & Motl, R. W. (2016). Association between compliance with physical activity guidelines, sedentary behavior and depressive symptoms. *Preventive Medicine, 91*, 152-157.
- American College of Cardiology, American Heart Association Task Force on Practice Guidelines, the Obesity Society. (2013). 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. Retrieved from <http://circ.ahajournals.org/content/early/2013/11/11/01.cir.0000437739.71477.ee>
- American Psychiatric Association. (2010). Practice guideline for the treatment of patients with major depressive disorder. Retrieved from https://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/mdd.pdf
- Anxiety and Depression Association of America. (2016). Facts and statistics. Retrieved from <https://adaa.org/about-adaa/press-room/facts-statistics#>
- Arvidsdotter, T., Marklund, B., Kylén, S., Taft, C., & Ekman, I. (2016). Understanding persons with psychological distress in primary health care. *Scandinavian Journal of Caring Sciences, 30*(4), 687-694.
- Blough, J., & Loprinzi, P. D. (2018). Experimentally investigating the joint effects of physical activity and sedentary behavior on depression and anxiety: A randomized controlled trial. *Journal of Affective Disorders, 239*, 258-268.
- Brumpton, B., Langhammer, A., Romundstad, P., Chen, Y., & Mai, X. (2013). The associations of anxiety and depression symptoms with weight change and incident obesity: The HUNT Study. *International Journal of Obesity, 37*:1268-1274.

- Camargo-Casas, S., Suarez-Monsalve, S., Perez Zepeda, M. U., Garcia-Pena, C., & Alberto Cano-Gutierrez, C. (2018). Multimorbidity, depressive symptoms, and self-reported health in older adults: A secondary analysis of the sabe bogota study. *Revista De Investigacion Clinica-Clinical and Translational Investigation*, 70(4), 192-197.
- Centers for Disease Control and Prevention. (2014). Facts about physical activity. Retrieved from <https://www.cdc.gov/physicalactivity/data/facts.htm>
- Centers for Disease Control and Prevention. (2015). Depression and obesity in the U.S. adult household population, 2005–2010. Retrieved from <https://www.cdc.gov/nchs/data/databriefs/db167.htm>
- Centers for Disease Control and Prevention. (2015). Health-related quality of life (HRQOL). Retrieved from <http://nccd.cdc.gov/hrqol>
- Centers for Disease Control and Prevention. (2017). Adult obesity facts. Retrieved from <https://www.cdc.gov/obesity/data/adult.html>
- Centers for Disease Control and Prevention. (2017). Antidepressant use among persons aged 12 and over: united states, 2011–2014. Retrieved from <https://www.cdc.gov/nchs/products/databriefs/db283.htm>
- Centers for Disease Control and Prevention. (2017). Mental health. Retrieved from <https://www.cdc.gov/nchs/fastats/mental-health.htm>
- Centers for Disease Control and Prevention. (2018). Behavioral risk Factor surveillance system. Retrieved from <https://www.cdc.gov/brfss/>
- Christodoulou, C., Michopoulos, J., Tournikioti, K., Douzenis, A., Bouras, G., Seretis, D.,

- Kontaxakis, V., & Lykouras, L. (2010). Hospital Anxiety and Depression Scale: A quantitative analysis in medical outpatients, psychiatric outpatients and normal subjects. *Psychiatriki*, 21(4), 279-286.
- Deng, Y., & Paul, D. R. (2018). The relationships between depressive symptoms, functional health status, physical activity, and the availability of recreational facilities: A rural-urban comparison in middle-aged and older Chinese adults. *International Journal of Behavioral Medicine*, 25(3), 322-330.
- Department of Health and Human Services. (2018). Physical activity guidelines for americans. Retrieved from https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf
- Forde, C. (n.d). Scoring the international physical activity questionnaire (IPAQ). *University of Dublin*.
- Frehlich, L., Friedenreich, C., Nettel-Aguirre, A., & McCormack, G.R. (2018). Test-retest reliability of a modified international physical activity questionnaire (IPAQ) to capture neighbourhood physical activity. *Journal of Human Sport and Exercise*, 13(1), 174-187.
- Helgadóttir, B., Hallgren, M., Ekblom, Ö. & Forsell, Y. (2016). Training fast or slow? Exercise for depression: A randomized controlled trial. *Preventive Medicine*, 91, 123-131.
- Husain, N., Chaudhry, N., Jafri, F., Tomenson, B., Surhand, I., Mirza, I., & Chaudhry, I. B. (2014). Prevalence and risk factors for psychological distress and functional disability in urban pakistan. *WHO South East Asia Journal of Public Health*, 3(2), 144-153.
- Jia, H., Zack, M. M., Gottesman, I. I., & Thompson, W. W. (2018). Associations of smoking, physical inactivity, heavy drinking, and obesity with quality-adjusted life expectancy among US adults with depression. *Value in Health*, 21(3), 364-371.

- Khanzada, F. J., Soomro, N., & Khan, S. Z. (2015). Association of physical exercise on anxiety and depression amongst adults. *Journal of the College of Physicians and Surgeons--Pakistan: JCPSP*, 25(7), 546-548.
- Kim, S., Jeon, S., Shin, D., Oh, K., Shin, Y., & Lim, S. (2018). Association between physical activity and depressive symptoms in general adult populations: An analysis of the dose-response relationship. *Psychiatry Research*, 269, 258-263.
- Kim, Y., Park, I., & Kang, M. (2013). Convergent validity of the international physical activity questionnaire (IPAQ): Meta-analysis. *Public Health Nutrition*, 16(3), 440-452.
- Kinley, D. J., Lowry, H., Katz, C., Jacobi, F., Jassal, D. S., & Sareen, J. (2015). Depression and anxiety disorders and the link to physician diagnosed cardiac disease and metabolic risk factors. *General Hospital Psychiatry*, 37: 288-293.
- Krause, N. (2018). Assessing the relationships among stress, god-mediated control, and psychological distress/well-being: Does the level of education matter? *Journal of Social Psychology*, 1-13.
- Linares-Manrique, M., Linares-Girela, D., Schmidt-Rio-Valle, J., Mato-Medina, O., Fernández-García, R., & Cruz-Quintana, F. (2016). The relation of physical self-concept, anxiety, and BMI among Mexican university students. *Revista Internacional De Medicina Y Ciencias De La Actividad Física Y Del Deporte*, 16(63), 497-519.
- Martínez, E., Gutiérrez-Bedmar, M., García-Rodríguez, A., Mariscal, A., Muñoz-Bravo, C., & Navajas, J. (2014). Weight status and psychological distress in a mediterranean spanish population: A symmetric U-shaped relationship. *Nutrients*, 6(4), 1662-1677.
- Michopoulos, I., Douzenis, A., Kalkavoura, C., Christodoulou, C., Michalopoulou, P., Kalemi,

- G., Fineti, K., Papatis, P., Protopas, K., & Lykouras, L. (2008). Hospital anxiety and depression scale (HADS): Validation in a greek general hospital sample. *Annals of General Psychiatry*, 7.
- Motl, R. W., McAuley, E., & Klaren, R. (2014). Reliability of physical-activity measures over six months in adults with multiple sclerosis: Implications for designing behavioral interventions. *Behavioral Medicine (Washington, D.C.)*, 40(1), 29-33.
- Mochcovitch, M. D., Deslandes, A. C., Freire, R. C., Garcia, R. F., & Nardi, A. E. (2016). The effects of regular physical activity on anxiety symptoms in healthy older adults: A systematic review. *Revista Brasileira De Psiquiatria (Sao Paulo, Brazil: 1999)*, 38(3), 255-261.
- Ng, C. W. M., How, C. H., & Ng, Y. P. (2017). Managing depression in primary care. *Singapore Medical Journal*, 58(8): 459-466.
- Nigatu, Y. T., Reijneveld, S. A., de Jonge, P., van Rossum, E., & Bültmann, U. (2016). The combined effects of obesity, abdominal obesity and major depression/anxiety on health-related quality of life: the LifeLines Cohort Study. *Plos One*, 11(2).
- Palgi, Y., Ben-Ezra, M., Hamama-Raz, Y., Shacham Shmueli, E., & Shrira, A. (2014). The effect of age on illness cognition, subjective well-being and psychological distress among gastric cancer patients. *Stress & Health: Journal of the International Society for the Investigation of Stress*, 30(4), 280-286.
- Park, H., Choi, E., & Wenzel, J. A. (2018). Racial/ethnic differences in correlates of psychological distress among five Asian-American subgroups and non-Hispanic whites. *Ethnicity and Health*, 1-17.

- Pelletier, L., Shanmugasagaram, S., Patten, S. B., & Demers, A. (2017). Self-management of mood and/or anxiety disorders through physical activity/exercise. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice*, 37(5), 149–159.
- Pierannunzi, C., Hu, S. S., & Balluz, L. (2013). A systematic review of publications assessing reliability and validity of the behavioral risk factor surveillance system (BRFSS), 2004-2011. *BMC Medical Research Methodology*, 13, 49.
- Siddiqui, F., Lindblad, U., & Bennet, L. (2014). Physical inactivity is strongly associated with anxiety and depression in Iraqi immigrants to Sweden: a cross-sectional study. *BMC Public Health*, 14(1), 884–899.
- Son, N. (2017). Assessment of body perception, psychological distress, and subjective quality of life among obese and nonobese subjects in turkey. *Nigerian Journal of Clinical Practice*, 20(10), 1302-1308.
- Stern, A. (2014). The hospital and anxiety depression scale. *Occupational Medicine*, 64(5), 393–394.
- Teychenne, M., Costigan, S. A., & Parker, K. (2015). The association between sedentary behaviour and risk of anxiety: a systematic review. *BMC Public Health*, 15(1), 1–8.
- U.S. Preventative Services Task Force. (2016). Final recommendation statement: depression in adults: screening. Retrieved from <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/depression-in-adults-screening1>

Weiss, S. J., Simeonova, D. I., Kimmel, M. C., Battle, C. L., Maki, P. M., & Flynn, H. A.

(2016). Anxiety and physical health problems increase the odds of women having more severe symptoms of depression. *Archives of Women's Mental Health*, 19(3), 491-499.

Zigmond, A.S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67, 361-370.

Table 1. Sample characteristics ($N=226$)

	<i>n</i> (%)
Age, mean (range), year	44 (18-94)
Gender	
Male	34 (15.0)
Female	192 (85.0)
Ethnicity	
Non-Hispanic Caucasian	196 (86.7)
Hispanic	16 (7.1)
African American	2 (0.9)
Asian/Pacific Islander	3 (1.3)
Other	9 (4.0)
Education	
High school graduates or less	22 (9.7)
Some college	52 (23.0)
College graduate	152 (67.3)
Body Mass Index (BMI) [†]	
Underweight	6 (2.7)
Normal weight (18.5–24.9 kg/m ²)	65 (28.8)
Overweight (25.0–29.9 kg/m ²)	53 (23.5)
Obese (≥ 30 kg/m ²)	98 (43.4)

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

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

[†]Body mass index (BMI) category per CDC Adult BMI calculator.

Table 2. Health status ($N=226$)

	<i>n</i> (%)
General health status	
Poor	5 (2.2)
Fair	42 (18.6)
Good	103 (45.6)
Very good	63 (27.9)
Excellent	12 (5.3)
Anxiety	
None	88 (38.9)
Mild-severe	133 (58.8)
Depression	
None	164 (72.6)
Mild-severe	59 (26.1)
Days of poor physical health/month, mean (SD)	3.8 (6.9)
Days of poor mental health/month, mean (SD)	8.8 (8.9)
Days of poor daily activities/month, mean (SD)	4.4 (7.3)
Physical activity, MET-minutes/week, median (IQR)	10812 (3523, 26956)
Sitting minutes/day, median (IQR)	360 (240, 555)

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

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

MET, Metabolic equivalent; IQR, Interquartile range

Table 3. Correlations with anxiety and depression ($N=226$)

	Anxiety	Depression
Age	-0.21***	-0.10
Female	0.05	-0.04
Caucasian ethnicity	0.09	0.14*
High school graduate or less	-0.14*	-0.04
Some college	0.04	0.20**
College graduate	0.06	-0.15*
Obesity	0.09	0.19**
MET-minutes/week ≥ 10812	-0.08	-0.09
Sitting minutes/day ≥ 360	0.19**	0.16*

Note. Correlations by Kendall's Tau test; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$
 Obesity, BMI ≥ 30 kg/m²;
 MET, Metabolic equivalent.

Table 4. Multivariate logistic regression predicting anxiety ($N=226$)

	OR	95%CI	<i>p</i> value
Caucasian ethnicity	3.41	1.37 – 8.52	0.009**
Sitting minutes/day ≥ 360	2.21	1.21 – 4.05	0.010*
Obesity	1.96	1.05 – 3.68	0.036*
Age	0.94	0.92 – 0.97	<0.001***

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

OR=odds ratio; CI=confidence interval

Obesity, BMI ≥ 30 kg/m²

Table 5. Multivariate logistic regression predicting depression ($N=226$)

	OR	95%CI	<i>p</i> value
Caucasian ethnicity	3.99	1.10 – 14.5	0.036*
Obesity	2.50	1.27 – 4.91	0.008**
Some college	2.15	1.04 – 4.44	0.038*
Sitting minutes/day ≥ 360	2.11	1.07 – 4.18	0.032*
Age	0.97	0.94 – 0.99	0.014*

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

OR=odds ratio; CI=confidence interval

Obesity, BMI ≥ 30 kg/m²