

EFFECTS OF HEALTHY LIFESTYLE ON PHYSICAL
AND MENTAL HEALTH STATUS

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Amber Lee Byer

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Thesis Supervisor:

Son Chae Kim, Ph.D., RN
St. David's School of Nursing

Second Reader:

Barbara G. Covington, Ph.D., RN
St David's School of Nursing

Approved:

Heather C. Galloway, Ph.D.
Dean, Honors College

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Abstract

This study explored the impacts of physical activity, sedentary behaviors, and consumption of sugar-sweetened beverages on physical and mental health. Previous studies suggest that physical inactivity or increased consumption of sugar-sweetened beverages may place adults at higher risk for poor physical and mental health outcomes. However, the impacts of these lifestyles on poor mental and physical health as well as daily activities have not been thoroughly studied. A cross-sectional online survey was conducted among 280 convenience sample of adults between October and November 2018. Kendall's tau correlations and multivariate logistic regression procedures were performed. In this study, poor physical and mental health as well as poor daily activities were defined as having ≥ 3 poor days per month. About 60% of participants were either overweight or obese. More than half reported anxiety symptoms (53.2%), while only 16% reported depression symptoms. Sedentary time ≥ 8 hours per weekend day was the significant predictor of poor physical health (OR=3.01), poor mental health (OR=2.08), and poor daily activities (OR=1.94). Having anxiety symptoms was a significant predictor of poor mental health (OR=8.79) and poor daily activities (OR=3.26), while having less than 4,000 metabolic equivalent-minutes per week was a significant predictor of poor physical health (OR=1.87). In contrast, overweight/obesity or consumption of sugar-sweetened beverages did not predict mental or physical health. Spending more than 8 sedentary hours per weekend day appears to be a consistent predictor of poor physical and mental health, as well as poor daily activities. Further studies are needed to determine cause-effect relationships between weekend sedentary behaviors and health status.

Keywords: Depression, anxiety, health status, sedentary behavior, physical activity

Introduction

Depression and anxiety are serious medical illnesses that can negatively impact the way a person thinks, feels and acts. Approximately one in six adults will suffer from depression during their lifetime, and around 16 million Americans are affected each year (Centers for Disease Control and Prevention [CDC], 2017a). The 2010 Global Burden of Disease Study found depression to be the leading cause of disability-adjusted life years for mental disorders (Furihata et al., 2018). Common symptoms for depression may be persistent feelings of sadness, feeling hopeless, increased irritability, loss of interest in daily activities, decreased energy, difficulty concentrating, changes in sleep habits, appetite changes, and thoughts of death or suicide attempts (The National Institute of Mental Health [NIMH], 2018a). Risk factors for depression in adults include family history of depression, having depression in the past, major life changes, stress, traumas, and certain illnesses or medications.

Adults with depression also have an increased risk for comorbidities such as diabetes and cardiovascular disease (Stubbs et al., 2018). The increased risk of these comorbidities is associated with the increase of sedentary behavior due to depression. In 2010, the economic burden in the United States for people suffering from depression was \$210.5 billion which was a 21% rise from the economic burden of 2005 (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Depression and Anxiety are two separate conditions that commonly occur together with anxiety sometimes being a symptom of depression or depression occurring as a result of living with and anxiety disorder (The National Institute of Mental Health, 2018b).

Anxiety, like depression, can interfere with a person's daily activities such as school, work, and relationships. Two of the most prevalent anxiety disorders are generalized anxiety disorder and panic disorder (NIMH, 2018b). Symptoms of anxiety disorders include feelings of restlessness, difficulty concentrating, irritability, feelings of worry, difficulty sleeping, heart palpitations, sweating, shortness of breath, and feelings of impending doom. An estimated 31.1% of the adult population in the United States will suffer from an anxiety disorder during their lifetime (NIMH, 2018b). Risk factors for anxiety disorders includes exposure to stressful or negative events, family history of anxiety, and some physical health conditions such as thyroid disease (NIMH, 2017b). In 2016, it was estimated that anxiety and depression disorders cost approximately \$1 trillion dollars globally every year (World Health Organization, 2016).

Due to the increasing prevalence of depression in the United States, the US Preventive Services Task Force (USPSTF) currently recommends that all adults over the age of 18 be screened for depression in the primary care setting (USPSTF, 2016). The evidence showed that implementing screening in the primary care setting improves the accurate identification of adults suffering from depression in the general population. Early identification and treatment of depression in adults has been shown to reduce the symptoms of depression and decreases the occurrence of clinical morbidity (USPSTF, 2016). Current treatment practices for depression and anxiety include psychotherapy, cognitive behavioral therapy, medications, support groups, and stress management techniques (NIMH, 2018).

Regular physical activity has been shown to improve physical health and to reduce the symptoms of depression and anxiety (Stubbs et al., 2018). The current

physical activity guidelines for adults include at least 150 minutes of moderate aerobic activity such as walking, running or cycling and at least two days of muscle-strengthening activities per week (United States Department of Health and Human Services [USDHHS], 2018). Currently, only one in five adults is estimated to be meeting these guidelines (CDC, 2015). Regular moderate physical activity has been shown to reduce the risk of cardiovascular events, lower lipid levels, decrease blood pressure, and reduce the symptoms of depression and anxiety. A strong base of previously conducted research shows that regular physical activity is associated with reduced symptoms of depression and anxiety (Rebar, Duncan, Short, & Vandelanotte, 2014). In contrast, recent research has suggested that increased time spent sitting or sedentary is associated with an increase in depression and anxiety symptoms (Rebar, Duncan, Short, & Vandelanotte, 2014).

Literature Review

Physical Activity and Depression

Depression can occur at any age and is one of the most common mental disorders affecting the general adult population within the United States (Heinzel et al., 2015). In a randomized controlled trial examining the long-term effects of exercise on depression symptoms in adults, different levels of physical activity were used to explore the effects of prescribed exercise on depression in adults (Helgadottir, Forsell, Hallgren, Moller, & Ekblom, 2017). Study participants between the ages of 18-67 years old were enrolled in a 12-week program consisting of four groups: Light exercise, moderate exercise, vigorous exercise, and control groups. The light exercise group participated in yoga and stretching, the moderate exercise group did intermediate aerobics, and the intense

exercise group participated in strenuous aerobics. The study findings showed significantly lower depression scores in the light exercise group as compared to the control group and the moderate exercise group. The largest effect of physical activity on depression scores was seen in the light exercise group, followed by the vigorous exercise group, and a smaller decrease in depression scores was seen in the moderate exercise group. Based on this study finding, healthcare providers may consider prescribing physical activity based on the individual's preference when using it to treat depression as all exercise groups showed improvement in depressive symptoms (Helgadottir, et al., 2017).

In a meta-analysis of 18 studies involving elderly patients over the age of 60, physical activity showed a significant overall effect for reducing depression symptoms when compared to control conditions ($p < 0.005$) (Heinzel et al., 2015). Depressive symptoms in the studies included reduction in feelings of sadness, increased energy, and increased feelings of self-efficacy. Physical activity in the studies being analyzed included aerobic exercise such as walking, running, swimming, and cycling resistance training including weights, Tai Chi and ballroom dancing. Another systematic review showed low cardiorespiratory fitness levels and medium cardiorespiratory fitness were associated with high risk for depression when compared to high levels of cardiorespiratory fitness (Schuch, 2016). Low cardiorespiratory fitness levels included participants who did not meet the recommended 150 minutes minimum of aerobic activity during the week while moderate cardiorespiratory fitness included those who do meet the minimum. In contrast, those with high cardiorespiratory fitness exceeded the

recommended 150 minutes per week and were associated with a lower risk for depression (Schuch, 2016).

A randomized controlled trial involving 46 inpatient adults with major depressive disorder (MDD) using prescribed physical activity showed a significant improvement in depressive symptoms compared to the control group ($p < 0.0001$) (Doose et al., 2015). The intervention group was prescribed eight weeks of exercise that took place three days a week. The exercise consisted of walking and running at the participants chosen intensity level. The control group was treated with anti-depressants but no weekly exercise. Following the eight-week intervention period, 40 percent of the participants were considered “recovered” from MDD and four were considered improved (Doose et al., 2015).

Physical Activity and Anxiety

Anxiety can be clinically defined as an unpleasant experience with subjective feelings of apprehension that is often paired with physical sensations such as sweating, muscle stiffness, shaking, irritability, and tachycardia (Mochcovitch, Deslandes, Freire, Garcia, & Nardi, 2016). Physical activity and meeting the recommended minimum of 150 minutes a week has been shown through previous research studies to reduce the symptoms of anxiety (Vancampfort, Stubbs, & Koyanagi, 2017). Given the possible benefits of physical activity on reducing anxiety symptoms, it is important for more research to be analyzed and conducted.

In a cross-sectional study, data taken from the World Health Survey were analyzed to examine the relationship between physical activity and the reduction of anxiety symptoms (Vancampfort, Stubbs, & Koyanagi, 2017). The International Physical

Activity Questionnaire (IPAQ) was used to assess physical activity levels in participants and then they were split into two groups: Those who met the 150 minutes of physical activity and those who did not meet the 150-minute minimum recommendation for physical activity. In the participants with low physical activity levels, several factors correlated with the inability to meet the recommended minimum requirements. These factors included female gender, older age, single marital status, unemployment, living in an urban area, smoking, other comorbidities and the presence of depression. Meeting the adequate physical activity recommendations did show a relationship with the reduction of anxiety symptoms. Given the possible benefits of physical activity on the symptoms of anxiety, the study concluded that future research that explores ways to increase physical activity in populations that showed lower levels of physical activity would be beneficial when planning interventions for patients with anxiety (Vancampfort et al., 2017).

A systematic review on the relationship between physical activity and anxiety in older adults was conducted to further explore the possible benefits based on previously conducted research (Mochcovitch, Deslandes, Freire, Garcia, & Nardi, 2016). These studies included five randomized controlled trials, two cross-sectional studies, and one cohort study. The studies being analyzed looked at a wide range of physical activities including walking, jogging, cycling, swimming, aerobics, tennis, golf, bowling, and others. Based on the studies that were reviewed, physical activity was shown to be effective for decreasing anxiety symptoms in the older adult population. The benefits of physical activity that may be responsible for reducing anxiety symptoms include neuroendocrine responses, anti-inflammatory benefits, and antioxidant effects. However, while physical activity may be a useful tool to reduce anxiety symptoms, there is no

conclusive evidence to determine what type of physical activity modalities may be best in older adults (Mochcovitch, et al., 2016).

Sedentary Behavior and Health Status

Sedentary behavior is often defined as having an energy expenditure of less than 1.5 metabolic-equivalents using resulting from being in a sitting or lying position (Trembley et al., 2017). Sedentary behaviors include a wide variety of activities that involve decreased energy expenditure including watching television, playing video games, working on a computer, and time spend driving (Trembley et al., 2017). In contrast to the many benefits of regular physical activity, increased sedentary behaviors have been found to cause an increase in depression and anxiety symptoms (Blough & Loprinzi, 2018). Indeed, some research suggests that sedentary behaviors may be linked to increased risk of poor physical health status as well. Previous studies have linked sedentary behavior to increase risk for several chronic diseases including obesity, osteoporosis, cardiovascular disease, diabetes, and some types of cancers (Teychenne, Costigan, & Parker, 2015).

A randomized controlled trial attempted to examine the effects of sedentary behavior on depression and anxiety among adults aged 18 to 35 years (Blough & Loprinzi, 2018). Within the study all participants were physically active and currently meeting the recommended 150-minute recommendation for physical activity. The study then broke participants up into three groups; No exercise group, reduced physical activity group, and the control group that maintained normal physical activity levels. The results of the study showed that increasing sedentary behavior increased the symptoms of depression but not anxiety within the no exercise experimental group while the control

group remained at baseline levels throughout the study. However, there were no increases in depression and anxiety symptoms amongst the restricted activity group. This research study suggests that even increasing sedentary for only a single week may increase depressive symptoms in young adults (Blough & Loprinzi, 2018).

A cross-sectional study involving 42,469 adults in low and middle-income countries examined the relationship between sedentary behavior, which was calculated in hours spent sitting or reclining, and depressive symptoms (Stubbs et al., 2018). Depressive symptoms were higher in participants who had more than 11 hours per day of sedentary behavior. In contrast, adults with less than eight hours per day of sedentary behavior showed fewer depressive symptoms. Another cross-sectional survey involving 2,559 adults showed that obesity coupled with physical activity below the recommended 150 minutes per week increased the risk of depressive symptoms ($p < 0.05$) (Furihata et al., 2018).

Sugar Sweetened Beverages and Health Status

Sugar-Sweetened Beverages (SSBs) are the leading source of added sugar in the United States (CDC, 2017b). Types of SSBs includes soda, fruit drinks, energy drinks, sweetened coffee beverages, sports drinks, and many other options. Increased consumption of SSBs puts individuals at higher risk for obesity, diabetes, cardiovascular disease, renal disease, dental cavities, and gout. In addition to increasing the risk of poor physical health, some research has hypothesized that SSBs may also contribute to increased risk of depression through biological pathways that lead to a dysregulation of the stress response (Hu, Cheng, & Jiange, 2019).

A recent meta-analysis analyzed 10 studies to examine the relationship between SSBs consumption and increased risk of depression symptoms (Hu, Cheng, & Jiange, 2019). Depression in four of the studies was determined by a physician's medical diagnosis while the other six studies used a variety of self-reported questionnaires to determine depressive symptoms. SSBs consumption was measured using self-reported participant data. SSB in this study included sodas, sugar or sweetened beverages, and artificial juices. The study findings indicated that SSBs consumption was shown to have an adverse effect on the risk of depression for participants. The amount of SSBs consumption threshold for depression was around two cups of soda per day. The results of the study indicated that there might be an increased risk of depression with increased consumption of SSBs but further research is needed to explore this relationship (Hu et al., 2019).

A cross-sectional research study involving 3,667 adults in China was conducted to explore the relationship between soda consumption and depressive symptoms (Yu et al., 2015). Among the participants who took part in the survey, 7.6% were determined to have moderate to severe symptoms of depression. The study found that approximately 5% of the participants consumed more than four sodas per week whereas three-quarters of participants consumed less than one soda per week. In comparing the results participants who consumed more than four sodas per week had a doubled prevalence of depressive symptoms when compared to participants who drank one or less soda per week. This study findings suggest that increased consumption of soft drinks may lead to an increase in depressive symptoms (Yu et al., 2015).

In summary, previously conducted research has demonstrated that physical activity may have the ability to reduce the symptoms of anxiety and depression. Many of the studies showed that meeting the recommended 150 minutes of physical activity per week can be beneficial to individuals suffering from depression or anxiety. In contrast, studies focusing on sedentary behavior have shown that individuals who spend more time sedentary are at a higher risk for depression and anxiety symptoms. Recent investigations into the relationship between SSBs consumption and depression have shown that individuals who consume higher amounts of SSBs may have an increased risk of depressive symptoms. However, further research is needed to explore the strengths of predictive relationships between each of these healthy behaviors and physical and mental health status in the general population.

Aims

The aims of this study were to explore the relationship between healthy behaviors and physical and mental health status and to determine the predictors of poor physical and mental health status.

Method

Design and Sample

A cross-sectional study using an online survey portal, Qualtrics^{XM} (Online survey software, Provo, UT), hosted by Texas State University, was conducted from October 2018 to November 2018. The survey was distributed via the social media tool, Facebook, to recruit potential subjects. Inclusion criteria were adults aged 18 and older who had access to social media platforms and English language comprehension. Exclusion criteria

were pregnant women, children under the age of 18, and adults with cognitive impairments.

Instruments

This study survey included: The International Physical Activity Questionnaire Short Form (IPAQ-SF), the Sedentary Behavior Questionnaire (SBQ) for adults, the Hospital Anxiety and Depression Scale (HADS), four questions from the 2018 Behavioral Risk Factor Surveillance System (BRFSS) to determine physical and mental health status, and three questions concerning sugar-sweetened beverage (SSB) consumption. The survey also included demographic questions such as age, gender, educational background, ethnicity, height, and weight. See Appendix A.

The International Physical Activity Questionnaire Short Form (IPAQ-SF) was used to determine the different levels of intensity of physical activity that individuals participate in during their everyday lives (Lee, Macfarlane, Lam, & Stewart, 2011). The IPAQ-SF is a self-reported questionnaire made up of seven open-ended questions used to determine an individual's recall of physical activity during the last seven days. These open-ended questions are used to determine the amount of time spent participating in vigorous activities, moderate activities, walking, and sitting (Craig et. al., 2013). Vigorous activities are described as any activity that requires intense physical effort and makes the participant breathe much harder than normal. Moderate physical effort is described as requiring moderately increased effort and makes the participant breathe a bit harder than normal. The IPAQ-SF takes the individual's reported physical activity and converts them to metabolic equivalent-minutes (METs) per week. To get the METs per week, each activity level is given the following equivalent score: Vigorous physical

activity is given 8 METs, moderate physical activity is given 4 METs, and walking is given 3.3 METs. Time spent sitting is assigned 1 MET. These METs are then multiplied by the minutes the activity was conducted and again by the number of days the activity was completed. Once this has been done for each category the scores are added together to give the METs per week for a participant (Forde, n.d.). The IPAQ-SF has satisfactory internal consistency reliability with a Cronbach's alpha of 0.80 (Craig et. al., 2003).

The Sedentary Behaviors Questionnaire (SBQ) for adults was used to determine the amount of time participants spent participating in nine sedentary behaviors during the week days and on the weekends (Rosenberg et al, 2010). The questionnaire is self-reported and is used to determine how many hours participants spend on these sedentary activities during the week and then how many hours spent on the weekends. Sedentary behaviors include time spent sitting watching TV, playing on the computer or video games, listening to music, while on the phone, doing paperwork or computer work, reading a book or magazine, playing a musical instrument, doing arts or crafts, and driving or riding a bus, train or car. The SBQ has an acceptable reliability using the test-retest method, ranging of 0.64-0.90 for weekdays and 0.51-0.93 on the weekend days (Rosenberg et. al., 2010).

The 14-item Hospital Anxiety and Depression Scale (HADS) was used to identify possible symptoms of depression and anxiety in participants (Snaith & Zigmond, 2000). The HADS is divided into two subscales: Anxiety and depression subscales. Each subscale is made up of seven items with the response options for each item ranging from 0 to 3, with a higher score indicating higher frequency of the symptom. The summation scores for each subscale range from 0 to 21, with the scores of 0-7 indicating the absence

of symptoms while the scores of 8-21 indicating clinical symptoms of the case. The HADS questionnaire has been found to be reliable with Cronbach's Alphas of 0.83 and 0.82 for the anxiety and depression subscale, respectively (Bjelland, Dahl, Haug, & Neckelmann, 2001).

Four questions were also taken from the 2018 Behavioral Risk Factor Surveillance System (BRFSS) to determine overall physical and mental health status. The first question asked participants to self-report their general health status on a scale that ranged from poor to excellent. Participants were then asked to determine how many of the past 30 days they had poor physical health, poor mental health, and poor unusual activities. These three questions were used as the dependent variables to determine the predictors of poor mental and physical health as well as poor daily activities.

Sugar-sweetened beverage consumption (SSBs) and nutritional knowledge was determined using questions from a previously conducted study (Gase, Robles, Barragan, & Kuo, 2014). The questions asked the participants the amount of SSBs consumed in three different categories: Soda (excluding diet soda), fruit juice, and sports/energy drinks. Participants were asked to report their consumption for each category ranging from twice or more a day to never. Participants were also asked to respond to the open-ended question of "How many calories is a healthy adult supposed to consume each day?" to determine overall nutritional knowledge (Gase et al., 2014).

Data Collection Procedures

The recruitment email containing a hyperlink to the online survey was sent out to invite potential subjects via local community or running clubs Facebook posts. If the potential participants clicked the hyperlink, it routed them to the study site on Qualtrics,

hosted by Texas State University. After completion of the survey, participants were automatically redirected to a separate, delinked second website to submit their personal email address for a chance to win a \$20 gift card from Amazon. The online survey was available from October 2018 to November 2018.

Ethical Considerations

The study was reviewed and approved by the Texas State University Institutional Review Board. A waiver of signed consent was granted due to the minimal risks involved in this online survey study. The recruitment email included statements that the participations are entirely voluntary, and they are free to withdraw from the study at any time without any penalty. They were reminded that their responses will be maintained confidential and their completion of the survey indicates their consent to participate.

Data Analysis

Descriptive statistics of means, standard deviations, percentages, and frequencies were performed. In this study, the dependent variables were poor physical and mental health as well as poor daily activities that were defined as having ≥ 3 poor days per month. They were coded as dichotomous variables (≥ 3 poor days per month = 1; < 3 poor days per month = 0). The Independent variables were also coded as dichotomous variables: Overweight/obesity ($BMI \geq 25 \text{ kg/m}^2 = 1$; $BMI < 25 \text{ kg/m}^2 = 0$); HADS anxiety and depression scores (8-21 = 1; 0-7=0); physical activity ($METs\text{-min/week} \geq 4,000 = 1$; $METs\text{-min/week} < 4,000 = 0$); weekday sedentary and weekend sedentary hours (≥ 8 hours = 1 ; < 8 hours = 0); and SSB consumption ($>$ once a day = 1; $<$ once a day = 0). To examine the correlations among these independent variables and dependent variables, Kendall's tau tests were performed among dichotomous variables. Those variables that

had statistically significant correlations with dependent variables were entered into multivariate logistic regression models to examine the predictors of days of poor physical and mental health as well as poor daily activities. IBM SPSS Statistics 25.0 software (IBM, Armonk, NY) was used to perform all data analyses and the statistical significance was set at p -value <0.05 .

Results

Sample Characteristics

A total of 280 participants completed the survey and the mean age was 41 years old. Most of the participants were female (77.5%), non-Hispanic Caucasian (79.6%), and had some college education or college degree (94.7%) (Table 1). About six-tenths (61.1%) had a BMI in the overweight or obese category.

Table 1. Sample characteristics ($N=280$)

	<i>n</i> (%)
Age, mean (range), year	41 (18-73)
Gender	
Male	61 (21.8)
Female	217 (77.5)
Ethnicity	
Non-Hispanic Caucasian	223 (79.6)
Hispanic	29 (10.4)
African American	2 (0.7)
Asian/Pacific Islander	9 (3.2)
Other	14 (5.0)
Education	
High school graduates or less	13 (4.6)
Some college	87 (31.1)
College graduate	178 (63.6)

Body Mass Index (BMI)†	
Underweight	1 (0.4)
Normal weight (18.5–24.9 kg/m ²)	104 (37.1)
Overweight (25.0–29.9 kg/m ²)	91 (32.5)
Obese (≥ 30 kg/m ²)	80 (28.6)

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.

Health Status and Healthy Behaviors

Table 2 depicts the health status and healthy behaviors. More than one-tenth of the participants (13.6%) reported that their health status as poor or fair. More than half (53.2%) reported having mild to severe anxiety symptoms while 16.1% having depression symptoms. Participants had an average of 3 days of poor physical health, 7 days of poor mental health, and 3 days of poor daily activities per month. The average amount of physical activity was 4,000 MET-minutes per week, whereas the mean sedentary hours per weekday and weekend day were 8.75 hours and 7.60 hours, respectively. Twenty percent of the participants had more than one sugar sweetened beverage every day and 62.8% had correct answer regarding daily recommended calorie intake.

Table 2. Health status and healthy behaviors (*N*=280)

	<i>n</i> (%)
General health status	
Poor	2 (0.7)
Fair	36 (12.9)
Good	129 (46.1)
Very good	91 (32.5)
Excellent	22 (7.9)

Anxiety	
None	129 (46.1)
Mild-severe	149 (53.2)
Depression	
None	234 (83.6)
Mild-severe	45 (16.1)
Days of poor physical health/month, mean (SD)	2.97 (5.56)
Days of poor mental health/month, mean (SD)	7.09 (8.41)
Days of poor daily activities/month, mean (SD)	3.10 (5.92)
Physical activity, MET-minutes/week, mean (SD)	4,006.3 (3,273.8)
Weekday sedentary hours/day, mean (SD)	8.75 (4.15)
Weekend sedentary hours/day, mean (SD)	7.60 (4.00)
SSB consumption > once a day	56 (20.0)
Nutritional knowledge: Daily recommended calorie intake	177 (62.8)

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; SSB, sugar-sweetened beverage

Predictors of Poor Health Status

The correlations among independent and dependent variables by Kendall's tau tests are shown in Table 3. Having more than 3 days of poor physical health per month had significant positive correlations with female ($r = 0.14, p = 0.017$), METs-minutes/week < 4,000 ($r = 0.14, p = 0.026$), weekday sedentary ≥ 8 hours ($r = 0.13, p = 0.037$), and weekend sedentary ≥ 8 hours ($r = 0.25, p < 0.001$). Having more than 3 days of poor mental health per month had significant correlations with age ($r = -0.25, p < 0.001$), female ($r = 0.15, p = 0.013$), college graduate ($r = -0.15, p = 0.011$), mild-severe anxiety ($r = 0.53, p < 0.001$), mild-severe depression ($r = 0.28, p < 0.001$), and weekend

sedentary ≥ 8 hours ($r = 0.19, p = 0.002$). Furthermore, having more than 3 days of poor daily activities per month had significant correlations with age ($r = -0.18, p < 0.001$), female ($r = 0.16, p = 0.010$), Hispanic ethnicity ($r = 0.19, p = 0.002$), college graduate ($r = -0.15, p = 0.011$), mild-severe anxiety ($r = 0.33, p < 0.001$), mild-severe depression ($r = 0.29, p < 0.001$), weekday sedentary ≥ 8 hours ($r = 0.14, p = 0.018$), and weekend sedentary ≥ 8 hours ($r = 0.17, p = 0.005$).

Table 3. Correlations with ≥ 3 days of poor physical/mental health and daily activities

	≥ 3 days of poor physical health	≥ 3 days of poor mental health	≥ 3 days of poor daily activities
Age	-0.07	-0.25***	-0.18***
Female	0.14*	0.15*	0.16*
Hispanic ethnicity	0.03	0.03	0.19**
College graduate	-0.02	-0.15*	-0.15*
Overweight/obesity	-0.02	-0.09	-0.08
Mild-Severe anxiety	0.11	0.53***	0.33***
Mild-severe depression	0.10	0.28***	0.29***
METs-minutes/week $< 4,000$	0.14*	0.03	-0.01
Weekday sedentary ≥ 8 hours/day	0.13*	0.09	0.14*
Weekend sedentary ≥ 8 hours/day	0.25***	0.19**	0.17**
SSB consumption $>$ once a day	-0.05	-0.001	-0.03

Note. Correlations by Kendall's Tau test; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$
 Overweight/obesity \geq BMI 25.0 kg/m²;
 MET, Metabolic equivalent; SSB, sugar-sweetened beverage

Multivariate logistic regression analyses are shown in Table 4 for each dependent variable. Table 4A shows that weekend sedentary ≥ 8 hours (odds ratio [OR]=3.01; 95%

confidence interval [CI] 1.72-5.26; $p < 0.001$) and METs-minutes/week $< 4,000$ (OR=1.87; 95%CI 1.05-3.34; $p = 0.033$) were positive predictors of having more than 3 days of poor physical health per month.

Table 4A. Multivariate logistic regression predicting ≥ 3 days of poor physical health

	OR	95%CI	<i>p</i> value
Weekend sedentary ≥ 8 hours/day	3.01	1.72 – 5.26	$<0.001^{***}$
Female	2.11	0.99 – 4.44	0.050
METs-minutes/week $< 4,000$	1.87	1.05 – 3.34	0.033*

Note. * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$; OR=odds ratio; CI=confidence interval

Table 4B depicts the predictors of poor mental health. For having more than 3 days of poor mental health days per month, the positive predictors were mild-severe anxiety (OR=8.79; 95%CI 4.58-16.9; $p < 0.001$) and weekend sedentary ≥ 8 hours (OR=2.08; 95%CI 1.08-3.99; $p = 0.028$), whereas the negative predictor was the age (OR=0.97; 95%CI 0.95-0.99; $p = 0.022$).

Table 4B. Multivariate logistic regression predicting ≥ 3 days of poor mental health

	OR	95%CI	<i>p</i> value
Mild-Severe anxiety	8.79	4.58 – 16.9	$<0.001^{***}$
Mild-severe depression	3.06	0.91 – 10.3	0.071
Weekend sedentary ≥ 8 hours/day	2.08	1.08 – 3.99	0.028*
Age	0.97	0.95 – 0.99	0.022*
College graduate	0.55	0.28 – 1.09	0.086

Note. * $p < 0.05$; *** $p < 0.001$; OR=odds ratio; CI=confidence interval

The positive predictors of having more than 3 days of poor daily activities per month were mild-severe anxiety (OR= 3.26; 95%CI 1.68-6.32; $p < 0.001$), mild-severe depression (OR=2.33; 95%CI 1.09-4.97; $p = 0.029$), weekend sedentary ≥ 8 hours (OR=1.94; 95%CI 1.07-3.50; $p = 0.029$), and Hispanic ethnicity (OR=3.18; 95%CI 1.35-7.53; $p = 0.008$) (Table 4C). In contrast participants being overweight/obese or the consumption of sugar sweetened beverages more than once a day did not predict poor physical or mental health status, nor did it predict poor daily activities.

Table 4C. Multivariate logistic regression predicting ≥ 3 days of poor daily activities

	OR	95%CI	<i>p</i> value
Mild-Severe anxiety	3.26	1.68 – 6.32	<0.001***
Mild-severe depression	2.33	1.09 – 4.97	0.029*
Weekend sedentary ≥ 8 hours/day	1.94	1.07 – 3.50	0.029*
Female	1.98	0.90 – 4.38	0.091
Hispanic ethnicity	3.18	1.35 – 7.53	0.008**

Note. * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$; OR=odds ratio; CI=confidence interval

Discussion

More than half of the participant in this study had mild to severe anxiety symptom, while 16% had mild to severe depressive symptoms. The study showed that individuals who spend up to eight or more hours sitting on weekend days have 2-3 times higher odds of having more than 3 days of poor physical and mental health as well as poor daily activities in a month. Individuals who have mild to severe anxiety or depression symptoms have 2-3 times higher odds of having more than 3 days of poor daily activities in a month. Finally, having physical activity levels less than 4,000 METs

minutes per week doubles the odds of having more than 3 days of poor physical health per month.

Based on this study, spending more than 8 hours per weekend day sedentary appears to be a consistent predictor of poor physical and mental health as well as of poor usual daily activities. A previously conducted cross-sectional survey showed that being sedentary for more than 11 hours per day increased depressive symptoms in participants (Stubbs et al., 2018). In contrast with the current study, the study by Stubbs et al. (2018) did not differentiate between weekday or weekend sedentary time and the increased risk of depressive symptoms was seen at 11 hours per day in comparison with only 8 hours or more per day in the current study. A similar study finding was also reported. A randomized controlled trial concerning sedentary behavior and depression and anxiety symptoms suggested that increasing sedentary time for even a single week might increase the risk for depressive symptoms in young adults (Blough & Loprinzi, 2018). In contrast with the current study, the increase in sedentary behaviors in this randomized controlled trial did not increase anxiety symptoms, but only depressive symptoms in participants. Unlike the current study, the Blough and Loprinzi (2018) study did not differentiate or examine the relationship of sedentary behaviors during specific times like weekdays versus weekend and physical or mental health.

In the current study, having mild to severe anxiety and depression symptoms place individuals at 2-3 times higher risk of having more than 3 days of poor daily activities. According to NIMH (2018a), depression and anxiety symptoms include a loss of interest in daily activities. This loss of interest in daily activities as a symptom of anxiety and depression may be a factor for the increased risk in poor daily activities. The

2010 Global Burden of Disease Study also found that depression was the leading cause of disability-adjusted life years out of all mental disorders (Furihata et al., 2018). According to previously conducted studies, regular physical activity and reduced time spent sedentary may reduce the symptoms of depression and anxiety (Stubbs et al., 2018; Rebar et al., 2014). The reduction of depressive and anxiety symptoms through increased physical activity may also reduce the number of days for poor daily activities for individuals and should be kept in mind for future interventional research.

Finally, having less than 4,000 METs minutes per week for participants doubles their odds of poor physical health in the month. According to the scoring of the IPAQ-SF this means that participants who are at less than a high level of physical activity are at an increased risk for poor physical health. Previously conducted research has shown that physical activity is one of the modifiable risk factors for cardiovascular disease and early death (Schuch et al., 2016). In contrast, studies have shown that an increase in sedentary behavior and physical inactivity places individuals at a higher risk for diseases such as obesity, diabetes, cancer, and cardiovascular disease (Stubbs et al., 2018). However, in comparison to the current study, previous studies did not indicate at what level a participant is at increased risk of poor physical health and only discussed whether participants were meeting the recommended 150 minutes per week of moderate exercise.

Further research is needed to determine the level at which physical activity may be a protective factor against poor physical health and the cause-and-effect relationship between the two variables. Further research is also needed to explore the effect of physical activity on mental health diseases as one research study showed that light levels of physical activity showed the most improvement on depression scores while moderate

and vigorous physical activity levels showed less improvement (Helgadottir, et al., 2017). Research is needed to determine what level of physical activity might be beneficial to both reduction of poor physical health and poor mental health for individuals.

Limitations

This study has several limitations. First, the study of findings of predictive relationship between anxiety and depression symptoms and poor health status should not be taken as a cause-and-effect relationship in this cross-sectional study. Second, the participants may over- or under-estimate the frequency and hours of their physical activity and sedentary behaviors in this self-reported online survey. Third, complexity of the question items on weekly physical activity may also cause over-estimation of participants' reports. Lastly, the participants recruited through Facebook were mostly female, Caucasians, and highly educated. This selection bias may limit generalizability of the study findings to other populations.

Implications for Practice

Based on the findings of this study, it is important for nurses to educate patients on the risks associated with sedentary behavior. This includes educating patients of the increased risk for poor physical health outcomes such as obesity, diabetes, and cardiovascular disease as well as the increased risk of anxiety and depressive symptoms. Individuals could benefit from being encouraged to sit less and move more. This may include recommending less screen time such as playing video games or watching TV, using a standing desk at work, taking walks with family members whenever possible, breaking up long periods of sitting by standing up and walking around every 30 minutes to an hour (Halloway & Buchholz, 2017). While in the hospital or acute care setting,

patients who are safely able may benefit from getting out of bed and ambulating throughout the day.

Patient's may benefit from education on the importance of stress management techniques to reduce the symptoms of depression and anxiety. These techniques include breaking up large tasks into smaller pieces to avoid being overwhelmed, spending time with loved ones, avoiding self-medication with alcohol or drugs, joining support groups, and participating in breathing exercise or activities an individual enjoys (NIMH, 2018). In addition to these stress management techniques, nurses might encourage individuals to participate in regular physical activities to decrease the symptoms of depression and anxiety while improving physical health. Individuals may benefit from education about the importance of meeting the recommended minimum of 150 minutes per week of moderate physical activity to improve health outcomes (USDHHS, 2018). Activities to meet these guidelines might include jogging, swimming, participating in a sports activity such as tennis or soccer, and brisk walking. Patients could benefit from increasing physical activity levels while being safe and aware of their ability levels.

Conclusion

Depression and anxiety are a serious medical condition that affects a large portion of the adult population. Individuals leading a sedentary lifestyle have an enhanced risk for both poor physical and mental health including negative outcomes such as obesity, diabetes, cardiovascular disease, and increased depressive or anxiety symptoms. Adequate levels of physical activity may be protective against poor physical health as well as able to decrease symptoms of depression and anxiety. Further studies are needed to determine the cause and effect relationship between sedentary behaviors on weekend

days and poor physical and mental health status. Future research could lead to the development of interventions that aim to reduce sedentary behaviors while increasing participation in regular physical activity to improve individual's overall health status.

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Appendix A

Thank you for your willingness to participate in this survey. Please complete the following questions by filling in the blank or checking the appropriate box. Your responses will be kept confidential and completion of this survey indicates your consent.

1. What is your age? _____ years old
2. What is your gender?
 - a. Male
 - b. Female
3. What is your ethnic background?
 - a. Non-Hispanic white
 - b. African-American
 - c. Hispanic
 - d. Asian/Pacific Islander
 - e. Other
4. What is your educational background?
 - a. High school graduate or less
 - b. Some college
 - c. College graduate
5. What is your weight? _____ lbs.
6. What is your height? _____ feet _____ inches
7. Have you ever been screened for depression as an adult?
 - a. Yes
 - b. No
8. Would you state that in general your health is:
 - a. Poor
 - b. Fair
 - c. Good
 - d. Very good
 - e. Excellent
9. Now thinking about your physical health, which includes physical illness and injury, for how many days during the **past 30 days** was your physical health **not** good?
_____(0-30 days)

10. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the **past 30 days** was your mental health **not** good?

_____ (0-30 days)

11. During the **past 30 days**, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

_____ (0-30 days)

12. How many Calories is a healthy adult supposed to consume each day?

_____ Calories

13. How often do you drink soda (soft drinks excluding diet soda)?

- a. Twice or more a day
- b. Once a day
- c. Once to 6 times a week
- d. Once to 3 times a month
- e. Never

14. How often do you drink fruit juice (orange juice, apple juice, etc.)?

- a. Twice or more a day
- b. Once a day
- c. Once to 6 times a week
- d. Once to 3 times a month
- e. Never

15. How often do you drink sports/energy drinks?

- a. Twice or more a day
- b. Once a day
- c. Once to 6 times a week
- d. Once to 3 times a month
- e. Never

On a typical WEEKDAY, how much time do you spend (from when you wake up until you go to bed) doing the following?

1. Watching television (including videos on VCR/DVD).
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

2. Playing computer or video games.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

3. Sitting listening to music on the radio, tapes, or CDs.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

4. Sitting and talking on the phone.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

5. Doing paperwork or computer work (office work, emails, paying bills etc.).
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

6. Sitting reading a book or magazine.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

7. Playing a musical instrument.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

8. Doing artwork or crafts.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

9. Sitting and driving in a car, bus, or train.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

On a typical WEEKEND DAY, how much time do you spend (from when you wake up until you go to bed) doing the following?

1. Watching television (including videos on VCR/DVD).
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more
2. Playing computer or video games.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more
3. Sitting listening to music on the radio, tapes, or CDs.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

4. Sitting and talking on the phone.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

5. Doing paperwork or computer work (office work, emails, paying bills etc.).
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

6. Sitting reading a book or magazine.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

7. Playing a musical instrument.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

8. Doing artwork or crafts.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

9. Sitting and driving in a car, bus, or train.
 - a. None
 - b. 15 min. or less
 - c. 30 min or less
 - d. 1 hr.
 - e. 2 hrs.
 - f. 3 hrs.
 - g. 4 hrs.
 - h. 5 hrs.
 - i. 6 hrs. or more

Please answer how you currently describe your feelings.

1. I feel tense or 'wound up'.
 - a. Most of the time
 - b. A lot of the time
 - c. From time to time, occasionally
 - d. Not at all

2. I still enjoy the things I used to enjoy.
 - a. Definitely as much
 - b. Not quite as much
 - c. Only a little
 - d. Hardly at all

3. I get a sort of frightened feeling as if something awful is about to happen.
 - a. Very definitely and quite badly
 - b. Yes, but not too badly
 - c. A little, but it doesn't worry me
 - d. Not at all

4. I can laugh and see the funny side of things.
 - a. As much as I always could
 - b. Not quite so much now
 - c. Definitely not so much now
 - d. Not at all

5. Worrying thoughts go through my mind.
 - a. A great deal of the time
 - b. A lot of the time
 - c. From time to time, but not too often
 - d. Only occasionally

6. I feel cheerful.
 - a. Not at all
 - b. Not often
 - c. Sometimes
 - d. Most of the time

7. I can sit at ease and feel relaxed.
 - a. Definitely
 - b. Usually
 - c. Not often
 - d. Not at all

8. I feel as if I am slowed down.
 - a. Nearly all the time
 - b. Very often
 - c. Sometimes
 - d. Not at all

9. I feel a sort of frightened feeling like 'butterflies' in the stomach.
 - a. Not at all
 - b. Occasionally
 - c. Quite often
 - d. Very often

10. I have lost interest in my appearance.
 - a. Definitely
 - b. I don't take as much care as I should
 - c. I may not take quite as much care
 - d. I take just as much care as ever

11. I feel restless as I have to be on the move.
 - a. Very much indeed
 - b. Quite a lot
 - c. Not very much
 - d. Not at all

12. I look forward with enjoyment to things.
 - a. As much as I ever did
 - b. Rather less than I used to
 - c. Definitely less than I used to
 - d. Hardly at all

13. I get sudden feelings of panic.
 - a. Very often indeed
 - b. Quite often
 - c. Not very often
 - d. Not at all

14. I can enjoy a good book or radio or TV program.
 - a. Often
 - b. Sometimes
 - c. Not often
 - d. Very seldom

Think about all the **Vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities **➔ Skip to question 3**

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**
_____ **minutes per day**

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

No moderate physical activities **➔ Skip to question 5**

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**
_____ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes time?

_____ **days per week**

No walking

➔ **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

The last question is about the time you spend **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

This is the end of the questionnaire, thank you for participating.