

THE RELATIONSHIP BETWEEN EXERCISE AND MENTAL HEALTH IN COLLEGE  
STUDENTS

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**Title**

The Relationship Between Exercise and Mental Health in College Students

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**DOCTOR OF PHILOSOPHY**

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## ABSTRACT

The purpose of this study was to evaluate the influence of an exercise program on aspects of wellness in college students. The study explored changes in physical fitness and on self-reports of anxiety and depression symptoms before and after participating in a six-week exercise program at a Midwestern university. The study participants consisted of 53 undergraduate students from activity courses, and 25 undergraduate students from a lecture course. The Burns' Anxiety Inventory, Burns' Depression Inventory, and the Attitudes Towards Exercise Inventory were used for assessment. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

Results indicated significant differences existed between pre- and post-scores for the treatment group that participated in the six-week exercise program in categories of anxiety, depression, attitudes/beliefs that exercise can improve mental health, and maximal oxygen uptake ( $VO_2$  max) scores which indicate cardiorespiratory fitness. Non-significant differences were found between pre and post data in the measures of attitudes in the stages of change, body composition and Body Mass Index for the treatment group. In the control group, a significant difference was noted in  $VO_2$  max, but no differences were found in all other categories of anxiety, depression, attitudes towards exercise, body fat, and Body Mass Index.

Results from this study indicate that an exercise prescription may be used as a tool to alleviate symptoms of depression and anxiety in college students. Additional studies may confirm significance in reducing anxiety and depression symptoms or seeing changes in body composition while adhering to a regular exercise program.

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## **DEDICATION**

To Dalton.

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## CHAPTER 1. INTRODUCTION

Lasker, Weiss, and Miller (2001) said, “The unique advantage of collaboration can be realized when the partnership as a whole is greater than the sum of its parts” (p.165). To name a few, disciplines such as nutrition, psychology, and exercise science are increasingly coming together in order to understand wellness in a holistic way. For approximately 20 years, the study of wellness has developed across disciplines to describe a holistic approach for understanding human development and for improving quality of life (Myers, Sweeney, & Witmer, 2000). For example, wellness experts are beginning to examine correlations between spiritual and physical health, physical and mental health, social and mental health, and so on. The increasing number of wellness programs being created on university campuses show the recognition of the importance of the holistic development and well being of college students (Sivik, Butts, Moore, & Hyde, 1992). Research on psychological well-being, life satisfaction, and happiness has greatly increased in the last 30 years (Myers & Diener, 1995), and these areas have become an important part of assessment for college students (Pascarella & Terenzini, 1991). College students’ sense of psychological well-being comes from their quality of life (Hermon & Hazler, 1999), measured in one study by the Wellness Evaluation of Lifestyle [WEL] (Myers, Sweeney, Witmer, & Hattie, 1998). Bezner, Adams, and Whistler (1999) have shown that exercise affects quality of life, perceptions of well-being, self-concept, self-esteem, life satisfaction and happiness. There is an increased need specifically for the fields of exercise and mental health to understand and share concepts with one another for the benefits of those they serve.

There has always been a connection between mental health and exercise. Benjamin Rush, the father of psychiatry, recommended exercise. William James, the father of psychology, recognized that exercise helped in mood regulation and decreased anxiety (Dishman, Washburn,

& Heath, 2004). It is reasonable to question what scientific evidence supports these positions. Few studies have attempted to determine a relationship between exercise and mental well-being (Insel & Roth, 2005), but research in this area has increased in the last 30 years. Most of the research about the connection between mental health and exercise has been done with older adult populations reporting positive mental health benefits resulting from exercise participation (Antunes, Stella, Santos, Bueno, & de Mello, 2005; Brown, Yore, Ham, & Macera, 2000; Burbank, Reibe, Padula, & Nigg, 2002; Chandler & Hadley, 1996; Chodzko-Zajko, et al., 2009; Morgan & Goldston, 1987; Netz & Wu, 2005; Tanaka, et al., 2009.)

### **Purpose**

The purpose of this study was to evaluate the influence of an exercise program on aspects of wellness in college students. The study explored changes in physical fitness and on self-reports of anxiety and depressive symptoms before and after participating in a six-week exercise program at a Midwestern university. Assessment tools that were used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and an Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

Further research targeting the effects of exercise on anxiety and depression needs to be conducted in order to expand the existing body of knowledge. This paper will add to the body of research by examining the specific effects of exercise on anxiety and depression in the college-aged population.

## **Rationale**

Finding alternative, cost-efficient, and easy-to-implement solutions for those suffering from anxiety and depressive symptoms was inspiration for this study. Several studies have measured the effects of exercise on mental health in older adults, yet additional studies need to focus on the college-age population. This study extends results from previous studies with older participants to the college-aged population, who are increasingly suffering effects of depression and anxiety (American College Health Association, 2009). Counselors on college campuses, faculty and staff, as well as exercise professionals and anyone working with college students can benefit from the findings of this research study.

## **Research Questions**

- 1) Will participants vary in their self-reported ratings of anxiety and depression before and after the completion of an exercise program?
- 2) Will participants' attitudes towards exercise and readiness to change occur during the course of the study?
- 3) How much physical change will occur in this exercise program?
  - a. Will physical changes be evident in fat loss?
  - b. Will participants show a change in cardiovascular health?

## **Limitations**

Though this research offers practical implications and informs research, limitations may exist in the generalization of the findings of this study because of the convenience sampling method versus random sampling, and the short duration of intervention without a long-term follow-up. The study collected information from participants at two specific points in time throughout the spring semester. Future longitudinal research to assess changes over time may

prove beneficial to further inform the body of research on this topic. Optimal study conditions would provide observation of changes of a long-term exercise program. Also, the wellness-related course content that participants received in the activity courses may be related to survey topics, and may have had an influence on the treatment groups' survey responses.

This study is limited to predominately traditional college students in the Midwest and is time-limited since students are enrolled in semester-long classes. The control group was predominantly female, which also may affect outcomes and may decrease generalizability of the study to the overall college population.

By having students log/recall their exercise participation, bias may have occurred in participants who want to appear as they exercised more than they actually did. Participants were motivated by extra credit, and may have reported they participated in activity when they really did not. Other considerations, such as changes in food intake, medications, therapy, and other variables that may affect results were not controlled with the proposed study. Another concern is that unforeseen health problems or other issues may have arisen in study participants throughout the study period that may challenge completion of the study or affect reports of anxiety or depression. The study was conducted during the shortened daylight of winter versus the longer daylight in summer that may affect results in the levels of depression, anxiety, and limitations to physical activity. A final consideration is that anxiety and depression may fluctuate at certain times throughout the semester. For example, students may experience higher levels of anxiety or depression before or after final exams or other times throughout the semester. Pre testing for the present study occurred towards the beginning of the semester, and the post testing took place

close to the time when students prepared for final exams at the end of the semester. In future studies, these factors could be explored to further inform the research on how anxiety and depression are experienced at different times throughout a standard semester.

As explained in the literature review, confounding factors may exist that prevent researchers from determining if exercise alone has helped depression and anxiety alone. Those who suffer from anxiety/depression may also experience other mental disorders at the same time (Kessler, Berglund, Demler, Jin, & Walters, 2005).

### **Definition of Terms**

Anxiety: According to Gladding (2006), anxiety is a mental and physical nervousness and uneasiness, often resulting in increased tension, usually associated with pressure to please, fear of failure, or fear of the unknown. Furthermore, Gladding describes anxiety as being connected to concrete events or free floating and not attached to one particular thing. The National Institute of Mental Health [NIMH], (2011) explains the symptoms of anxiety to include visible signs such as sweating, fatigue, headache, irritability, twitching, trembling, difficulty swallowing, and blushing.

Body Composition: Body composition is defined by the amount of fat and nonfat components in the body. The fat component of body composition is measured as a percent of body fat or fat mass. The nonfat component is called the lean body mass (Hoeger & Hoeger, 2008).

Body Mass Index (BMI): A method for defining obesity by height and weight (World Health Organization [WHO], 2008).

Cardiovascular Fitness: Cardiovascular fitness is the efficiency of the circulatory system to deliver oxygen to the muscles working to maintain prolonged types of physical activity (American College of Sports Medicine [ACSM], 2006).

Counseling: The application of mental health, psychological or human development principles, through cognitive, affective, behavioral or systemic interventions strategies that address wellness, personal growth, or career development, as well as pathology (Gladding, 2006).

Depression: Depression is defined by Gladding (2006) as a common as well as major disorder characterized by sadness, dejection, lack of energy, hopelessness, and loneliness. Gladding also identifies that depression may be chronic or acute, mild or severe. NIMH (2011) identifies depressive symptoms as a person that is persistently sad, anxious, or “empty”; hopeless and/or pessimistic; irritable/restless; fatigued/decreased energy; difficulty concentrating; overeating or appetite loss; thoughts of suicide; persistent aches/pains, headaches, cramps or digestive problems that do not ease with treatment. Depression often coexists with anxiety symptoms.

Duration: Duration is related to amount of time that is spent on a specific activity, such as hours or minutes (Thomas, Nelson, & Silverman, 2005).

Frequency: Frequency in exercise refers to the number of times per week or a given period of time that an individual is physically active (Thomas, Nelson, & Silverman, 2005).

Intensity: Intensity can be described as the level of difficulty of a specific activity. It is usually described as light, moderate, or vigorous activity. One way that intensity can be described is with rating of perceived exertion, which depicts how much effort one feels they are putting out and is used to monitor intensity (Noble & Robertson, 1996). Intensity can also be

measured relatively according to the percentage of oxygen uptake or maximum heart rate. Each method of describing intensity has strengths and weaknesses (Thomas, Nelson, & Silverman, 2005).

Physical Activity: Body movement produced by contraction of skeletal muscles that substantially increases energy expenditure (American College of Sports Medicine, 2006).

V<sub>O<sub>2</sub> max</sub>: V<sub>O<sub>2</sub> max or maximal oxygen uptake, is a common and widely accepted measure of cardiovascular fitness measured by an interaction between oxygen utilization, and the pulmonary and cardiorespiratory systems. (Thomas & Gengenbach, 2007).</sub>

Wellness: Wellness is a complex term affecting those of all ages (Miller & Iris, 2002). Early definitions of wellness included that wellness was a way of life (Dunn, 1959). Since 1947, the World Health Organization has described wellness in a positive light, more than just an absence of disease (WHO, 1947). The philosophy of wellness has become a way of looking at illness from a strength-based and developmental perspective (Gerstein, 2006). Wellness has been defined by most experts as a multidimensional state of being in positive health as exemplified by quality of life and a sense of well-being (Adams, Bezner, & Steinhardt, 1997; Corbin, Lindsey, Welk, & Corbin, 2002; Payne & Hahn, 2000). Wellness has been nationally defined by the United States Department of Health and Human Services [USDHHS] as a focus on quality of life and activities to reduce illness (USDHHS, 2010). Reicherter and Greene (2005) define wellness as a balance of physical, emotional, social, spiritual, intellectual, and occupational components. Definitions of wellness may come from a sociological point of view (Veenhoven, 2007), medical stand point (Stewart, Ware, Sherbourne, & Wells, 1991), or a number of different disciplines-all of which vary slightly from one another.

The number of categories that exist in wellness have been debated to range from two to seven or more, but the most popular categories include physical, social, emotional/mental, spiritual, and intellectual (Adams, Bezner, & Steinhardt, 1997; Corbin, Lindsey, Welk, & Corbin, 2002). There is a growing consensus that professionals working in the fields of health should look at wellness in a more holistic and collaborative manner. For approximately 20 years, the study of wellness has developed across disciplines to describe a holistic approach for understanding human development and for improving quality of life (Myers, Sweeney, & Witmer, 2000).



## CHAPTER 2. REVIEW OF THE LITERATURE

As identified in the previous section, the purpose of this study was to evaluate the influence of an exercise program on aspects of wellness in college students. The study explored changes in physical fitness and on self-reports of anxiety and depressive symptoms before and after participating in a six-week exercise program at a Midwestern university. Assessment tools that were used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and an Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness. The following literature review relates to the aforementioned research questions:

1. Will participants vary in their self-reported ratings of anxiety and depression before and after the completion of an exercise program?
2. Will participants' attitudes towards exercise and readiness to change occur during the course of the study?
3. How much physical change will occur in this exercise program? (Specifically pertaining to fat loss and cardiovascular health)

### **Mental Health**

Mental health is defined by the National Institute of Mental Health as the way one thinks, feels, and acts when coping with life and involves continued forward movement in abilities to perform daily physical tasks and challenges (National Institute of Mental Health, 2007). The Surgeon General describes mental health as a "state of successful performance of mental function, resulting in productive activities, fulfilling relationships with other people, and the ability to adapt to change and to cope with adversity" (USDHHS, 1999, p. 4). Mental illness

refers to all diagnosable mental disorders: “health conditions that are characterized by alternations in thinking, mood, or behavior associated with distress and/or impaired functioning” (USDHHS, 1999, p. 4). Mental health is further defined by the World Health Organization as one of the core elements of wellness, along with physical and social well-being (1964). Mental health is not only the absence of illness, but the capability to respond positively to stressors in life.

College is a stressful time of challenges and transitions. College students are balancing many demands between classroom expectations, work, extracurricular activities, social life, and more (Thome & Espelage, 2004). The risk for mental health issues is increased for college students facing a great deal of stress (Kadison & DiGeronimo, 2004).

### **College Students, Depression and Anxiety**

Rates of depression and anxiety in college students are salient issues to explore. The National Mental Health Association [NMHA] (2005) reported the following statistics on depression and anxiety in college students:

- Depression affects over 19 million American adults annually, including college students. At colleges nationwide, large percentages of college students are feeling so depressed that they are unable to function. Ten percent of college students have been diagnosed with depression, including 13% of all college women (NMHA, 2005).
- Anxiety disorders affect over 19 million American adults every year, and anxiety levels among college students have been rising since the 1950s. In 2000, almost seven percent of college students reported experiencing anxiety disorders

within the previous year. Women are five times as likely as men to have anxiety disorders (NMHA, 2005).

In 2009, the American College Health Association [ACHA] indicated that depression and anxiety continue to be two of the most common health problems that university students experience, and are often experienced concurrently. The National Co-Morbidity Survey indicated that anxiety is the third most prevalent mental illness in the US, following depression and alcoholism (Kessler et al. 2005). The National Institute of Mental Health (2011) reported 18.1% of individuals in the United States suffer from Generalized Anxiety Disorder, and 6.7% suffer from Major Depressive Disorder. Anxiety and other comorbid conditions increase the lifetime occurrence of suicide ideation and suicide attempts (Lepine & Lellouch, 1995). Eighty-five percent of people with anxiety disorders experience academic or occupational difficulties due to their inability to meet demands in maintaining relationships or employment (Bruce & Saeed, 1999).

In 2005, 17.0% and 13.2% of students who completed the American College Health Association's National College Health Assessment (N = 80,121) reported that they had experienced depression and anxiety, respectively. Students who completed this survey also indicated that depression and anxiety frequently interfered with their academic performance. The American Psychiatric Association (2000) reported that half of all college students reported feeling so anxious and depressed during their college experience that they had difficulty functioning.

According to Reavley and Jorm (2010), "The age at which most young people are in higher education is also the age of peak onset for mental and substance use disorders, with these having their first onset before age 24 in 75% of cases. In most developed countries, over 50% of

young people are in higher education” (p. 134). “Face-to-face, cognitive–behavioral/skill-based interventions” (p. 132) resulted in the most effective strategies to prevent or intervene early with depression or anxiety in college students (Reavley & Jorm, 2010).

The number of university students who are coming to campus with complicated mental health care needs is growing on all campuses across the nation (Benton, Robertson, Tseng, Newton, & Benton, 2003). For example, the proportion of students over a 13-year period (N = 13,257) who received counseling center treatment for depression, anxiety, or suicide almost doubled from 21.1% to 40.7%, 36.3% to 62.9%, and 4.8% to 8.9%, respectively. University counseling centers report increases not only in the use of student services, but also in the length of service utilization. In a survey, 60% of university counseling center directors reported record numbers of students using their services for extended periods of time (National Survey of College Counseling Center Directors, 2005.) This survey reported that approximately 30% of college students see a counselor during their first four years of college, with numbers increasing each year.

Students seek help at a counseling center at their college campus for a number of different reasons. Below is a chart depicting the number of Midwestern campus’ students who came to the counseling center for issues of depression, social, and generalized anxiety, compared to the national average of college students (Center for the Study of Collegiate Mental Health, 2010).

The national sample was taken from 19,193 college students who sought services at 52 different institutions of higher education for counseling services during the fall semester of 2009 (Center for the Study of Collegiate Mental Health, 2010). Age ranged from 18 – 63.3 years, with a mean age of 22.6 years. The sample consisted of 64.2% females, and 35.4% male. Race was

self-reported as 72.6% of the sample as White/Caucasian, 7% as Black/African American, 6% as Asian/Asian American, 4.9% as Hispanic/Latino, 3.1% as Multiracial, 2.7% Preferred not to answer, 2.5% as other, .05% as Native American, and .03% as Native Hawaiian or Pacific Islander. First year students consisted of 18.1% of the sample, 19.7% were sophomores, 22.1% were juniors, 22.8% were seniors, and 14.9% were graduate students (Center for the Study of Collegiate Mental Health, 2010).

Table 1

*Reasons to Seek Counseling on Campus: Midwest vs. National Average*

	National Average Score (N=19,193)	Midwest Counseling Center (N=779)
Depression	40-41%	41-42%
Social Anxiety	50-51%	51-52%
Generalized Anxiety	41-42%	51-54%

(Center for the Study of Collegiate Mental Health, 2010)

At a counseling center at the Midwestern campus between 7/1/2010 to 6/30/2011, 779 students came in for services and were compared to the national normative sample above. There were no comparative data available from the Midwestern campus' counseling center on mean age, race, gender, etc. The Midwestern campus' scores closely resembled those of the national average in the category social anxiety, but were slightly higher in the category of depression, and higher in the category of generalized anxiety (Center for the Study of Collegiate Mental Health, 2010).

Kadison and DiGeronimo (2004) state in their book, *College of the Overwhelmed: The Campus Mental Health Crisis and What to Do about It*:

If your son or daughter is in college, the chances are almost one in two that he or she will become depressed to the point of becoming unable to function; one in two that he or she will have regular episodes of binge drinking; and one in ten that he or she will seriously consider suicide. In fact, since 1998, the likelihood of a college student suffering depression has doubled, suicidal ideation has tripled, and sexual assaults have quadrupled (p. 1).

These researchers go on to say that many students are dropping out of college due to mental illness and that lengthy waitlists exist at counseling centers to meet the demand for services.

In 2005, the American Psychiatric Association [APA] appointed a Presidential Task Force on Mental Health on College Campuses in the US (Wampold, Goodheart, & Levant, 2007). They reported that more students enter college already taking psychiatric medications, and more colleges are reporting increases in severe psychopathology in students. The APA also reported that campus mental health centers were prescribing more medications, and that suicide was the second leading cause of death among students.

The ACHA surveyed college students' mental and physical health in 2000. The survey, National College Health Assessment, included data from over 16,000 students at 20 public colleges or universities and at eight private colleges or universities throughout the United States (ACHA, 2005). The assessment revealed that 10 percent of all students surveyed had been diagnosed with depression (ACHA, 2005).

A potential cause for depression and anxiety in college students may be perfectionism and increased pressure to perform well. Literature has shown a relationship between perfectionism and depression (Blatt, 1995) and anxiety (Diffenbacher & Suinn, 1986). In a clinical study by Alden and Wallace (1991), the thoughts, feelings, and behaviors associated with perfectionism were the same as those who suffered from diagnosed anxiety. Perfectionism is defined by Frost, Marten, Lahart, and Rosenblate (1990) as having excessively high personal standards; a need for, and pursuit of organization; a chronic concern of mistakes; and frequent doubts about one's actions. Mental health risks ensue from constantly putting more pressure on oneself to succeed. The atmosphere at college is a setting where standards to succeed are climbing. Kadison and Geronimo (2004) said: "...college students today are more driven to succeed than any generation before them-and more likely to break down" (p. 124). Higher ratings of suicide ideation result from students who set higher standards for themselves and believed others expected excellence of them in their performances (Hewitt, Flett, & Weber, 1994). In addition to contributing to anxiety and/or depression, perfectionism is also associated with unhealthy eating, anorexia, and bulimia (Halmi et al., 2000).

### **College Students and Stress**

Stress may also be the culprit for producing anxiety and depression in college students. Anxiety and depression are often a result of stress. When stress is perceived negatively or if a student experiences too much stress, physical or psychological impairment may occur (Misra, McKean & West, 2000). Researchers reported that some of the most common reactions to stress in students include emotional reactions, such as worry, fear, guilt, anxiety, anger, grief, and

depression. Students who experience higher levels of stress are known to have a higher likelihood to engage in unhealthy behaviors such as drinking alcohol, eating nutrient-lacking food, or not getting enough sleep.

Ross, Niebling, and Heckert (1999) examined the major sources of stress in college students. In their study, 100 undergraduate students at a Midwestern university were given the Student Stress Survey, which is a combination of the Student Stress Scale and the Taylor Manifest Anxiety Scale. The results attributed 81.1 % of all stress sources to daily pressures and hassles. They conclude that students need to develop the skills and resistance to handle these stresses, so the stress does not develop into depression and/or anxiety.

In 2009, the Center for the Study of College Student Retention surveyed more than 2,200 college students across 40 colleges and universities and found that stress was greatly affecting students' performances and that they were not seeking help for their stress or other problems. They also reported that there is a waitlist at many Universities for students to get in to see a counselor.

The Center for the Study of College Student Retention reported:

- Eighty five percent of students felt stressed on a daily basis.
- Academic concerns such as grades scored at 77 % of all students.
- Six out of 10 students reported having felt so stressed they could not complete their schoolwork on one or more occasions.
- Since starting college, over 70% of students did not consider talking to a counselor to help them deal with stress or any other emotional or mental health issues.



Misra and McKean (2000) studied the difference in stress levels between males and females in college. Compared to males, females reported higher levels of stress. A study by Hudd et al. (2000) revealed that in a survey of 145 undergraduate students, 63.8% of women reported feeling stressed often, compared to only 36.3% of males.

Towbes and Cohen (1996) created the College Chronic Life Stress Survey. They found that first-year students scored higher than other students in chronic stress. Misra and McKean (2000) also found that emotional, behavioral, and physiological reactions to stress were higher among freshman than any other group of students.

A possible explanation for freshman experiencing more stress than upper class students is the fact that they have not yet established a strong social support system. Allen and Hiebert (1991) indicated that freshmen and sophomores lack social support networks and have not developed coping mechanisms to deal with stress that comes with the traditional college experience. According to a 2004 study by the National Alliance on Mental Illness, students are most likely to turn to friends should they experience a serious emotional problem while at school. Further results showed that 62 percent of students reported that they would turn to a friend, 46 percent would go to a parent, but only 30 percent would visit a campus counseling facility. Joining a group exercise program may be a good opportunity to help increase the social opportunities and support of students, and provide an effective protective factor against stress.

Social support is very important to maintaining or adopting healthy behaviors. Lau, Quadrel, and Hartman (1990) have shown that there is substantial change in health behaviors during the first three years of college and that peers and friends can have a strong effect on the types and amount of health changes.

## **Effects of Exercise on Depression and Anxiety**

Explanations on the etiology of mental disorders such as anxiety and depression come from various perspectives including genetic, biological, biopsychosocial, neurochemical, neuropsychological, physiological, behavioral, sociological, psychodynamic, cognitive, and so on. The etiology of depression and anxiety is too wide in range to cover fully in the scope of this paper. The most basic principles will be provided in this section.

From the biological/physiological perspective, depression and/or anxiety can be attributed to an imbalance in serotonin, dopamine, and norepinephrine, the neurotransmitters responsible for positive feelings (Remick, 2002). Serotonin affects emotional states, such as depression and anxiety, mood, and sleep; dopamine is responsible for pleasure centers in the brain and motor control; norepinephrine affects sleep, pain tolerance, attention, mood, and anxiety. Another group of neurotransmitters are called beta-endorphins. Beta-endorphins are responsible for pain-blocking perception and aid in elevation of mood (Silverthorn, 2004). Serotonin, dopamine, and beta-endorphins in the brain can be detected immediately after exercise (Myer, 2004; Weicker & Struder, 2001).

Even small amounts of physical activity can produce benefits to well-being. Taylor (2004) reveals that a ten-minute walk can improve well-being for two-hours. Similar “dose-response” effects studied by several researchers determined an inverse relationship between exercise and depression and anxiety (Babykak, et al., 2000; Dunn, Trivedi, & O’Neal, 2002; Goodwin, 2003). An immediate result of exercise is that it takes 4 to 6 hours after the workout for anxiety levels to return to the pre-exercise state (Landers, 1999). Landers (1999) indicated that positive mental health effects begin during the first occurrence of exercise and its effects are ongoing. Positive physiological changes from exercise have been noted to occur within six days

of the onset of an exercise regimen (Rogers & Vanamoto, 1988). Some of the changes reported from exercise in the first two weeks of an exercise study were increases in maximal oxygen uptake and reductions in heart rate and blood pressure (Rogers & Vanamoto, 1988).

Aerobic activity has consistently revealed the greatest mental health benefits for exercise participants, in comparison to resistance training (Babyak et al., 2000; Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Lawlor & Hopker, 2001). Low to moderate exercise has been recommended, rather than intense exercise for reducing anxiety and depression feelings (Tankaka et al., 2009). Studies have confirmed that an improved mood and reduction in depressive symptoms occurred even in an absence of the social benefits of group exercise (Babykak et al., 2000; Landers, 1999). This reveals that additional mental health benefits result from exercise, apart from the emotional and social benefits that result from exercising with others.

#### **Additional Benefits of Exercise on Mental Health, Depression, and Anxiety**

Misra and McKean (2000) reported that students experienced benefits from leisure activity that significantly reduced their academic stresses in areas of conflict, change, and frustration. The same study revealed students benefitted in their behavioral and cognitive reactions to stressors. This study suggested that time management, exercise, and leisure activity can help to reduce anxiety.

Most of the research on physical activity and mental health has focused on how exercise can benefit moderate cases of depression and anxiety in the general population or older adults (Morgan & Goldston, 1987). Though exercise has been shown to help, the types and severity of anxiety or depression that one faces needs to be taken into consideration when determining how much exercise can benefit a person's mental health status. Generally, acute anxiety responds

better to general forms of exercise than chronic anxiety (Paluska & Schwenk, 2000). The effectiveness of exercise on severe depression and anxiety has not been demonstrated (Dishman, et al., 2004). Research suggests that forms of group exercise are well accepted by people with serious mental illness and are often considered one of the most valued components of treatment (Richardson, et al., 2005). Those who suffer from anxiety/depression may also be experiencing other mental disorders, and this makes it challenging to determine if exercise alone improves depression or anxiety (Kessler, Berglund, Demler, Jin, & Walters, 2005).

In addition to potentially alleviating symptoms of depression, one's self-concept can improve with exercise, by improving one's appearance and increasing self-esteem (Sonstroem, 1998). To increase self-esteem, Babyk et al., (2001) concluded that people can gain psychological benefits by being able to incorporate their own exercise program to help their mental health and see positive benefits, rather than relying on another in counseling or something outside of their own control. This idea of the benefits of self-change is consistent with the Transtheoretical model and self-efficacy theories (McKenzie & Smelter, 2001; Prochaska, Norcross, & DiCembente, 2005).

Evidence has shown that exercise can affect clinical populations similarly to psychotherapeutic interventions, and can help self-esteem and social withdrawal (Richardson, et al., 2005). North, McCullagh, and Zung (1990) also provided data suggesting that exercise can be as effective as psychotherapy. Lawlor and Hopker (2001) identified that aerobic exercise alone had a greater effect in reducing depressive symptoms than psychotherapy. In experimental studies, outpatient clients with depression improved the most when a combination of exercise and psychotherapy occurred (North, McCullagh, & Zung, 1990).

In a recent meta-analysis Fournier et al. (2010) found that in patients with mild or moderate depression symptoms, a drug treatment response was minimal or nonexistent. Medications may not work for many reasons, including poor adherence or improper doses. Data suggests that around 20% of people need 10–12 weeks or more before responding to the medications for anxiety and depression (Tedeschini, Fava, & Papakostas, 2011). Exercise may provide an additional or alternative cost-effective option in helping to alleviate symptoms of depression and anxiety without the wait or while waiting for the benefits of medication to take effect, side-effects or additional cost of medication. Physical activity should also be considered as a protective factor in the initial development of anxiety and/or depression for all ages. Exercise has been shown to reduce the chances of developing mental illness, including clinical depression in a study conducted by Smith et al. (2007). The evidence has suggested that aerobic activity can improve psychological well-being in non-clinical and clinical populations (Cox, Thomas, Hunton, & Donahue, 2004; Wipfli, Rethorst, & Landers, 2008).

Exercise may help students with their studies, through the improvement of their cognitive functioning. Physical fitness has been positively related to the preservation of cognitive function, and a high level of fitness may protect against cognitive dysfunction for all ages (Barnes, Yaffe, Satariano, & Tager, 2003).

Research on the effects of exercise and cognitive functioning has been done for a long time. Clarke (1958) reviewed seven studies and found that all the results supported the hypotheses that exercise adds to the enhancement of cognitive functioning. Tomporowski and Ellis (1986) reviewed 27 studies and came to the conclusion that general exercise produces short-term improvement on cognitive tasks, but that the results of the studies were conflicting. Etnier, et al. (1997) reviewed approximately 200 studies and reviews and while claiming mixed results,

did report from their meta-analysis that exercise has a slight positive effect on cognition. The authors also conclude that short term cases of exercise lasting less than three months are not likely to be very influential, whereas long-term exercise programs lasting for three months to one year or more are more likely to impact cognitive functioning.

Morgan and Goldston (1987) studied depression symptoms in men after beginning an exercise program, and found that symptoms reduced. Not only can exercise produce psychological benefits that are similar to the effects of psychotherapeutic interventions in clinical populations, evidence has shown that exercise also can improve self-esteem and reduce social withdrawal (Richardson, et al., 2005) A person's self-concept can improve with exercise by improving one's appearance, which contributes to increased self-esteem (Sonstroem, 1998). Mees (2003) concludes that exercise, new interests and experiences, and social interaction may help preserve mental function for all ages.

The effects of a sedentary lifestyle are often ignored when considering its potential impact on mental health (Paluska & Schwenk, 2000). Overall, physical activity in the United States is well below the recommended amounts needed for good health. More than 50% of adults in the United States do not get enough activity to ensure health benefits (ACSM, 2006). Because the research indicates that depression is more likely to occur among people who are sedentary or report little physical activity (Paluska & Schwenk, 2000), the lack of physical activity in college students is a major concern.

The World Health Organization (2008) predicted that depression will be the second leading cause of death, following cardiovascular disease, by the year 2020. In addition to depression, other negative effects of inactivity may include chronic disease, such as diabetes, obesity, or a number of other chronic health conditions. Hoffman et al. (2005) reported that 83%

of all individuals with severe mental illness are obese or overweight. This may be a result of medication side effects, and may result in further problems for the person. In addition to negative physical health conditions that may result from obesity, the inactive person is at risk for social stigmatization, discrimination, and psychological problems (Hoffman et al., 2005).

### **College Students and Exercise**

The transition that occurs between adolescence into adulthood is associated with increased sedentary behaviors (Gordon-Larsen, Nelson, & Popkin, 2004). Forty to fifty percent of college students do not meet recommended exercise guidelines (Keating, Guan, Pinero, & Bridges, 2005). A sedentary lifestyle often leads to negative health effects such as obesity, depression, and other chronic diseases. Wengreen and Moncur (2009) conducted a study of 159 freshmen in college and found that an average weight gain in the first year of college was 10 pounds. This widely recognized weight gain in the freshman year of college is often termed as the “freshmen 15”. College students often are at risk for becoming overweight due to a low level of physical activity, added stress, and poor eating habits that lead to weight gain (Ferrara, 2009). The U.S. Department of Health and Human Services (2010) indicated that low levels of activity are associated with risk for major health conditions, including psychological problems. Physical activity in college freshmen decreases as they progress through their education (Butler, Black, Blue, & Gretebeck, 2004). In a sample of 763 college students who were 18 to 27 years old, a cross-sectional study examined a correlation between body mass index and physical activity habits and found that on average, participants were overweight and exercised less than three days in the previous week surveyed (Huang, Harris, Lee, Naxir, Born & Kaur, 2003). It is important to target freshman college students for early intervention in developing positive exercise habits,

while their health habits are still being formed. This influence may help to ameliorate decreases in physical activity over the adult lifespan.

A program called Project GRAD at a California university attempted to influence college seniors to adopt physical activity and to maintain it in their lives after graduation (Calfas, et al., 2000). The participants in this study were students who were randomly assigned to a control group in a health education class or to a three month experimental physical activity intervention. Tools used for assessment were a seven day activity recall and a readiness to change questionnaire. Results revealed that the treatment effects were not maintained after a year at the follow-up assessment (Calfas, et al., 2000). Positive effects were maintained in the short-term, but additional methods needed to be employed in order to create long-lasting effects and exercise adherence (Calfas, et al., 2000).

Another study prescribed exercise to those suffering from mental health issues, with 109 adults assigned to either a high intensity exercise group, a moderate intensity exercise group, a placebo group or a waiting list (Moses, Steptoe, Matthews, & Edwards, 1989). After 10 weeks, significant improvements in mental health occurred in the moderate to intense exercise group only. The authors indicated that the high intensity exercise was likely to be too demanding for those suffering from anxiety. Another study has also supported that moderate intensity exercise used for mental health symptoms is the most successful for the improvement of patient satisfaction and also exercise adherence (Moses, et al., 1989). A caution that must be identified in conducting exercise studies is that overtraining in physical activity may mimic depression and generate the same psychological symptoms (Paluska & Schwenk, 2000).



## **Recommendations for Exercise**

Studies have shown an inverse relationship between physical activity and depression (Chambliss & Dishman, 2004). Being part of an exercise program was shown to help reduce behavioral disturbances (Lyketsos, Lopez, & Jones, 2002) and with depression (Taylor, Cable, & Faulkner, 2004). According to Sothorn, Loftin, Suskind, Udall, and Blecker (1999), aerobic exercise reduces mental stress and depression, as well as improves oxygen transportation, and improves cholesterol by lowering low density blood lipoproteins and increasing high density blood lipoproteins. They also encourage resistance training to promote further health benefits.

A study conducted on young adults to measure depressive symptoms after beginning a running program reported that the exercise intervention produced the same positive effects as psychotherapy (Griest, et al., 1979). Studies have typically used 8-12 weeks of exercise prescription to measure psychological changes (Hortobagyi, & DeVita, 2000; Lexell, 1995). The amount of physical activity one needs in order to make a difference to mental health symptoms has yet to be clearly defined.

The recommended amount of activity for those aged 18-24 has been defined by the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) as 30 minutes of moderate-intensity physical activity five days a week (ACSM, 2008). According to ACSM (2008), Health and Human Services guidelines call for a minimum of 150 minutes of moderate physical activity a week. This recommendation can be met by exercising for at least 30 minutes five days out of the week.

Individuals aged 18-24 years are not meeting these recommendations. The American College Health Association (ACHA) (2005) indicated that only 44.2% of students met guidelines for exercising vigorously 20-30 minutes three days out of the week. Americans as a whole are

not meeting these guidelines either (Sission, McClain, & Tudor-Locke, 2008). Studies on men and women show that meeting this guideline for physical activity provides protection against several diseases including hypertension, diabetes mellitus type II, cancer, osteoporosis, depression, heart disease, and functional impairment (Dergance et al., 2003).

*Healthy Campus 2010*, a companion document of *Healthy People 2010* (American College Health Association, 2004), developed a goal to increase the proportion of college students in the United States who participated in physical activity to 55%. Their goal is for students to exercise at least 3 days/week at a moderate intensity for at least 30 minutes, or at a vigorous intensity for 20 or more minutes. The national baseline assessment that the ACHA conducted revealed that approximately only 40% of students were meeting this guideline (ACHA, 2005).

Studies have been conducted in relation to college students and exercise patterns. Caspersen, Pereira, and Curran (2000) examined data from the National Health Interview Survey, the 1992 Youth Risk Behavior Survey Supplement for Adolescents, and the 1991 Health Promotion/Disease Prevention Supplement for Adults, and found that adolescent physical activity patterns decreased most from ages 15 through 18. Furthermore, regular vigorous activity and strength training declined from ages 12 through 21. In another study, young adults from ages 18 through 29 showed continued decrease of activity patterns (Caspersen, et al., 2000). There is an apparent downhill slide occurring between the ages of 12 - 29 years in the amount of physical activity one obtains.

Evans and Cry-Cambell (1997) identify that an individual's fat-free body mass decreases by about fifteen percent between the third and eighth decade of life. If energy expenditure does not match caloric intake, body fat mass will increase. An increased body fat mass leads to

obesity and overweight individuals. Being obese or overweight introduces a number of adverse health effects for individuals, including an increased risk for heart disease, depression, cancer, stroke, hypertension, osteoarthritis, sleep problems, diabetes, and more (Ferrini & Ferrini, 2000; Stevens, Cai, & Pamuk, 1998). College students are at risk for becoming overweight or obese due their low level of physical activity and poor eating habits that increase weight gain (Ferrara, 2009).

Lifelong health behaviors in adulthood are being established during early adulthood, so the decline in physical activity is concerning (Buckworth, & Nigg, 2004). In 2003, Wallace and Buckworth found that with increasing exercise, students maintained the change of increased activity patterns unless they declined in self-efficacy and social support.

### **Models of Behavior Change**

Several models of behavior change have been popular in relation to health behaviors. The most popular and well-researched are the Health Belief model (Rosenstock, 1990), the Theory of Planned Behavior (Ajzen, 1986) and the Transtheoretical model (Prochaska, Norcross, & DiClemente, 2005). These three models of behavior change emphasize self-efficacy and an individuals' power in choosing a behavior and carrying it out. There is another model of behavior change called the Social Ecological Model that recognizes additional factors of that influence health behaviors, such as the community, physical environments, society, and even government (Green, Richard, & Potvin, 1996). The Social Ecological Model for physical activity was based upon work done by Bronfenbrenner (1977), who developed an ecological theory of human development. It is not the purpose of this paper to explain or study the effects each of these factors play on exercise behaviors, but is important in understanding exercise behavior change as a whole.

The Health Belief Model explains a motivation to engage in a health behavior by first perceiving a personal threat to one's health, and then believing that engaging in certain behaviors will prevent them from the perceived threat (Rosenstock, 1990). Dishman (2004) explains that the Health Belief Model may not be very effective since learning behavioral skills is a necessary part of carrying through with exercise intentions-a part missing from this model.

The Theory of Planned Behavior proposes that behaviors in health-related activities are a result of intentions to participate in that activity. Intentions to participate in an activity involve attitudes about the activity and its outcomes, motivation, social norms and a belief in the personal ability to carry out the activity (Ajzen, 1985). It has been argued that intentions alone are not enough to increase physical activity because most active individuals have already moved past planning for exercise and getting over past habits of inactivity (Dishman, 2004). If there is not an intent to perform, it is not likely to happen. Though the Theory of Planned Behavior informs understanding on the decision making processes to become active, more needs to be learned about this multifaceted theory (Conn, Tripp-Reimer, & Maas, 2003).

Another model of behavior change that may help increase amounts of exercise is the Transtheoretical Model (TM). This model was developed to support intentional behavior change, based on observations that people move through stages in order to make any kind of change in behavior. It was developed at the University of Rhode Island Cancer Prevention Research Center, and the results of years of study and observation on how people quit smoking (Prochaska & Velicer, 1997). In addition to the intentions to exercise, a major component of the previously discussed Theory of Planned behavior and Health belief model, TM carries the intentions out to commitment and relapse prevention. Self-efficacy is also an important aspect of this model. TM has been used widely in understanding exercise behaviors, and its validity has been tested and is

supported (Cardinal, 1997; Shumaker, Ockene, & Riekert, 2009). TM is derived from multiple theoretical constructs in the field of counseling, but predominantly from cognitive and behavioral theory. The stages of change readiness in this model are precontemplation, contemplation, preparation for change, action, and maintenance (Prochaska, Norcross, & DiClemente, 2005).

Prochaska et al. (2005) describe the TM stages as follows. In the *precontemplative* stage of the TM, individuals are not considering change or may be unaware of the need to change. An example of someone in the precontemplative stage is the person who comes to counseling because someone else wants them to change. Goals and interventions planned at this stage should try to understand and validate the person's feelings and should match the client's level of motivation. The *contemplative* stage is the second stage in the TM where clients remain hesitant to the change process, but are considering the benefits of change. Treatment plans for clients in this stage should not focus the goals too much, but match them to the client's level of motivation. The focus here should be on the benefits of change and also to build awareness for the client on how their behavior (or lack of it) is affecting them or others. In the *preparation for change* stage, individuals commit to change. They are making arrangements for the change/s to take place. Treatment plans should help the client find resources to make their plans possible, and provide support. Building self-efficacy at this stage is very important. The *action* stage is where individuals are engaged in behavior change. Individuals should receive ongoing support in this stage. Finally, in the *maintenance* stage, the individual is engaged in behavior change activities and assumes that they also want to continue these behaviors long term. The focus in this stage is to keep offering support and also address any occurrences of potential relapse.

The concept of the TM is borrowed in part from Albert Bandura's (1986) social cognitive theory, indicating that people need to believe in their ability to carry out a particular task before they can achieve a result. A good goal of an exercise program is to build exercise self-efficacy. Building self-efficacy with exercise promotes recommended amounts of activity. Like the TM model, constructs from the Theory of Planned Behavior also indicate that adult behavior is based on behavioral beliefs, perceived control (self-efficacy), and normative beliefs (Conn, Tripp-Reimer, & Maas, 2003).

The TM has been used in studies examining exercise behavior (Booth, et al., 1993; Burbank, Reibe, Padula, & Nigg, 2002). TM can be considered a type of cognitive-behavioral intervention. Cognitive and behavioral interventions have shown positive short-term results for those with anxiety (Heimberg & Juster, 1995). Long-term interventions lasting more than one year have been more of a challenge due to participant adherence (Gould, Otto, Pollack, & Yap, 1997). A cognitive-behavioral theoretical approach is the most appropriate construct for the present study, to work within the time frame allotted for intervention. Interventions with a cognitive framework have provided strong empirical evidence for success in working with anxiety and depression (Rapee & Heimberg, 1997).

### **Theoretical Basis for the Transtheoretical Model**

The TM was birthed from the constructs of Cognitive Behavioral therapy. Cognitive Behavioral therapy emerged from the concepts of both cognitive and behavioral therapies. The overall premise of Cognitive Behavioral Therapy is that desired emotional and behavioral change can be achieved through cognitive changes, as cognitive change can be achieved through altered actions or emotions.

Cognitive Behavioral Therapy has been utilized with a variety of clients with a range of clinical problems. Cognitive Behavioral Therapy (CBT) is one of the leading empirically supported therapies. There are a large number of controlled studies that indicate CBT has been highly effective in treating problems such as depression, anxiety, eating disorders, substance abuse, and also in the prevention of relapse (Freeman, Felgoise, Nezu, Nezu, & Reinecke, 2005). Some of the approaches that fall under the category of Cognitive Behavioral Therapy include McMullin's cognitive restructuring (McMullin, 2000); Aaron Beck's Cognitive therapy (Beck, Rush, Shaw, & Emery, 1979); Albert Ellis's Rational Emotive Behavior therapy (Ellis & Dryden, 2007); Lazarus's Multimodal assessment (Lazarus, 1981); and others

### **Exercise as Prescription**

An additional tool worth discussing is the application of exercise prescription to be used as a tool in treatment of mental health. Solution-focused treatment models are increasingly being utilized in treatment for depression and anxiety. Physicians, psychologists, and counselors have used exercise prescription to treat depression and anxiety in the past. Sixty percent of 1,750 physicians surveyed indicated they had prescribed exercise for anxiety (Ryan, 1983). In *The Exercise Prescription for Depression and Anxiety*, Psychologist Keith Johnsgard (1989) points out a number of case studies that have used exercise as a treatment with success. Calls for using exercise as a form of treatment for anxiety and depression have been identified by others in Callahan (2004) and Chung and Baird (1999), where exercise was indicated as a neglected intervention in mental health. The use of exercise as a prescription may grow in popularity due to the increased rates of depression, anxiety, and other mental health concerns. Additionally, traditional treatments of psychotherapy involve greater cost in terms of finances, side effects, and

time (Morgan & Goldston, 1987). Therefore, psychotherapy should not be considered as the first and only line of treatment.

### **Treatment Planning**

Counselors adopt different theoretical orientations that they base their therapeutic practice upon. Treatment goals, objectives, and interventions depend upon what theory they conceptualize in order to assist the client. Treatment plans are a necessary part of counseling. Treatment plans include mutually agreed upon goals, objectives, and strategies to reach these goals (Seligman, 2004; Sommers-Flanagan & Sommers-Flanagan, R., 2003). Goals created in treatment may help motivate the client to change, educate clients on positive outcomes, and provide a way to evaluate interventions (Hackney & Cormier, 2005).

When considering treatment plans, it is important for counselors to take a holistic perspective and see the client's issues through behavioral, emotional, cognitive, biological, and social perspectives. More experienced counselors have considered a broader scope of information when developing treatment plans than the less experienced counselors (Falvey, Bray, & Hebert, 2005). Lazarus and Lazarus (2005) and Seligman (2004) are three well-known individuals who developed holistic models of assessment for treatment planning in counseling.

Exercise prescription may serve as valuable tool to be used in conjunction with a treatment plan in counseling. In some cases, exercise prescription may be the only tool needed for certain clients. Adding exercise treatment may encourage positive social interaction (if used in a group setting); decrease symptoms of mild to moderate depression and anxiety; and increase an overall sense of well being. As a bonus, it is likely to help maintain or improve physical health.



An exercise program should include a health education piece along with instructions of how to do the exercises, so participants know how and why they are doing the activity. Health education should provide participants of exercise with information on the benefits and precautions to take when exercising, skills and support to make or maintain positive choices that improve their daily living.

Treatment planning should also take cultural background of clients into consideration. Social resources from within the client's culture need to be examined to provide competent treatment planning (Sommers-Flanagan & Sommers-Flanagan, 2003). A variety of exercise prescriptions or exercises is something that may be able to be implemented by all cultures.

### **Information Specific to the Region of North Dakota**

The university studied is surrounded by many rural areas. The students that attend come from many rural communities or plan to work in them after graduation. Rural communities are said to experience mental health problems, such as depression, at a greater rate or equivalent to urban areas (Sawyer, Gale, & Lambert, 2006). Furthermore, individuals from rural areas receive less treatment of any kind for their mental health problems, as well as less specialized mental health services (Hauenstein, Turner, LeVine, Schank, & Leichter, 2006). Rural areas possess a strong stigma regarding mental illness (Gamm, Stone, & Pittman, 2003). According to Sirey and colleagues (2001), stigma keeps people from seeking help for mental health and keeps people from making progress through treatment. In rural settings, residents can easily observe the comings and goings of others into mental health facilities. The same thing may be said for college campuses.

An example of how mental health relates to what people believe about individual work and efforts is found in a study done by Thorngren (2003). The focus group believed that not

working contributed to depression, and that engaging in work alleviated depression. Farming and rural communities exhibit a strong sense of individualism, and a mentality where people are self-reliant, self-sufficient, and solve their own problems (Human & Wasem, 1991).

Based on this information, exercise prescription used as a preventive or treatment tool for those from and surrounded by rural communities may provide a good option, in addition to a full treatment plan by counseling professionals. Exercise is something people can do individually to take control of and better their overall health.

### **Summary**

Wellness was described most consistently as a combination of a number of factors that act in an integrated and complex on a continuum (Adams, Bezner, & Steinhardt, 1997). Each dimension of wellness is part of a whole (Adams et al., 1997), thus we get the term ‘holistic’ wellness. Some of the most popular aspects of wellness include social, physical, intellectual, emotional, psychological, and spiritual (Adams et al., 1997). Other categories and conceptualizations of wellness were discussed earlier in this paper. Wellness is a complex term and is somewhat ambiguous in its definition within and between various professions. For example, Reicherter and Greene (2005) add the aspect of occupational wellness as one of the main aspects of wellness versus the psychological category being a major category. The key elements of wellness most often include two to seven categories, with the most popular categories being physical, social, emotional/mental, spiritual, and intellectual (Adams, Bezner, & Steinhardt, 1997; Corbin, Lindsey, Welk, & Corbin, 2002).

Collaboration between different wellness-related fields, specifically mental health and exercise, could benefit from knowing specifics on how exercise can benefit mental health in physical, social, and mental health. One obstacle in collaboration between fields is that the traditional education systems in the US have created specialized disciplines, each with their own

theories, language, and expertise. Moreover, they do not know much about each other nor how to collaborate (Hall, 2005). Hind et al. (2003) explained that the most difficult part of interprofessional learning is that one profession might hold stereotypical views and negative attitudes of another profession. Mental health professionals can learn much from exercise professionals, and visa versa in order to help individuals reduce the impact of depression and anxiety.

Due to enrollment in college and universities growing, the number of students who are at risk for poor mental health and other issues has also increased (Merisotic & Phipps, 2000). College is the peak time in which most mental health disorders surface (Reavley & Jorm, 2010). Depression, anxiety, and suicide are specifically increasing on college campuses (Benton, Robertson, Tseng, & Newton, 2003). Stress is greatly increased for college students often experiencing great transition in their lives, and if the stress becomes too much, physical and/or psychological impairment may occur (Misra, McKean, & West, 2000).

Adding to the risk for mental health issues, young adults aged 18-24 are at an increased risk for choosing a number of negative health behaviors including increased sedentary behavior (VanKim, Laska, Ehlinger, Lust, & Story, 2010). College students are not getting enough physical activity since 40-50% of college students do not meet standard exercise guidelines (Keating, Guan, Pinero, & Bridges, 2005). College campuses are considered a prime environment for promotion of healthy behaviors, such as introducing patterns of regular physical activity (Sparling, 2007). The reasons why the college campus is a prime environment is because it is a crucial time in which new habits are being formed for life. College students are balancing many demands between classroom expectations, work, extracurricular activities, social life, and more (Thome & Espelage, 2004). If not introduced to positive and healthy options and methods

of coping such as exercise and healthy eating in this crucial time, students may be at greater risk to choose unhealthy options such as sedentary behavior, substance abuse or other negative behaviors (Reavley & Jorm, 2010). A number of free services are available on many college campuses to help ensure healthy behavior including wellness centers, counseling services, and dieticians.

A cost-efficient and practical solution to depression, anxiety and other mental health concerns is greatly needed for all populations as mental health issues are becoming a public health issue worldwide, decreasing quality of life and costing Americans over \$150 billion per year (Rice & Miller, 1995). Anxiety and depression account for approximately \$90 billion of the total spent each year on treatment for mental health disorders (Rice & Miller, 1995). Not only are depression and anxiety taking a toll on a large population in terms of interfering with quality of life, the financial burden is increasing at a fast pace. A more cost-effective, practical solution is required to improve financial, mental, and overall physical health.

Providing individuals with a way to adopt a lifestyle that allows for greater well-being and means to achieve it can be provided with following an exercise prescription (McKenzie & Smelter, 2001). Research has demonstrated the benefits of exercising on mental health including improving overall well-being, increasing mental well-being, decreasing stress, increasing self esteem, and reducing the risk for hopelessness, depression, and suicidal behavior (Savage, 2009; Taliaferro, Rienzo, Pigg, Miller, & Dodd, 2009). Exercise has definite beneficial effects on reducing symptoms of depression and anxiety, and also in lowering the risk of a major relapse into depression (Babyak, Blumenthal, & Herman, 2000).

Other positive benefits of physical activity include many physical improvements in the body such as a decreased risk for chronic diseases and improved cardiovascular and mental health (Penedo & Dahn, 2005). Exercise has also been noted to reduce tension, fatigue, and confusion, while increasing feelings of vigor (Puetz, O'Connor, & Dishman, 2006).

In summary, three major approaches used in exercise for behavior change are the Health Belief model (Rosenstock, 1990), the Theory of Planned Behavior (Ajzen, 1985) and the Transtheoretical Model (Prochaska et al., 2005). These major models of change are often used to measure change in health behaviors such as exercise and smoking cessation. Cognitive Behavioral Theory was the major theoretical construct responsible in the formation of the Transtheoretical Model. In addition, solution-focused treatment models are increasingly being utilized in treatment for depression and anxiety. For example, exercise can be a solution-focused treatment that can be utilized in treatment planning for depression and anxiety. As noted, the benefits of exercise prescription specifically for rural populations can be especially beneficial due to strong values placed on 'do it yourself' solutions (Human & Wasem, 1991).

Indeed, more studies need to be done on the effects of exercise on mental health in the college population. There have been far more studies between exercise and mental health with older adults than with younger populations (Antunes, Stella, Santos, Bueno, & de Mello, 2005; Brown, Mishra, Lee, & Bauman, 2000; Chandler & Hadley, 1996; Chodzko-Zajko, et al., 2009; Morgan & Goldston, 1987; Netz & Wu, 2005; Tanaka, et al., 2009). An aim of this study, therefore, was to both contribute to the previous body of literature and to answer specifically how exercise affects depression and anxiety in the college-aged population. In addition, this study also reviewed attitudes toward physical activity that exist in the college-aged population. This study was unique in its use of the Burns Anxiety Inventory and the Burns Depression

Inventory, which are already widely used in campus counseling centers. These inventories have not been previously utilized in other studies in conjunction with exercise. This study was valuable in that it provides information to mental health or exercise science professionals on other campuses in order to better serve college students.

## CHAPTER 3. METHODOLOGY

### **Purpose**

Again, the purpose of this study was to evaluate the influence of an exercise program on aspects of wellness and mental health of college students. The study explored changes in physical fitness and on self-reports of anxiety and depression symptoms before and after participating in a six-week exercise program at a Midwestern university. Assessment tools that were used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and an Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

An exercise program with a moderate intensity regimen was implemented over the course of a 6-week period. A period of six weeks was chosen as this was reported as a relatively adequate amount of time where improvements in psychological responses have been seen (Moses, et al., 1989) as well as physical improvements (Hoeger & Hoeger, 2008).

### **Population**

Students for the treatment group were recruited from two sections of activity classes at a Midwestern university during the Spring semester of 2012. The activity courses were taught by the same instructor. The instructor was asked for permission to recruit her students for the study before the start of the semester. A control group was selected that consisted of students in a lecture-only class, also at the Midwestern university. The instructor of the lecture class was also sent an email prior to the start of the 2012 semester explaining the study and asking permission for student recruitment. The activity courses had 183 students enrolled, and the lecture course had 75 students enrolled.

Students who volunteered for the study may or may not have suffered from anxiety or depression. The general public consists of individuals who suffer from depression and anxiety and those who do not. Studies conducted in non-clinically depressed participants may produce results more applicable to the general public (Brown, 1990). A risk taken in the present study was that a large number of participants would not suffer from anxiety or depression symptoms, rendering us unable to determine if exercise had an effect on these symptoms over time. However, according to statistics provided in the literature, a large percentage of college students experience these symptoms. Having a majority of students who do not experience depression or anxiety symptoms was unlikely. Participants were asked information on their class standing, major, exercise habits, and other basic demographic information on the initial demographic questionnaire. The complete initial questionnaire is found in Appendix F.

Over the course of the study, participants were asked to engage in a predetermined amount of physical activity each week according to ACSM (2008) and the US Department of Health and Human Services Guidelines that call for a minimum of 150 minutes of moderate physical activity per week. Participants then recorded the amount and type of activity on an activity log provided in Appendix H. Participants took an anxiety and depression inventory, found in Appendices B and C, and completed a physical assessment at the onset and completion of the study. Institutional Review Board (IRB) approval was obtained prior to the study (Appendix A). Participants from both activity classes and the lecture class signed an informed consent form if they agreed to participate in the study (Appendices I and J).



## **Instrumentation**

The Burns Depression Inventory (Appendix C) and the Burns Anxiety Inventory (Appendix B) are widely used in the mental health field at large and in the University Counseling Center at the Midwestern University to evaluate depression and anxiety in students who present with symptoms. Burns' Anxiety Inventory, Burns' Depression Inventory are self-report measures that were used before and after the exercise program to assess any change in depression or anxiety symptoms. David Burns, the creator of the inventories, granted permission to use these inventories in the study.

Out of the mental health tools used to assess anxiety and depression, the Burns' Anxiety Inventory, and the Burns' Depression Inventory are of the most common and accessible. They can be self-administered. By giving a numeric rating to overall anxious or depressive symptoms, a person can evaluate anxiety or depression as often as necessary, to see how anxiety fluctuates and to evaluate the progress of treatment.

### **The Burns Anxiety Inventory**

The Burns Anxiety Inventory (BAI) is a measure of thirty-three symptoms of anxiety, within the categories of anxious feelings, anxious thoughts, and somatic manifestations of anxiety. Scores of 498 outpatients seeking treatment for mood disorders suggested excellent reliability and internal consistency with an alpha score of 0.94 (Burns, 1999). This inventory can be found in Appendix B.

The inventory is divided into three categories: anxious feelings, anxious thoughts, and physical symptoms. A person taking the assessment ranks each item on a scale from zero, "not at all," to three, "a lot." Anxious feelings items include "feeling that things around you are strange, unreal, or foggy" and "apprehension or a sense of impending doom." Thoughts include such

items as "difficulty concentrating" and "fears of being alone, isolated, or abandoned." Physical symptoms lists sixteen items, including "pain, pressure, or tightness in the chest" and "restlessness or jumpiness."

Burns indicated that an individual can complete and score the entire inventory in under 2 minutes. To evaluate the level of anxiety that is indicated on the checklist, each item is added up numerically. A score of 0 to 4 indicates minimal or no anxiety, 5 to 10 means borderline anxiety, a score between 11 to 20 signifies mild anxiety, 21 to 30 is moderate anxiety, 31 to 50 means severe anxiety, and a score of 51 to 99 indicates extreme anxiety or panic (Burns, 1999).

### **The Burns Depression Inventory**

The Burns Depression Inventory (BDI) asked participants questions that pertain to fifteen symptoms of depression including low self-esteem, hopelessness, and sadness. The BDI was validated in an unpublished pilot study with a group of 50 outpatients being treated for mood disorders (Burns, 1999). The tool was designed to be used in tracking clients' progress between therapy sessions. The BDI can be found in Appendix C.

The BDI is a 25-question rating scale for depression. Each question is answered in the context of "during the past week, including today" and on a scale of 0 to 4, with 0 being "not at all" and 4 being "extremely" (Burns, 1999).

Scoring of the Depression Inventory is similar to the scoring of the Burns Anxiety Inventory. A score of 0 to 4 indicates minimal or no depression, 5 to 10 means borderline depression, a score between 11 to 20 signifies mild depression, 21 to 30 is moderate depression, and 31 to 45 means severe depression (Burns, 1999).

### **The Physical Activity Readiness Questionnaire**

The Physical Activity Readiness Questionnaire (PAR-Q) (Appendix E) was used to assess physical activity readiness. This survey was completed by students prior to the physical assessments and before engaging in physical activity. This survey was used to determine if participants were safe to begin the study. The PAR-Q is a medically accepted pre-exercise tool. It complements exercise programs, exercise testing procedures, and the liability considerations with programs and testing procedures (McGraw-Hill, 2002).

### **Attitudes Toward Exercise and Physical Activity Survey**

The Attitudes Toward Exercise and Physical Activity survey is an assessment of attitudes and beliefs of individuals on the effects of physical activity. McPherson and colleagues (1967) constructed this survey in order to assess common opinions, beliefs, attitudes, and fallacies about exercise and physical activity. Questions on the Attitudes survey indicate whether or not participants' believe exercise behavior has the ability to benefit aspects of mental health. The questions from the Attitudes survey also allow for assessment of where an individual falls within the stages of change indicated by the Transtheoretical model (Prochaska, Norcross, & DiCembente, 2005).

The Attitude survey contains 50 questions which students answer using a 5-point likert scale as to whether they disagree, strongly disagree, agree, strongly agree, or are neutral about a statement provided about exercise. A copy of this survey is found in Appendix D.

Questions on the Attitudes Toward Physical Activity Inventory were divided by the researcher into two categories to better understand the specific attitudes that changed during the course of the study. The two categories that were created were, 'Stages of Change', and 'Belief that physical activity has the ability to benefit mental health'. The stages of change category

informs where the participant fall within the Stages of Change according to the Transtheoretical Model of behavior change from pre to post. The belief about physical activity benefitting mental health was examined to determine if a change was identified in the participants over the course of the study with a regimen of activity employed.

The questions that were included in the category that indicated a change in beliefs about exercise benefitting mental health throughout the course of the study were: #2: Exercise helps to work off emotional tensions and anxieties; #5: Regular physical activity makes one feel better; #10: Exercise does little to improve a person's sense of well-being; #13: Participation in physical activity aids mental relations; #21: A person in good physical condition is more able to endure nervous stress; #22: Exercising with a group leads to improved social relationships; #26: Exercise gets rid of harmful feelings and emotions such as anger and hostility; #29: Regular participation in physical activity makes one look better. #32: A period of exercise gives a feeling of well-being; #43: Physical activity in some form is an excellent remedy for the tense, irritable and anxious person; and #44: Regular physical activity makes a man more alert.

Questions that were included in the category that indicated stages of change throughout the study were: #1: Physical exercise is beneficial to the human body; #18: I think exercise is good for me; #27: Those who are physically healthy do not need to engage in physical exercises; #34: Those who are physically able should engage in a weekly session of physical activity. According to the Transtheoretical Model previously discussed, if students believe exercise is good and beneficial, they will then be more likely to exercise.

### **Weekly Exercise Recall Log**

The self-report measure for physical activity in this study was a simple weekly activity recall, in which participants recorded the type of activity they engaged in, the duration of that activity (length of the workout), and the intensity in which they exerted themselves (light, moderate, or intense). A copy of this self-report form is attached in Appendix H. Physical activity measurement most often occurs using self-report, accelerometer, heart rate monitors, pedometers, direct observation, and more (Dale, Welk, & Matthews, 2002). Costs and availability of these measures varies widely. Self-report measures are used in studies of physical activity due to their low cost and simplicity. The validity of the self-report measure shows to be modest in comparison to other measures (Matthews, 2002). This measure was selected as it met the goals and purposes of this study. Using a self-report instrument involves a participant by providing information on their exercise behaviors. Matthews (2002) identifies four types of self-report instruments including physical activity logs; global self-report; recall questionnaires; and quantitative history questionnaires. A weakness reported on the self-report instruments is that individuals have a tendency to overestimate participation in vigorous activity, while underestimating participation in light or moderate intensity exercise (Sallis & Saelens, 2000). More information on the reliability and validity of the seven day recall can be found in Dishman & Steinhardt (1988).

### **Weight and Percentage of Body Fat**

Weight and body fat composition was measured using the Tanita® Body Composition Analyzer, model TBF-300A-III, a bioelectrical impedance measurement tool. This machine was selected because of its usefulness for this study, accuracy of measurement, and its ease of use. The bioelectrical impedance technique sends electrical current through the body to estimate body

fat, lean body mass and the amount of body water through the sensors on the surface of the machine (Hoeger & Hoeger, 2008). The premise of the bioelectrical impedance technique is that electrical current passes more easily through lean tissue than through fat tissue. Fat content is derived by subtracting lean body mass from body weight to give a fat mass. Percentage of body fat predictions for these scales can be off by as much as ten percent (Hoeger & Hoeger, 2008).

No harm is done to the participant in using this machine. Participants simply stand on the scale and a researcher stands by to assist and enter necessary information, such as age and height, into the machine. Readings were printed out by the machine after each participant was assessed. Weight and body fat scores were then recorded for each participant. This procedure was done at the onset and end of the study. The Tanita®'s specific manufacturers' instructions were followed to ensure the most accurate results.

### **Rockport Walk Test**

The Rockport one mile walk test was conducted to determine cardiovascular fitness. Individuals were instructed to walk as brisk as possible for one mile without running on the track in the campus Wellness Center. The Rockport test is a good option for individuals who are unable to run, have lower fitness levels, or are experiencing an injury (Hoeger & Hoeger, 2008). The Rockport was selected as a test that most or all participants should be able to do. Polar® heart rate monitors were used during the Rockport walk test to measure the time it took to complete the mile and the subject's heart rate at the end of the assessment.

The Rockport Walk Test was scored using the ExRx.net website which calculated  $VO_2$  max, or maximal oxygen uptake.  $VO_2$  max is a common and widely accepted measure of cardiovascular fitness. Scoring for the  $VO_2$  max was computed through the ExRx.net website that automatically calculates individual  $VO_2$  scores into categories of poor, fair, average, good, or

excellent according to data entered on age, gender, weight, heart rate, and the minutes and seconds it took to walk the mile during the Rockport Walk test. Walking time was measured in minutes according to a formula provided by Dolgener, Hensley, Marsh, and Fjelstul (1994), which divided the number of seconds by sixty to obtain the fraction of a minute.

### **Timeline**

The subjects who gave consent participated in an exercise program to measure the effects on anxiety, depression, and body composition. Participants completed validated anxiety and depression questionnaires at the baseline and end of the study, separated by 6 weeks of exercise that assessed change in reported anxiety or depression. A timeline and a description of the activity is as follows:

#### **Week 1**

The researcher visited classrooms to introduce the study and passed around a sign-up sheet for those interested in participating in the study. If students chose to participate, they were instructed to come to the exercise lab on campus the following week to complete initial assessments (Anxiety/Depression/PARQ/Body composition/Rockport). An email reminder was also sent out to those students who turned in an informed consent, reminding them of the assessment time and location.

Each class was assigned a different day to come in for their testing. During the data collection, five research assistants were available to help in handing out surveys and consent forms, assessing body fat using the Tanita®, and assisting in administration of the Rockport walk test. Students were expected to come on their assigned day unless they obtained permission from the researcher to come in at a different time for their assessment.

## **Week 2**

The initial physical assessment was conducted in an exercise lab on campus. The Rockport Walk Test at the campus Wellness Center was completed directly after the initial assessments were completed. The initial visit took between 20-40 minutes to complete. When participants arrived for the assessments, they first signed in and received a packet to complete. Included in this packet was a PAR-Q form, demographic questionnaire, attitudes survey, anxiety inventory, and a depression inventory. These items took five to fifteen minutes to complete. After the paper assessments were completed, the researchers verified results of the treatment group's answers on the PAR-Q form to determine if it was medically safe for them to proceed in an exercise program. If participants' PAR-Q scores were satisfactory, their body composition was measured. This portion of the testing took between 5-10 minutes. The students were instructed beforehand to wear clothing for the physical measurements portion of the study that included loose shorts and t-shirt, and shoes they would be taking off to take their body composition/weight.

Once the body composition analysis was completed, the participant was instructed to go directly to the track to complete their Rockport Walk Test at the campus Wellness Center, where researchers would be on hand to assist them. Students needed to bring their student ID to get into the Wellness Center for this test, and bring appropriate shoes and attire for walking a mile. If they forgot their ID, they were sent away to get it and come back to do the testing.

The Rockport Walk Test took approximately 12-25 minutes to complete. During the Rockport Test, students wore a Polar<sup>®</sup> heart rate monitor and were instructed to walk twelve laps (one mile) around the track as fast as they could without running. They were instructed to walk individually, versus with a friend, in order to get their personal best time and so the monitors



would not interfere with each other. After the walk test, participants with the help of the researchers, recorded their heart rate and the time it took to complete the mile on a data sheet.

Students needed to come for the initial assessment in order to be a part of this study. If students were unable to attend the assessment times due to conflicting schedules or other circumstances, they made other arrangements with the researcher to ensure this was completed. If participants failed to show up and did not attempt to set up an alternative time to complete the assessments, they were not allowed to participate in the study and were notified of this through email. Those who did not show up for initial testing were not able to remain in the study since pre and post data collection was very important to the results of the study. Those who could not meet the requirements for participating in the study had the option to complete an alternative assignment provided to them for the same amount of extra credits points in their classes. A grading rubric was also provided to these participants, so they would know what was expected of the assignment. Students could not complete both the alternative assignment and study. They could choose one or the other for points.

The number of points assigned for participation in the study in the activity courses were a total of 15 out of 510 total class points. Points were awarded down according to how much of the study that was completed. Subjects received 4 extra credit points for completing pre-testing, 4 points for 6 weeks of completing activity logs, and 7 points for completing post-testing. Points assigned for participation in the study in the lecture courses were a total of 12 out of 600 total class points. In the lecture course, subjects received 3 points for participating in pre-testing, and 3 points for post-testing. As requested by the instructor, students in the lecture course received an additional 6 points by providing their course instructor with a paper that used terminology from

their classroom to describe their participation in the research experience. Students were given the same amount of possible points for completing the alternative assignment in the activity and lecture classes, and they could not receive points for doing both the alternative assignment and the study.

A total of 47 students chose to do the alternative assignment, with 20 students from one section of an activity course and 27 students from the other activity course. There were no students who chose to do the alternative assignment in the lecture only class.

### **Weeks 3-8**

In weeks three through eight, treatment group participants (activity classes) were required to complete their weekly activity logs that were provided on their course Blackboard internet site. Participants in the control group (lecture course) were not required to do any extra activity during this time. They were to continue with their normal patterns of activity.

In order to complete the necessary 150 minutes of moderate physical activity each week, participants could choose the exercises they wanted to do that fell within the category of moderate activity. Exercise completed was recorded on a log and turned in online weekly for data collection (Appendix H). Examples of approved activities were provided at the beginning of the study, and could include working individually or in a group walking, cycling, step, dance, or other aerobic activities. If students had questions as to whether a particular activity counted as moderate, they were instructed to ask the researchers in person or through email throughout the study. Researchers would respond to a question within twenty-four hours of the question being asked. Weekly the researchers monitored throughout the study if the activities that were being recorded met the criteria for 150 minutes of moderate activity. If the activity was considered less than moderate activity, the student was notified through email that this type of activity would not

be counted towards the study and that they should find a different type of activity to participate in for the following week. Suggestions for approved activities were also provided to each of the students during the initial classroom visits.

Participants submitted their exercise logs each Friday by 5 pm through their course Blackboard site. This drop box was secure and only accessible by the researcher to read. If students were unable to submit the log by this time, prior arrangements needed to be made with the researcher to determine a time for reasonable submission. If technological problems arose in submitting, a solution to submit this log by the earliest time possible was arranged by the researcher. This rarely happened throughout the study.

Email reminders were sent to students throughout the week to remind students to complete their log and submit it each Friday. After the forms were submitted, the researcher would verify that each participant was completing the required 150 minutes of moderate activity for the week, and the data were recorded in Microsoft Excel. It was also made known that researchers were available to answer any questions participants had concerning the logs or any part of the research experience.

### **Week 9**

Participants completed their exit questionnaire, surveys and physical assessments during week nine. They were reminded by email and by the instructor in their classes to come for this post-testing. The procedures for post-testing were followed in the same format that was carried out for pre-testing during week two. The same number of researchers were available to assist in post-testing, and it took virtually the same amount of time to complete all activities. Alternative assignment papers were also due this week.

## **Week 10**

Data continued to be entered and the instructors of the activity and lecture classes received a list of participants who completed the study in order to receive extra credit. Students who chose to complete the alternative option to the study also had the points they have received on their papers submitted to the instructor at this time.

### **Analysis of Data**

Data collected in this study were entered and stored in Microsoft Excel. Data were then analyzed using SAS statistical software (Version 9.2.2) (SAS Institute Inc., Cary, NC). Descriptive statistics performed included means, frequency tables, and two-way tables. The statistical tests that were performed were t-tests and paired t-tests in order to determine significance for each of the three research questions. The data were analyzed for changes between pre and post survey data and physical characteristics, and also relative to the differences from pre to post survey data and physical characteristic data for the treatment and control group. Level of significance was set at  $p < .05$ .

## CHAPTER 4. RESULTS

As previously noted, the purpose of this study was to evaluate the influence of an exercise program on aspects of wellness and mental health of college students. The study explored changes in physical fitness and on self-reports of anxiety and depression symptoms before and after participating in a six-week exercise program at a Midwestern university. Assessment tools that were used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and an Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

The activity courses had 183 students enrolled. Out of the 183 students, 53 enrolled in the study. Of the 53 in the activity courses, or treatment group, 9 subjects discontinued from the study between pre-and post-testing. The lecture course had 75 students enrolled, 33 signed up to participate, and 25 completed the study. The 8 students that dropped out of the study from the lecture class did so prior to pre-testing. If a student discontinued the study, their data was eliminated from statistical calculations. There were 78 students who participated in the study, overall.

There were 22 majors reported in the treatment group ranging from Accounting to Zoology. The treatment groups' majors represented 6 different major colleges. Of the participants in the treatment group, 19% were from the college of Science and Mathematics; 32% from Pharmacy, Nursing and Allied Sciences; 9 % from Human Development and Education; 26% Engineering and Architecture; 9% Business; and 6% Ag, Food Systems and Natural Resources. Majors in the treatment group were more varied than the control group. Majors of the Control group were either Elementary Education, Human Development and

Family Sciences, or a combination of both. These majors came solely out of the college of Human Development and Education.

In the treatment group, 65% (N=33) of the subjects were Freshman 22% (N=11), Sophomores, 10% Juniors (N=5), and 4% (N=2) were Seniors. In the control group, 4% (N=1) were Freshman, 32% (N=8) were Juniors, and 64% (N=16) were Sophomores. Participants overall consisted of 45 females and 30 males. The ages of participants ranged from 18-39. Over 90% of participants were between 18 – 21 years old, about 10% were between the ages of 23 - 39 years old. 62 study participants were Caucasian, 4 were Asian, 5 were Black, 4 participants chose not to respond, and 3 participants responded, 'other' - which included 1 Somali and 2 of mixed race. Additional self-reported demographic data of participants can be found in Appendix M.

At pre testing, all students in the treatment and control group passed the PAR-Q questionnaire at the beginning of testing which indicated whether or not subjects were able to participate in the physical activity requirements of the study. It was deemed safe for all subject to participate in the Rockport Walk Test for testing, and to participate in the recommended amounts of physical activity each week.

### **Survey Information**

The results of T-tests used to examine differences in survey information of pre and post means between the control and treatment group are displayed in Table 2. According to the data analysis, it appears there are no significant differences between the treatment and control group when comparing pre or post testing means in the categories of anxiety, depression, and attitudes of physical activity. Next, paired T-tests will display results indicating the amount of change that transpired over the course of study within the control and treatment groups from pre to post.

Table 2

*T-tests for Anxiety, Depression, and Attitudes Towards Physical Activity*

	<u>Pre</u>		t-value	p-value	<u>Post</u>		t-value	p-value
	Control	Treatment			Control	Treatment		
	Mean±(sd)	Mean±(sd)			Mean±(sd)	Mean±(sd)		
Burns Anxiety	14.7200 ± 13.2146 (N=25)	12.7885 ± 11.8012 (N=52)	0.65	0.5198	13.7273 ± 9.8183 (N=22)	10.0000 ± 8.0522 (N=44)	1.65	0.1046
Burns Depression	5.1600 ± 5.0388 (N=25)	6.3654 ± 6.8256 (N=52)	-0.79	0.4349	5.5652 ± 5.9683 (N=23)	4.6364 ± 5.9341 (N=44)	0.61	0.5459
Attitudes- Mental	4.0114 ± 0.2916 (N=24)	4.1122 ± 0.4377 (N=51)	-1.18	0.2418	4.0826 ± 0.4979 (N=22)	4.2996 ± 0.4421 (N=44)	-1.80	0.0763
Attitudes- Stage of Change	4.5521 ± 0.4297 (N=24)	4.5096 ± 0.3569 (N=52)	0.45	0.6528	4.4545 ± 0.3906 (N=22)	4.579 ± 0.4568 (N=44)	-1.10	0.2765

The results of the paired T-tests used to examine changes between pre and post survey information in the control group are shown in Table 3. No significant difference was noted between pre and post anxiety scores in the control group ( $p=0.3244$ ). This implies that the post scores are not significantly different than the pre scores for the control group according to the Burns' Anxiety scale. Similarly, a paired T-test for depression scores reveals there is no significant difference between pre and post for the control group ( $p=0.6344$ ) according to the Burns' Depression scale. Results of the paired T-tests of attitudes towards how physical activity affects mental health in the control group revealed a non-significant difference between pre and post scores ( $p=0.4341$ ). In other words, participants' attitudes towards how exercise affects mental health did not significantly change over the course of the study. Results of the statistical analysis of attitudes towards becoming physically active (stages of change) in the control group through a paired T-test revealed a non-significant difference between pre and post scores ( $p=0.5050$ ). The attitudes of participants that determined their readiness/motivation to engage in

physical activity according to the Transtheoretical model indicated a non-significant change from pre to post. The readiness to engage in physical activity did not change over the course of the study for the control group.

Table 3

*Paired T-tests for Control Group Survey Information*

	Mean Difference	Sd	t-value	p-value
Burns Anxiety (N=22)	1.9545	9.0841	1.01	0.3244
Burns Depression (N=23)	-0.3478	3.4590	-0.48	0.6344
Attitudes- Mental (N=22)	-0.0702	0.4132	-0.80	0.4341
Attitudes- Stages of Change (N=22)	0.0568	0.3929	0.68	0.5050

Table 4 displays the results of paired T-tests conducted on the treatment group for anxiety, depression, and attitudes towards physical activity in order to determine change that occurred from pre to post. A significant difference ( $p=0.0069$ ) was found between pre and post scores for the treatment group in the category of anxiety. Overall anxiety scores decreased in the treatment group between pre and post. The treatment group also showed a significant decrease in depression scores pre and post ( $p=0.0475$ ), indicating that the treatment group experienced fewer symptoms of depression after participating in six weeks of prescribed physical activity.

Results of the statistical analysis of attitudes towards how physical activity affects mental health in the treatment group in Table 4 revealed a significant difference between pre and post scores ( $p=0.0013$ ). Results of the statistical analysis of attitudes towards engaging in physical



activity in the treatment group through a paired T-test revealed a non-significant difference between pre and post scores ( $p=0.2531$ ). The attitudes of participants that determined their readiness/motivation to engage in more physical activity indicated a non-significant change from pre to post, but their beliefs about the positive effects of exercise significantly changed.

Table 4

*Paired T-tests for Treatment Group Survey Information*

	Mean Difference	Sd	t-value	p-value
Burns Anxiety (N=44)	3.3636	7.8625	2.84	0.0069*
Burns Depression (N=44)	1.7045	5.5430	2.04	0.0475*
Attitudes-Mental (N=43)	-0.01945	0.3688	-3.46	0.0013*
Attitudes-Stages of change (N=43)	-0.0852	0.4881	-1.16	0.2531

Note: \*Significance level was set at  $p < .05$

**Physical Measurement Data**

Table 5 displays the results of T-tests conducted to compare pre and post means of physical characteristics between the treatment and control groups. Results of the T-tests for physical characteristics of participants displayed results in the categories of BMI, VO<sub>2</sub>, and body fat. Results indicate a significant difference between both pre and post means in the category of body fat. The control group started the study with significantly higher body fat ( $28.3360 \pm 7.8075$ ) than the treatment group ( $20.4962 \pm 10.3437$ ),  $p=.0013$ . The control group remaining significantly higher than the treatment is what may be expected, as their body fat was

significantly higher in the pre testing. There was no significant difference in the categories of BMI and VO2 pre and post in the treatment groups.

Table 5

*T-tests for Physical Characteristics*

	<u>Pre</u>		t-value	p-value	<u>Post</u>		t-value	p-value
	Control Mean±(sd) (N=25)	Treatment Mean±(sd) (N=52)			Control Mean±(sd) (N=23)	Treatment Mean±(sd) (N=44)		
BMI	24.2920 ± 4.8626 (N=25)	24.0000 ± 4.0936 (N=52)	0.28	0.7837	24.3304 ± 5.2394 (N=23)	24.1704 ± 4.0917 (N=44)	0.14	0.8908
VO2	42.3910 ± 4.7483 (N=21)	41.8569 ± 7.2958 (N=39)	0.34	0.7336	43.5534 ± 6.8325 (N=20)	45.6371 ± 5.5311 (N=38)	-1.26	0.2143
Body Fat	28.3360 ± 7.8075 (N=25)	20.4962 ± 10.3437 (N=52)	3.35	0.0013*	27.9391 ± 8.2672 (N=23)	21.8750 ± 10.5031 (N=44)	2.40	0.0191*

Note: \*Significance level was set at  $p < .05$

As seen in Table 6, a non-significant difference exists in pre and post scores for BMI in the control group ( $p=0.8199$ ). VO2 Max scores in the control group reveal a non-significant difference in scores between pre and post ( $p=0.5007$ ). Body fat scores for the control group indicate there is not a significant difference between pre and post scores ( $p=0.5328$ ). In the control group, there were no significant changes in the measures of physical fitness in the areas of BMI, body fat, or VO2 max.

Table 7 displays the paired T-tests of the treatment group for physical characteristics in order to determine change from pre to post. Paired T-tests for BMI in the treatment group indicate a non-significant difference between pre and post scores ( $p=0.1237$ ). VO2 Max scores of the treatment group reveal a highly significant difference ( $p=0.0003$ ) between pre and post scores. Analysis on body fat scores of the treatment group also show a non-significant difference between pre and post scores ( $p=0.5082$ ).

Table 6

*Paired T-tests for Control Group Physical Characteristics*

	Mean Difference	Sd	t-value	p-value
BMI (N=23)	-0.0304	0.6335	-0.23	0.8199
VO2 Max (N=20)	0.7009	4.6244	0.69	0.5007
Tanita Body Fat (N=23)	-0.3130	2.3692	-0.63	0.5328

Table 7

*Paired T-tests for Treatment Group Physical Characteristics*

	Mean Difference	Sd	t-value	p-value
BMI (N=44)	-0.1750	0.7393	-1.57	0.1237
VO2 Max (N=38)	3.7039	5.7313	3.98	0.0003*
Tanita Body Fat (N=44)	-0.1659	1.6494	-0.67	0.5082

Note: \*Significance is set at  $p < .05$ .

For additional information on raw scoring on categories in pre/post data, charts can be found in Appendix N.

## **CHAPTER 5. DISCUSSION**

The purpose of this study was to evaluate the influence of an exercise program on aspects of wellness and mental health of college students at a Midwestern university. The study explored changes in physical fitness and on self-reports of anxiety and depression symptoms before and after participating in a six-week exercise program. Assessment tools that were used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and an Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

### **Addressing the Research Questions**

Over the course of the study, these research questions were examined:

- 1) Will participants vary in their self-reported ratings of anxiety and depression before and after the completion of an exercise program?
- 2) Will participants' attitudes towards exercise and readiness to change occur during the course of the study?
- 3) How much physical change will occur in this exercise program?
  - a. Will physical changes be evident in fat loss?
  - b. Will participants improve in cardiovascular health?

### **Anxiety and Depression**

Results of the Burns' Anxiety Inventory and Burns' Depression Inventory revealed that self-reported ratings of anxiety and depression in participants significantly changed over the course of the study for those participating in weeks of exercise. Anxiety scores decreased in the treatment group between pre and post ( $p=0.0069$ ). The treatment group also showed a significant

decrease in depression scores from pre and post ( $p=0.0475$ ). This result is consistent with other studies in the general and older population that by participating in the recommended amount of moderate to intense physical activity, benefits exist in decreasing anxiety and depression (Babyak, Blumenthal, & Herman, 2000; Chambliss & Dishman, 2004; Chambless, Ollendick, & Thomas, 2001; North, McCullagh, & Zung, 1990; Savage, 2009; Sothorn, Loftin, Suskind, Udall, & Blecker, 1999; Taliaferro, Rienzo, Pigg, Miller, & Dodd, 2009; Taylor, Cable, & Faulkner, 2004). In addition to regular physical activity decreasing symptoms of anxiety and depression, studies also reported an increase in an overall sense of well-being (Cox, Thomas, Hunton, & Donahue, 2004; McKenzie & Smelter, 2001; Wipfli, Rethorst, & Landers, 2008).

The control group results reveal that their depression and anxiety scores from pre to post did not differ significantly. Paired T-tests reveal non significant differences from pre to post according to the Burns' Anxiety scale ( $p=0.3244$ ), and according to the Burns' Depression scale ( $p=0.6344$ ). These results may indicate that the six weeks of exercise in the treatment group did account for a decrease in anxiety and depression over the course of the study, while those who did not participate in the exercise program experienced no significant change.

Participants were required to participate in at least 150 minutes of moderate physical activity per week, according to ACSM (2008) Guidelines. The activities reported by participants for the study included: ultimate frisbee, running, jogging, biking, elliptical machine, baseball, push ups, pull ups, rollerblading, basketball, volleyball, gardening, farmwork, kickboxing, brisk walking, soccer, and rugby.

The results in changes of anxiety and depression over the course of six weeks was previously reported as a relatively adequate amount of time where improvements in psychological responses have been shown (Moses, et al., 1989). Other studies have typically

used 8-12 weeks of exercise prescription to measure psychological changes (Hortobagyi, & DeVita, 2000; Lexell, 1995; Moses, Steptoe, Matthews, & Edwards, 1989). Though more physical activity seem to yield better results, even small amounts of physical activity can produce benefits to well being. An immediate result of exercise is that it takes four to six after the workout for anxiety levels to return to the pre-exercise state (Landers, 1999). Landers (1999) indicated that positive mental health effects begin in the first occurrence of exercise and its effects are ongoing. Positive physiological changes from exercise have been noted to occur within six days of the onset of an exercise regimen (Rogers & Chikashi, 1988).

Studies reported that intense, versus moderate, physical activity increased anxiety and that overtraining mimicked symptoms of depression (Moses, et al., 1989; Paluska & Schwenk, 2000). It's important that the recommended amount and type of physical activity is used in persons with anxiety or depression symptoms. In addition to benefits reducing moderate depression and anxiety, physical activity also can offer other positive benefits such as physical improvements in the body such as a decreased risk for chronic diseases and improved cardiovascular and other aspects of mental health (Penedo & Dahn, 2005).

### **Attitudes Towards Physical Activity**

To answer the second research question, 'Will participants' attitudes towards exercise and readiness to change occur during the course of the study?', participants took the Attitudes Towards Physical Activity Inventory (Appendix D). Questions from the Attitudes Inventory identified attitudes held by participants that indicated how they think about exercise according to the Transtheoretical Model of Behavior Change and if participants had beliefs indicating exercise would benefit their mental health. The Transtheoretical Model explains how individuals move

through the stages of change (Prochaska, Norcross, & DiClemente, 2005). The stages of change readiness in this model are precontemplation, contemplation, preparation for change, action, and maintenance (Prochaska, Norcross, & DiClemente, 2005).

Participants' attitudes in the treatment group towards how exercise affects mental health significantly changed over the course of participating in six weeks of moderate exercise ( $p=0.0013$ ). This result may be attributed to the participants experiencing positive mental health benefits by being in the study, or from receiving information on the benefits of exercise on mental health in their wellness course. Another explanation may be that because participants knew this study was to measure the effects of exercise on mental health, they answered questions in a positive light to provide 'favorable' bias in their responses to benefit purposes of the study. These, however, are only speculations. The important factor is that attitudes/beliefs that physical activity benefits mental health significantly increased over the course of the study for the treatment group. On the other hand, attitudes/beliefs that physical activity improves mental health in the control group reveal no significant difference ( $p=0.4341$ ). Attitudes/beliefs about benefits of exercise to mental health not displaying a significant change in the control group from pre to post may indicate that it was in fact the treatment that had an effect on the results for the treatment group.

The attitudes of treatment group participants indicating a change of stage in the Transtheoretical model according to questions in the Attitudes Towards Physical Activity Inventory indicated a non-significant change from pre to post ( $p=0.2531$ ). Their readiness to engage/commit to physical activity did not change over the course of the study by participating in the six week exercise program. An explanation for this result may be that students were motivated to exercise only out of a reward of gaining extra credit points, and not to necessarily

gain physical or mental benefits or to see long term effects. The change in stages toward exercise in the control group also showed a non-significant difference between the pre and post tests ( $p=0.5050$ ). This result is not surprising as the control group did not receive information on the benefits of exercise from a wellness course or participate in a greater amount of exercise to motivate change in exercise habits or beliefs about exercise.

The results of a change in attitudes of participants in the treatment group is a positive indicator of the effects an exercise programs can have on beliefs and cognitions of individuals towards exercise. These results indicated that the greater the belief that exercise has positive benefits, the more likely individuals will participate in exercise. Again, if the exercise prescription was assigned over a greater number of weeks, more change in attitudes towards exercise may be noted. It would be beneficial for this study to be carried out for a longer time to examine the effects of exercise on anxiety, depression, physical measures, attitudes towards physical activity and how individuals move into other stages of the Transtheoretical model over time.

### **Body Fat and Cardiorespiratory Fitness**

The third research question, ‘Will physical changes be evident in fat loss?’, was examined over the course of the 6 week exercise program with body fat measurements and estimates of BMI. The National Health and Nutrition Examination Survey (NHANES) reported in 2004 that those ages 2-19 were at risk of being overweight. One reason why college student populations experience an increase in body fat is that stressors causing elevated cortisol in the body can lead to an accumulation of fat in the adipose tissues (Bjorntorp, 2001). Having an increase in fat as one ages has also been attributed to factors such as high caloric intake, a lack of knowledge of healthy lifestyles, and a decrease in physical activity (Hill and Peters, 1998).



The results of the BMI and body composition tests indicated that no significant change was recorded after six weeks of implementing an exercise program. This is not surprising as six weeks of exercise may not be enough time to see a change in body fat percentage. Body fat data from the treatment group illustrate non-significant difference between pre to post scores ( $p=0.5082$ ), while for BMI similarly reveal a non-significant difference ( $p=0.1237$ ). In the control group, there were no significant differences in the measures of physical fitness in the areas of BMI ( $p=0.8199$ ), or body fat ( $p=0.5328$ ) from pre to post. These results are not surprising, as no treatment was assigned that would indicate any change in these categories would occur. Non-significant changes in BMI and body fat were not a surprise as six weeks of moderate activity is not adequate to see a lot of physical change occur, though a study has reported six weeks of regular physical activity revealing general physical improvements for participants (Hoeger & Hoeger, 2008). Though significant differences were not found in physical measurements between pre and post of the treatment group in the current study, other studies have indicated an inverse relationship between increased physical activity and body fat in programs lasting 6-12 weeks (King et al., 2001).

Understanding how body fat can affect the wellness of the college student population is important. Evans and Cry-Cambell (1997) identified that an individual's fat-free body mass decreases by about fifteen percent between the third and eighth decade of life. If energy expenditure does not match caloric intake, body fat mass will increase. An increased body fat mass leads to obesity and overweight individuals. Being obese or overweight introduces a number of adverse health effects for individuals, including an increased risk for heart disease, depression, cancer, stroke, hypertension, osteoarthritis, sleep problems, diabetes, and more (Ferrini & Ferrini, 2000; Stevens, Cai, & Pamuk, 1998). Obesity and its related chronic diseases

such as type 2 diabetes, heart disease, stroke, hypertension, and some types of cancer, decrease one's quality of life (Mhurchu et al., 2004). Not only does having too much body fat have negative effects on health and quality of life, a poor diet and lack of physical activity was the second leading cause of preventable death after smoking (Mokdad, 2004).

In addressing the final research question, 'Will participants show a change in cardiovascular health?', results of V02 max data obtained from the Rockport Walk Test indicated a highly significant improvement in cardiovascular health over the course of the six week exercise program ( $p=0.003$ ). These results are encouraging as it shows an improvement in cardio respiratory health over the course of the study.

The control group did not significantly increase in V02 Max between pre and post ( $p=0.5007$ ). This is consistent with other physical measurements of non significant changes in body composition and BMI. This again is not surprising, given activity amounts did not change between pre and post.

Aerobic activity is encouraged throughout the literature and has consistently revealed the greatest mental health benefits for exercise participants, compared to resistance training (Babyak et al., 2000; Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Lawlor & Hopker, 2001). Low to moderate exercise has been recommended, rather than intense exercise for reducing anxiety and depression feelings (Tanaka et al., 2009). Studies have revealed that two weeks was long enough to notice a change in cardiorespiratory fitness levels measured by maximal oxygen uptake and reductions in heart rate (Rogers & Chikashi, 1988).

Such a significant difference in VO2 max was surprising and indicative that cardio respiratory fitness of the treatment group significantly improved over the course of the six-week exercise program. If this study was carried out for a greater number of weeks, the results might show a bigger change in physical attributes than the current study revealed.

This study was limited to a convenience sample of predominately traditional college students in the Midwest and was time-limited since students are enrolled in semester long classes. Another item to consider is that the control group were selected from a class consisting of entirely from one major college, while the treatment group consisted of a wider sample that spread across 6 different major colleges. It could be assumed that those in the treatment group, because they chose to take a wellness course, were more interested in physical activity to begin with than the control group. The control group was also predominantly female, which also affects outcomes and may decrease generalizability of the study to the overall college population. Future studies could randomly select participants from the overall college population in order to provide more generalized results.

Considerations such as dietary intake, medications, diagnosis of mental illness and other variables that may affect results in future studies that were not controlled with the present study. Other mental health concerns may also be examined in future studies, in addition to anxiety and depression. A final consideration is that anxiety and depression may fluctuate at certain times throughout the semester. In future studies, these factors could be explored for further informing the research in how anxiety and depression is experienced at different times throughout a standard semester.

## **CHAPTER 6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

The purpose of this study was to evaluate the influence of an exercise program on aspects of wellness in college students at a Midwestern university. The study explored changes in physical fitness and on self-reports of anxiety and depression symptoms before and after participating in a six-week exercise program. Assessment tools used were the Burns' Anxiety Inventory, Burns' Depression Inventory, and the Attitudes Towards Exercise Inventory. Quantifiable measures of physical fitness were assessed using anthropometric measures for weight and body composition, and the Rockport walking test was used as a measure of cardiovascular fitness.

With anxiety as the third most prevalent mental illness in the US, following depression and alcoholism (Kessler et al. 2005), and with the rates of anxiety and depression in college students rising (NMHA, 2005), additional cost-effective solutions are needed in response to this growing problem. Finding solutions for those experiencing anxiety and depressive symptoms in the college-aged population was an inspiration for this study. Several studies had been conducted on populations in older adults, yet studies need to be conducted in the college-age population group.

This study confirms researchers' determinations of an inverse relationship between exercise and depression and anxiety (Babykak, et al., 2000; Dunn, Trivedi, & O'Neal, 2002; Goodwin, 2003). Low to moderate intensity aerobic activity has previously revealed the greatest mental health benefits for exercise participants (Babyak et al., 2000; Cox, Thomas, Hunton, & Donahue, 2004). In the current study, moderate activity was also shown to produce positive mental and physical health benefits in participants.

Results indicated significant differences existed between pre- and post-scores for the treatment group that participated in the six-week exercise program in categories of anxiety, depression, attitudes/beliefs that exercise can improve mental health, and maximal oxygen uptake (VO<sub>2</sub> max) scores which indicate cardiorespiratory fitness. Non-significant differences were found between pre and post data in the measures of attitudes in the stages of change, body composition and Body Mass Index for the treatment group. In the control group, a significant difference was noted in VO<sub>2</sub> max, but no differences were found in all other categories of anxiety, depression, attitudes towards exercise, body fat, and Body Mass Index.

College students and adults alike should aspire to meet, at minimum, physical activity recommendations. Forty to fifty percent of college students do not meet recommended exercise guidelines (Keating, Guan, Pinero, & Bridges, 2005). Universities can use the findings from this study to inform and set goals for students' physical activity in order to promote positive mental health. This action can then also provide some prevention against negative health conditions caused by inactivity. A realistic goal set by *Healthy People 2010* (American College Health Association, 2004) is to increase the proportion of college students from 44% to 55% who exercise at least 3 days/week at a moderate intensity for at least 30 minutes, or at a vigorous intensity for 20 or more minutes.

It would prove beneficial to target college freshman because the transition that occurs between adolescence into adulthood around the time of entering college is associated with increased sedentary behaviors (Gordon-Larsen, Nelson, & Popkin, 2004). The inactive college student is at greater risk for negative physical health conditions, social stigmatization, discrimination, and psychological problems (Hoffman et al., 2005). College students participating in exercise programs can benefit from the social interaction that can take place in

certain types of physical activity, such as group fitness classes, exercising with friends, in the campus fitness center, or joining a team sport/intramural sports often offered on college campuses. Social support is very important to maintaining or adopting healthy behaviors (Lau, Quadrel, & Hartman, 1990).

In order for students to develop a lifestyle of wellness, it is essential to develop cognitions and appropriate beliefs associated with long-term, successful healthy behaviors. Making healthy lifestyle choices, including adequate physical activity, are major factors that one carries throughout their life (McReynolds & Rossen, 2004). With the theoretical backing of the Transtheoretical Model of Behavior Change based on the constructs of cognitive-behavioral intervention, one can design an exercise prescription in order to introduce the personal benefits of exercise. This will likely help the individual shape positive attitudes toward increased, then maintained, physical activity. University counseling centers, exercise professionals, and others working with the college population have a valuable opportunity to instill knowledge, skills, and positive attitudes about health in a crucial time of students' development of cognitive decision-making and long-term behaviors.

### **Summary**

Overall, results from this study indicate that participation in moderate intensity exercise may be used as an additional tool to alleviate symptoms of depression and anxiety in college students. Results from the study can benefit society by identifying how participating in the recommended amounts of physical activity can help alleviate symptoms of anxiety and

depression in the college students or in the general population. Scientific literature would benefit from the duplication of this study for a longer duration in order to determine whether or not increased statistical significance is found in changes to body composition or in the reduction of anxiety and/or depression symptoms while adhering to regular exercise.

Mental health professionals can specifically benefit from the knowledge this study provides in terms of understanding the type of mental health benefits available to students through participation in certain types of exercise, how exercise can be used as additional tool in treatment plans for students who present moderate or mild symptoms of depression or anxiety, or as prevention tool for mental illness. The findings of this study may benefit exercise science professionals as they prescribe exercise prescriptions, specifically in terms of intensity and type of physical activity, for those suffering effects of depression and anxiety. Alleviating symptoms of depression and anxiety can greatly improve one's quality of life, success in college and career, and relationships.

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## APPENDIX A. IRB APPROVAL AND CONTINUATION FORMS

**NDSU**

**NORTH DAKOTA STATE UNIVERSITY**

*Institutional Review Board*

*Office of the Vice President for Research, Creative Activities and Technology Transfer  
NDSU Dept. 4000  
1735 NDSU Research Park Drive  
Research 1, P.O. Box 6050  
Fargo, ND 58108-6050*

701.231.8995

Fax 701.231.8098

Federalwide Assurance #FWA00002439

February 9, 2012

Donna Terbizan  
Department of Health, Nutrition and Exercise Science  
Benston Bunker Fieldhouse

### Notice of IRB Approval

Protocol #HE12117

"The Relationship between Exercise and Mental Health in College Students"

Co-investigator(s) and research team: Nikki Demers, Sarah Hilgers, Rebecca Woods, Trista Manikowski, Courtney Simons, Sarah Kerns, Jaime Raden, Danielle Anderson

Approval period: 2/9/2012 to 2/8/2013

Continuing Review Report Due: 1/1/2013

Research site(s): NDSU

Funding agency: n/a

Review Type:  Expedited category # 4, 7  Full Board

IRB approval is based on original submission, with revised: protocol (received 2/8/2012), and consent forms (received 2/9/2012).

#### Additional approval is required:

- o prior to implementation of any proposed changes to the protocol (*Protocol Amendment Request Form*).
- o for continuation of the project beyond the approval period (*Continuing Review/Completion Report Form*). A reminder is typically sent two months prior to the expiration date; timely submission of the report is your responsibility. To avoid a lapse in approval, suspension of recruitment, and/or data collection, a report must be received, and the protocol reviewed and approved prior to the expiration date.

#### A report is required for:

- o any research-related injuries, adverse events, or other unanticipated problems involving risks to participants or others within 72 hours of known occurrence (*Report of Unanticipated Problem or Serious Adverse Event Form*).
- o any significant new findings that may affect risks to participants.
- o closure of the project (*Continuing Review/Completion Report Form*).

**Research records are subject to random or directed audits at any time to verify compliance with IRB regulations and NDSU policies.**

Thank you for cooperating with NDSU IRB procedures, and best wishes for a successful study.

Sincerely,



Teryl Grosz, MS, CIP  
Manager, Human Research Protection Program

Last printed 2/9/2012 9:56:00 AM

NDSU is an EO/AA university.

**Institutional Review Board** ...for the protection of human participants in research

Date of Receipt

North Dakota State University  
Sponsored Programs Administration  
1735 NDSU Research Park Drive  
NDSU Dept #4000  
PO Box 6050  
Fargo, ND 58108-6050 231-8995(ph) 231-8098(fax)



**Continuing Review or Completion Report Form**

Use this form to: 1) request a continuation of IRB approval if a project is currently active (recruiting subjects, collecting data, or analysis of identifiable data), or 2) report completion of a project.

**Protocol Information**

Protocol #: **HS12117** Original approval date\*: **2/9/2012**

Title: **THE RELATIONSHIP BETWEEN EXERCISE AND MENTAL HEALTH IN COLLEGE STUDENTS**

Principal investigator: **Donna Terbizan** 7/20/12

Co-investigator: **Nikki Demers** 12/12/11

Department: Health, Nutrition, & Exercise Sciences

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E-Mail/Campus Address:  
**nikki.demers@my.ndsu.edu**

\* Complete and submit an updated protocol form & relevant attachments every 5 years following approval. Protocol records must be updated every 5 years by completing a new protocol form and any relevant attachments, and including it with this report. Use the most recent version of the forms on the IRB website at: [http://www.ndsu.edu/research/irb/rcatt\\_irb\\_forms.php](http://www.ndsu.edu/research/irb/rcatt_irb_forms.php).

**Project Status**

Ongoing and currently active Expected end date of research: **May 2013**

Complete, abandoned or inactive

Source of current funding\*\*: FAR#  Not funded  
Current Funding period: Start date: End Date:

Pending funding proposals\*\*:  N/A

\*\*Attach copy of final grant application(s), and/or recent report to funding agency

**Research team:** List all NDSU individuals involved in the research (project design/oversight, recruiting participants, obtaining informed consent, intervening or interacting with participants to obtain information/data, and/or handling identifiable information for research purposes). May provide as a separate attachment.

Name, dept. or affiliation: Specify role in research: Training date: (IRB Use only)



Donna Terbizan	Principle Investigator/Project Oversight	7/20/12
Nikki Demers	Co-investigator/Project Design	12/12/11
Sarah Hilgers Rebecca Woods	Course Instructors/recruitment	Hilgers - 3/16/12 Woods - 1/19/12
<del>Trista Manikowske</del> <i>Removed per D.T.</i> Sarah Kerns Danielle Anderson Courtney Simons Jaime Raden	Data Collection Assistants	<del>Manikowske</del> Kerns - 2/21/12 Anderson - 1/18/12 Simons - 2/24/10 Raden - 2/23/11

**Project Summary**

Brief summary of results to date:

**Data collection has been completed. Analysis of data has been conducted and is continuing to be examined and reported on into a doctoral dissertation.**

List research site(s):

NDSU's Bentson-Bunker Fieldhouse Human Performance Laboratory and Wellness Center

List presentations or publications that have resulted from this research since the last review:

**None**

**Participants:**

# Completing since last review: <b>78</b>	Total # completing (cumulative): <b>78</b>
Will more participants be recruited? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes* – Indicate approximately how many: <b>* Attach a copy of current consent form(s), and any recruitment materials</b>	
Informed Consent: A copy of the approved informed consent form has been signed by each of the participants in the study, and retained for your records. Has this requirement been met? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No – explain: <input type="checkbox"/> N/A, waiver approved	
Have any potential participants declined to participate, or withdrawn from the research? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes - explain: <b>After signing up for the study, select students disenrolled from the study and their results were not included.</b>	
Summarize any complaints about the research (and their resolution) since the last review? <b>None</b>	

**Risk/Benefit Ratio:**

Summarize any unanticipated problems (even if previously reported) or adverse events that have occurred since the last review:

**None**

*Unanticipated problem: an unanticipated problem that involves risks to subjects or others is any incident, experience, or outcome that meets all the following criteria:*

- is unexpected (in terms of nature, severity, or frequency) given the characteristics of the subject population and the research as described in the IRB approved protocol and consent document(s)
- is related, or possibly related to participation in the research
- suggests the research places subjects or others at greater risk of harm (physical, psychological, economic, or social harm) that previously known or recognized
- may not have resulted in actual harm to subjects, but may only represent increased risk of harm (ie., physical, psychological, social, economic, legal).

*Adverse event: any untoward or unfavorable medical occurrence (physical or psychological) in a human subject, including any abnormal sign, symptom, or disease, temporally associated with the subject's participation in the research, whether or not considered related to their research participation. Such events may have already been expected to occur with a certain frequency and severity, and previously identified as potential risks in the protocol form, and consent document(s).*

Has any new information resulted from the study or any literature, that would affect the risk/benefit ratio for new subjects (or for those currently or previously enrolled)?

No

Yes –explain, and indicate how this has been/will be addressed with future, current, or previously enrolled participants:

**Investigator's Assurance**

The signature below certifies that:

- information provided in this application is complete and accurate
- each individual involved as a member of the research team possesses the necessary experience for conducting research activities in their assigned role, and is aware of and will abide by NDSU policies and procedures for the protection of research participants
- the research will be conducted according to the approved protocol
- changes will receive IRB approval prior to implementation, unless necessary to prevent immediate serious harm to participants
- all unanticipated problems involving risks to participants or others will be promptly reported to the IRB.

Donna Terbizan via email 12/20/12

**Principal Investigator signature, date**

*In lieu of a written signature, submission of this report via the Principal Investigator's NDSU email constitutes an acceptable electronic signature.*

-----FOR IRB USE ONLY-----

Project is:	<input checked="" type="checkbox"/> Approved for continuation	<input type="checkbox"/> Complete/Inactive	<input type="checkbox"/> Archive after _____
IRB Signature:	<u>Kristy Shuley</u>	Date:	<u>1/24/2013</u>
Reviewed by:	<input type="checkbox"/> Full Board - meeting date _____	<input checked="" type="checkbox"/> Expedited review, category #	<u>4/7</u>
Current approval period expires:	<u>2/8/2014</u>		
Next Continuing Review/Completion Report due*:	<u>4/1/2014</u>		
<i>Note that the IRB office will typically notify the investigator a month prior to the due date; however, timely submission of the report is the PI's responsibility.</i>			

## APPENDIX B. BURNS ANXIETY INVENTORY

Name: \_\_\_\_\_ Class/section #: \_\_\_\_\_ Date: \_\_\_\_\_

### The Burns Anxiety Inventory

Instructions: The following is a list of symptoms that people sometimes have in anxiety. Put the number (0-3) in the space to the right that best describes how much that symptom or problem has bothered you during the past week. Make sure you answer all the questions. If you feel unsure about any, put down your best guess.

**0 - NOT AT ALL**

**1 - SOMEWHAT**

**2 - MODERATELY**

**3 - A LOT**

#### Symptom List

##### *CATEGORY I: ANXIOUS FEELINGS*

- \_\_\_\_\_ 1. Anxiety, nervousness, worry or fear
- \_\_\_\_\_ 2. Feeling that things around you are strange, unreal, or foggy
- \_\_\_\_\_ 3. Feeling detached from all or part of your body
- \_\_\_\_\_ 4. Sudden unexpected panic spells
- \_\_\_\_\_ 5. Apprehension or a sense of impending doom
- \_\_\_\_\_ 6. Feeling tense, stressed, "uptight", or on edge

##### *CATEGORY II: ANXIOUS THOUGHTS*

- \_\_\_\_\_ 7. Difficulty concentrating
- \_\_\_\_\_ 8. Racing thoughts or having your mind jump from one thing to the next
- \_\_\_\_\_ 9. Frightening fantasies or daydreams
- \_\_\_\_\_ 10. Feeling that you're on the verge of losing control
- \_\_\_\_\_ 11. Fears of cracking up or going crazy
- \_\_\_\_\_ 12. Fears of fainting or passing out
- \_\_\_\_\_ 13. Fears of physical illnesses or heart attacks or dying
- \_\_\_\_\_ 14. Concerns about looking foolish or inadequate in front of others
- \_\_\_\_\_ 15. Fears of being alone, isolated, or abandoned
- \_\_\_\_\_ 16. Fears of criticism or disapproval
- \_\_\_\_\_ 17. Fears that something terrible is about to happen

##### *CATEGORY III: PHYSICAL SYMPTOMS*

- \_\_\_\_\_ 18. Skipping or racing or pounding of the heart (sometimes called "palpitations")
- \_\_\_\_\_ 19. Pain, pressure or tightness in the chest
- \_\_\_\_\_ 20. Tingling or numbness in the toes or fingers
- \_\_\_\_\_ 21. Butterflies or discomfort in the stomach
- \_\_\_\_\_ 22. Constipation or diarrhea
- \_\_\_\_\_ 23. Restlessness or jumpiness
- \_\_\_\_\_ 24. Tight, tense muscles
- \_\_\_\_\_ 25. Sweating not brought on by heat
- \_\_\_\_\_ 26. A lump in the throat

- \_\_\_\_\_ 27. Trembling or shaking
- \_\_\_\_\_ 28. Rubbery or “jelly” legs
- \_\_\_\_\_ 29. Feeling dizzy, lightheaded, or off balance
- \_\_\_\_\_ 30. Choking or smothering sensations or difficulty breathing
- \_\_\_\_\_ 31. Headaches or pains in the neck or back
- \_\_\_\_\_ 32. Hot flashes or cold chills
- \_\_\_\_\_ 33. Feeling tired, weak, or easily exhausted

Scoring key: refer to this key to determine your degree (if any) of anxiety.

\* Copyright © 1984 by David Burns, M.D., from *The Feeling Good Handbook*, copyright © 1989

#### Scoring Key for Anxiety

Total Score Degree of Anxiety

0 – 4 Minimal or no anxiety

5 – 10 Borderline anxiety

11 – 20 Mild anxiety

21 – 30 Moderate anxiety

31 – 50 Severe anxiety

51 – 99 Extreme anxiety or panic

## APPENDIX C. BURNS DEPRESSION CHECKLIST

Name: \_\_\_\_\_ Class/section #: \_\_\_\_\_ Date: \_\_\_\_\_

### The Burns Depression Checklist

Instructions: Place a number (0-3) in the line to the right of each of the 15 symptom clusters to indicate how much this type of feeling has been bothering you in the past several days. Make sure you answer all the questions. If you feel unsure about any, put down your best guess.

**0 - NOT AT ALL**

**1 - SOMEWHAT**

**2 - MODERATELY**

**3 - A LOT**

- \_\_\_\_\_ 1. Sadness: Have been feeling sad or down in the dumps?
- \_\_\_\_\_ 2. Discouragement: Does the future look hopeless?
- \_\_\_\_\_ 3. Low self-esteem: Do you feel worthless or think of yourself as a failure?
- \_\_\_\_\_ 4. Inferiority: Do you feel inadequate or inferior to others?
- \_\_\_\_\_ 5. Guilt: Do you get self-critical and blame yourself for everything?
- \_\_\_\_\_ 6. Indecisiveness: Do you have trouble making up your mind about things?
- \_\_\_\_\_ 7. Irritability and frustration: Have you been feeling resentful and angry a good deal of the time?
- \_\_\_\_\_ 8. Loss of interest in life: Have you lost interest in your career, your hobbies, your family or your friends?
- \_\_\_\_\_ 9. Loss of Motivation: Do you feel overwhelmed and have to push yourself hard to do things?
- \_\_\_\_\_ 10. Poor self-image: Do you think you're looking old or unattractive?
- \_\_\_\_\_ 11. Appetite Changes: Have you lost your appetite? Or do you overeat or binge compulsively?
- \_\_\_\_\_ 12. Sleep changes: Do you suffer from insomnia and find it hard to get a good night's sleep? Or are you excessively tired and sleeping too much?
- \_\_\_\_\_ 13. Loss of libido: Have you lost your interest in sex?
- \_\_\_\_\_ 14. Hypochondriasis: Do you worry a great deal about your health?
- \_\_\_\_\_ 15. Suicidal impulses: Do you have thoughts that life is not worth living or think that you might be better off dead?

† Anyone with suicidal urges should seek immediate consultation with a qualified psychologist or psychiatrist

Scoring key: please refer to this key to determine your degree (if any) of depression.

\* Copyright © 1984 by David Burns, M.D., from *The Feeling Good Handbook*, copyright © 1989

Scoring Key for Depression

Total Score Degree of Depression

0 – 4 Minimal or no depression

5 – 10 Borderline depression  
11 – 20 Mild depression  
21 – 30 Moderate depression  
31 – 45 Severe depression

## APPENDIX D. ATTITUDES TOWARD PHYSICAL ACTIVITY SURVEY

### Attitude Toward Exercise and Physical Activity

**Directions:** In order to assess your attitudes toward exercise and physical activity, we would like you to express your true feelings, beliefs and actions with respect to the following statements. There are no right or wrong answers, it is strictly a matter of personal beliefs and attitudes toward exercise. Therefore, please express how you feel, not how you think you should feel. Please place the corresponding letter in the space provided before each question.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A	B	C	D	E

1. \_\_\_\_\_ Physical exercise is beneficial to the human body.
2. \_\_\_\_\_ Exercise helps to work off emotional tensions and anxieties.
3. \_\_\_\_\_ Adults get all the physical activity they need in their daily work.
4. \_\_\_\_\_ Exercise is of little value in maintaining desirable body weight.
5. \_\_\_\_\_ Regular physical activity makes one feel better.
6. \_\_\_\_\_ Physical education should be a required subject for elementary and secondary school children.
7. \_\_\_\_\_ Exercise does more harm than good.
8. \_\_\_\_\_ Those who are physically able should take part in a daily period of physical activity.
9. \_\_\_\_\_ An individual has all the strength and stamina he needs without participating in an exercise program.
10. \_\_\_\_\_ Exercise does little to improve a person's sense of well-being.
11. \_\_\_\_\_ Heavy physical exercise makes an individuals muscle bound.
12. \_\_\_\_\_ When recovering from a cold it is best if one does not engage in physical activity.
13. \_\_\_\_\_ Participation in physical activity aids mental relaxation.
14. \_\_\_\_\_ Exercise is important in aiding a person to gain and maintain all-around good health.
15. \_\_\_\_\_ The heart cannot be strengthened by exercise.
16. \_\_\_\_\_ A person's leisure time should be spent in rest and relaxation.
17. \_\_\_\_\_ Individual sports such as tennis, are more satisfying to play than team games.
18. \_\_\_\_\_ I think exercise is good for me.
19. \_\_\_\_\_ You should seek help from a qualified physical educator before you undertake strenuous exercise.
20. \_\_\_\_\_ Regular exercise decreases one's desire to smoke.
21. \_\_\_\_\_ A person in good physical condition is more able to endure nervous stress.
22. \_\_\_\_\_ Exercising with a group leads to improved social relationships.
23. \_\_\_\_\_ Exercise becomes less necessary as one advances in age.



24. \_\_\_\_\_ A woman can improve her poise and posture by regular participation in physical activity.
25. \_\_\_\_\_ Regular physical activity has a beneficial effect on an individual's ability to carry out his job responsibilities.
26. \_\_\_\_\_ Exercise gets rid of harmful feelings and emotions such as anger and hostility.
27. \_\_\_\_\_ Those who are physically healthy do not need to engage in physical activity.
28. \_\_\_\_\_ Anyone over 25 years of age should avoid exercise because he/she might strain her/his heart.
29. \_\_\_\_\_ Regular participation in physical activity makes one look better.
30. \_\_\_\_\_ It is better to have never exercised at all than to have exercised and stopped completely.
31. \_\_\_\_\_ It is annoying that we have to waste our time exercising.
32. \_\_\_\_\_ A period of exercise gives a feeling of well-being.
33. \_\_\_\_\_ Exercise is of no real value in improving one's health.
34. \_\_\_\_\_ Those who are physically able should engage in a weekly session of physical activity.
35. \_\_\_\_\_ Muscles, when not used, turn to fat.
36. \_\_\_\_\_ Exercise is valuable in building up an adequate reserve of strength and stamina for everyday living.
37. \_\_\_\_\_ Regular exercise does not relieve constipation.
38. \_\_\_\_\_ If I exercised, I would rather do it by myself.
39. \_\_\_\_\_ Girls should not exercise strenuously because they will become muscular.
40. \_\_\_\_\_ Physical exercise is less important today than it was in my parent's time.
41. \_\_\_\_\_ Exercise increases one's appetite.
42. \_\_\_\_\_ When one reaches full physical growth, exercise is no longer necessary.
43. \_\_\_\_\_ Physical activity in some form is an excellent remedy for the tense, irritable and anxious person.
44. \_\_\_\_\_ Regular physical activity makes one more alert.
45. \_\_\_\_\_ Regular physical activity has little effect on one's personality.
46. \_\_\_\_\_ A person in good physical condition is less likely to have colds.
47. \_\_\_\_\_ Regular physical activity will help me live longer.
48. \_\_\_\_\_ Working up a good sweat helps to get rid of body poisons.
49. \_\_\_\_\_ When a person improves his physical condition, he improves his work productivity.
50. \_\_\_\_\_ Physical activity can help in preventing major medical diseases.

## APPENDIX E. PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

Physical Activity Readiness  
Questionnaire - PAR-Q  
(revised 2002)

# PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
<input type="checkbox"/>	<input type="checkbox"/>	2. Do you feel pain in your chest when you do physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	3. In the past month, have you had chest pain when you were not doing physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
<input type="checkbox"/>	<input type="checkbox"/>	5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do you know of any other reason why you should not do physical activity?

If  
you  
answered

### YES to one or more questions

Take a 20-minute rest before starting or stop for 30-60 seconds if you start becoming much more physically active. If you have chest pain, stop all your activity about the PAR-Q and call your doctor your week YES.

- You may be able to do an activity you are not used to doing more slowly and build up gradually. Do so, and if you feel any chest pain, stop your activity and take a 20-minute rest. Call your doctor your week YES.
- If you are on a continuing program, be safe and be healthy.

### NO to all questions

If you answer NO to every question on the PAR-Q, you can start becoming more active. If you are between the ages of 15 and 69, you can start becoming much more physically active. If you are over 69, you can start becoming more active.

- Use common sense when you start becoming more active. If you are over 69, you should be sure you are not doing more than you are used to doing. If you are between the ages of 15 and 69, you can start becoming much more physically active.

### DELAY BECOMING MUCH MORE ACTIVE:

- If you are becoming ill because of a temporary illness such as a cold or a fever, wait until you feel better.
- If you are on any medicines, talk to your doctor before you start becoming more active.

**PLEASE NOTE:** If you are over 69 years of age, you should call your doctor if you answer YES to any of the seven questions. If you are between the ages of 15 and 69, you should call your doctor if you answer YES to any of the seven questions.

**Informed Use of the PAR-Q:** The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

**No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.**

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME \_\_\_\_\_

SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

SIGNATURE OF PARENT  
or GUARDIAN (for participants under the age of majority) \_\_\_\_\_

WITNESS \_\_\_\_\_

**Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.**



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## APPENDIX F. INITIAL DEMOGRAPHIC QUESTIONNAIRE

Name: \_\_\_\_\_ Class/section: \_\_\_\_\_

### Initial Questionnaire:

1. Name: \_\_\_\_\_
2. Email: \_\_\_\_\_
3. Class standing (Freshmen, Sophomore, Junior, or Senior): \_\_\_\_\_
4. Do you attend class/es fulltime, part-time, or other (circle one)
5. Major/s: \_\_\_\_\_
6. Minor/s: \_\_\_\_\_
7. Race: \_\_\_\_\_
8. Age: \_\_\_\_\_
9. Height: \_\_\_\_\_
10. Do you live (check response):  
 On campus \*If yes, do you have a roommate? Yes or No (circle)  
 Off campus \*If yes, do you have a roommate? Yes or No (circle)  
 With parents  
 In an apartment
11. Are you currently (check response):  
 Single  
 Married  
 Living with partner
12. Do you have a job in addition to taking class/es? Yes or No (circle) If yes, on average, how many hours per week do you work at this job? \_\_\_\_\_
13. Are you on a meal plan at NDSU? Y or N (circle) If yes, what meal plan?  
\_\_\_\_\_
14. Gender: (check response)  Female  Male

**APPENDIX G. FOLLOW UP QUESTIONNAIRE**

**Name:** \_\_\_\_\_ **Class name/section:** \_\_\_\_\_

Follow up Questionnaire

1. Are you planning to continue with meeting the recommendations of 150 minutes of exercise per week or more after the study is complete? Y or N (circle)
  
2. A. Do you feel participating in this exercise program helped in the levels of anxiety that you experience? Y or N (circle)  
  
B. On a scale 1-10, (with 1 being least effective and 10 being very effective), please rate the amount of help on anxiety symptoms exercising has been for you. 1 2 3 4 5 6 7 8 9 10
  
3. A. Do you feel participating in this exercise program helped in the symptoms of depression that you experience? Y or N (circle)  
  
B. On a scale 1-10, (with 1 being least effective and 10 being very effective), please rate the amount of help on depressive symptoms exercising has been for you. 1 2 3 4 5 6 7 8 9 10
  
4. List any other benefits did experienced (if any) while participating in the study:  
\_\_\_\_\_
  
5. Did you experience any negative events of any kind while participating in the study? Y or N (circle) If yes, explain here: \_\_\_\_\_
  
6. Over the course of the study were you treated for any new symptoms of depression/anxiety? Yes or No (circle) If so, please describe treatment:  
\_\_\_\_\_
  
7. Have you noticed anything ‘different’ about yourself after participating in the recommended amounts of exercise over the course of this study? (Example: physical differences, mood differences, etc.)Y or N (circle) If, yes, please describe:  
\_\_\_\_\_
  
8. If you were to experience depression or anxiety symptoms in the future, would you use exercise as a tool to help alleviate these symptoms? Y or N

### APPENDIX H. EXERCISE LOG

Name: \_\_\_\_\_ Week: (circle one) 1 2 3 4 5 6

Date	Activity	Duration (minutes)	Intensity (moderate/vigorous)	Explanation of activity

**APPENDIX I. LECTURE COURSE CONSENT FORM**  
**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

**“The relationship between exercise and mental health in college students”**

**Title of Research Study:** The relationship between exercise and mental health in college students

**This study is being conducted by:** Donna Terbizan, Bentson Bunker Fieldhouse/xxx-xxx-xxxx, Email: D.Terbizan@ndsu.edu, and Nikki Demers, Benston Bunker Fieldhouse/xxx-xxx-xxxx, Email: nikki.demers@my.ndsu.edu

**Why am I being asked to take part in this research study?** You have been selected to participate because of your enrollment in a lecture course at North Dakota State University during the spring of 2012. In order to enroll in this study, you must be able to briskly walk one mile, and must be 18 years of age. There will be approximately 25-150 students participating in the study.

**What is the reason for doing the study?** The purpose of this study is to evaluate the influence of an exercise program on aspects of wellness in college students. The study will explore changes in physical fitness, body composition, and anxiety and depression symptoms before and after participating in a six-week exercise program at (Midwestern University). Students who volunteer for the study may or may not suffer from anxiety or depression. Students in the lecture course are serving as the control group for this study, and will do no structured exercise during the study other than what you are currently doing. By participating in the study, you can earn 6 extra credit points for your class. You will receive 3 points for completing the pretesting in February and 3 points for completing the post-testing in April. You can receive an additional 6 extra credit points by providing a paragraph to your course instructor using course terminology to describe your participation experience.

**What information will be collected about me?**

You will be asked to meet outside of class for approximately one hour of time in February and again for one hour in April for assessments described below.

During the initial and final assessments, you will complete a questionnaire asking a series of questions pertaining to your class standing, major, exercise habits, etc. You will then take a short anxiety and depression inventory, a PAR-Q questionnaire, (to determine physical activity readiness), and an Attitudes Towards Exercise questionnaire. These surveys will take no longer than fifteen minutes to complete. For the physical assessments, you will have your height measured in inches and then have your body fat content and weight measured on the Tanita-300 Analyzer. This machine sends electrical current through the body to estimate body fat, lean body mass and the amount of body water through the sensors on the surface of the machine. There is no harm done to you by using this machine. You will then take the Rockport one-mile walk test to determine cardiovascular fitness. You will walk as brisk as possible for one mile without running on the track on the second floor the NDSU Wellness Center. You will wear a Polar<sup>®</sup> heart rate monitor during the Rockport walk test to measure the time it takes to complete the mile as well as read your heart rate at the end of the assessment. The Rockport Walk Test will take approximately 15-20 minutes to complete. Research assistants will be on hand to help with all aspects of these assessments.

**Where is the study going to take place, and how long will it take?** The assessments will take approximately 1 hour. Assessments will take place on campus.

**What are the risks and discomforts?**

Minimal muscle or joint discomfort may occur when participating in the Rockport Walk Test fitness testing. This soreness should subside in two to three days. Other minimal potential risks may include increased heart rate and breathing rate, abnormal blood pressure and in rare cases, fainting. However the potential risk is not greater than walking briskly to class or more than what you already encounter while participating in regular activity. No risks will be involved while being weighed, measuring height or filling out questionnaires. All measurements will be conducted individually and your results will be held confidentially by the research team.

It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known risks to the participant [or embryo or fetus if the subject is or may become pregnant. If new findings develop during the course of this research that may change your willingness to participate, we will tell you about these findings.

**What are the benefits to me?**

As a benefit to participating in the study, you will receive valuable information on your current physical fitness status, and will receive an objective assessment of your fitness level. Also extra credit/research credits will be distributed if you complete the study. Attendance of study participants will be mandatory at all assessments in order to receive the points. In extenuating circumstances, students who miss or are unable to attend the times set up for assessments, need to make arrangements with the researcher to set up another time to have them completed.

You may not get any benefit from being in this research study.

**What are the benefits to other people?**

The research will benefit scientific research and provide information on how to enhance the wellbeing of college students. Results from the study may benefit society by identifying how participating in the recommended amounts of physical activity can help alleviate symptoms of anxiety and depression in college students or the general population.

**Do I have to take part in the study?**

Your participation in this research is entirely optional. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

**What will it cost me to participate?**

There is no monetary cost involved in participating in this study.

**What are the alternatives to being in this research study?**

If you do not wish to participate in the study you can still earn extra credit points by completing an alternative assignment. The alternative assignment will be a 3-5 page typed paper explaining the impact of physical activity on health (this may include physical, mental, social, and/or emotional health). The paper will be graded by the researcher according to the quality of content and a rubric that will be established. The points awarded for this alternative option will be equal to the points awarded as participating in the study. The due date for this alternative assignment will be Friday April 27<sup>th</sup>. The instructor of the course will be given a list of the students who completed this option after they have been graded. And you can receive an additional 6 extra credit points by providing a paragraph to your course instructor using course terminology to describe your participation experience.

**Who will see the information that I give?**

The information you provide will remain confidential. Your name will never be used throughout the study or in the final report. Collected data will not be released to anyone other than the principle investigator and members of the research team. You can choose to not answer any of the questions throughout the program. You may withdraw your consent at any time. Information gathered from this study may be used in publication in research or professional journal articles following the study, but your name will not be associated in any way with the data.

We will keep private all research records that identify you. Your information will be combined with information from other people taking part in the study. The information collected about you will be stored in a locked file cabinet in the principle investigator's office. We need to keep your name and your data connected until all information has been collected. We will then destroy any links to your name, and the data will only contain participant numbers.

The data from this project are owned by North Dakota State University and the investigators. You are able to see the data you have provided by submitting a written request to the principle investigator, Donna Terbizan, at the Benson-Bunker Fieldhouse, Room 1. Data obtained from this study will be kept for seven years following the study.

**Can my taking part in the study end early?** If you fail to complete this informed consent, or the PAR-Q, or do not show up to either of the assessment periods you may be removed from the study. If the PAR-Q suggests that it is

unsafe for you to participate in physical activity, you will not be able to take part in the study. But you can complete the alternative assignment to receive extra credit points.

**Will I receive any compensation for taking part in this study?**

You will have an opportunity to participate in this study for 6 points of extra credit, plus an additional 6 points as describe above. You can discontinue from the study at any time, and will not be penalized. However, to receive extra credit you need to complete the entire study. If you do not wish to participate in the study, you may earn extra credit points by completing the alternative assignment described above. There will be no additional monetary award for participation.

**What happens if I am injured because of this research?**

If you receive an injury in the course of taking part in the research, you should contact Donna Terbizan at (xxx) xxx-xxxx or Nikki Demers at (xxx) xxx-xxxx. Treatment for the injury will be available including first aid, emergency treatment and follow-up care as needed. Payment for this treatment must be provided by you and your third party payer (such as health insurance or Medicare). This does not mean that you are releasing or waiving any legal right you might have against the researcher or the University as a result of your participation in this research.

**What if I have questions?**

Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, please contact Nikki Demers at (xxx) xxx-xxxx, nikki.demers@ndsu.edu or Dr. Donna Terbizan at (xxx) xxx-xxxx, d.terbizan@ndsu.edu.

**What are my rights as a research participant?**

You have rights as a participant in research. If you have questions about your rights, or complaints about this research or to report a research-related injury”, you may talk to the researcher or contact the NDSU Human Research Protection Program by:

- Telephone: 701.231.8908
- Email: ndsu.irb@ndsu.edu
- Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: [www.ndsu.edu/research/irb](http://www.ndsu.edu/research/irb).

**Documentation of Informed Consent:**

You are freely making a decision whether to be in this research study. Signing this form means that

1. You have read and understood this consent form
2. You have had your questions answered, and
3. You have decided to be in the study.

You will be given a copy of this consent form to keep.

\_\_\_\_\_  
Your signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Your printed name

\_\_\_\_\_  
Signature of researcher explaining study

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name of researcher explaining study



**APPENDIX J. ACTIVITY COURSE CONSENT FORM**  
**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

**“The relationship between exercise and mental health in college students”**

**Title of Research Study:** The relationship between exercise and mental health in college students

**This study is being conducted by:** Donna Terbizan, Bentson Bunker Fieldhouse/xxx-xxx-xxxx, Email: D.Terbizan@ndsu.edu, and Nikki Demers, Benston Bunker Fieldhouse/xxx-xxx-xxxx, Email: nikki.demers@my.ndsu.edu

**Why am I being asked to take part in this research study?** You have been selected to participate because of your enrollment in (Activity course) at North Dakota State University during the spring of 2012. In order to enroll in this study, you must be able to briskly walk one mile, and must be 18 years of age. There will be approximately 25-150 students participating in the study.

**What is the reason for doing the study?** The purpose of this study is to evaluate the influence of an exercise program on aspects of wellness in college students. The study will explore changes in physical fitness, body composition, and anxiety and depression symptoms before and after participating in a six-week exercise program at NDSU. Students who volunteer for the study may or may not suffer from anxiety or depression.

**What information will be collected about me?**

You will be asked to meet outside of class for approximately one hour of time in February and again for one hour in April for assessments described below. Between these assessments, you will be asked to engage in 150 minutes of moderate physical activity each week and record the duration and type of activity on an activity log provided. You will submit this log on your course blackboard site each Friday by 5pm.

During the initial and final assessments, you will complete a questionnaire asking a series of questions pertaining to your class standing, major, exercise habits, etc. You will then take a short anxiety and depression inventory, a PAR-Q questionnaire, (to determine physical activity readiness), and an Attitudes Towards Exercise questionnaire. These surveys will take no longer than fifteen minutes to complete. For the physical assessments, you will have your height measured in inches and then have your body fat content and weight measured on the Tanita-300 Analyzer. This machine sends electrical current through the body to estimate body fat, lean body mass and the amount of body water through the sensors on the surface of the machine. There is no harm done to you by using this machine. You will then take the Rockport one-mile walk test to determine cardiovascular fitness. You will walk as brisk as possible for one mile without running on the track on the second floor the NDSU Wellness Center. You will wear a Polar<sup>®</sup> heart rate monitor during the Rockport walk test to measure the time it takes to complete the mile as well as read your heart rate at the end of the assessment. The Rockport Walk Test will take approximately 15-20 minutes to complete. Research assistants will be on hand to help with all aspects of these assessments.

**Where is the study going to take place, and how long will it take?** The assessments will take anywhere from 45 minutes to 1 hour. Assessments will take place on campus. Between the assessments, you will be asked to spend a minimum of 150 minutes doing moderate physical activity.

**What are the risks and discomforts?**

Minimal muscle or joint discomfort may occur when participating in the Rockport Walk Test fitness testing and during the six weeks of activity participation. This soreness should subside in two to three days. Other minimal potential risks may include increased heart rate and breathing rate, abnormal blood pressure and in rare cases, fainting. However the potential risk is not greater than walking briskly to class or more than what you already encounter while participating in regular activity. No risks will be involved while being weighed, measuring height or filling out questionnaires. All measurements will be conducted individually and your results will be held confidentially by the research team.

It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known risks to the participant [or embryo or fetus if the subject is or may become pregnant. If new findings develop during the course of this research that may change your willingness to participate, we will tell you about these findings.

**What are the benefits to me?**

As a benefit to participating in the study, you will receive valuable information on their current physical fitness status, and will receive an objective assessment of your fitness level. Also extra credit/research credits will be distributed in the following manner: Completing the pretesting (sign up/complete surveys/participate in physical assessment) = 4 points; completing activity logs for 6 weeks = 4 points; completing posttesting (resurveys/physical assessments) = 7 points. You can receive points by doing the alternative assignment noted below, but cannot receive points for both participating in the study and then deciding to not continue participation in the study and then complete the alternative assignment. Total points available. Attendance of study participants will be mandatory at all assessments in order to receive the points. In extenuating circumstances, students who miss or are unable to attend the times set up for assessments, need to make arrangements with the researcher to set up another time to have them completed.

You may not get any benefit from being in this research study.

**What are the benefits to other people?**

The research will benefit scientific research and provide information on how to enhance the wellbeing of college students. Results from the study may benefit society by identifying how participating in the recommended amounts of physical activity can help alleviate symptoms of anxiety and depression in college students and in the general population.

**Do I have to take part in the study?**

Your participation in this research is entirely optional. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

**What will it cost me to participate?**

There is no monetary cost involved in participating in this study.

**What are the alternatives to being in this research study?**

Students who do not wish to participate in the study will be given an opportunity to earn extra credit points by completing an alternative assignment. The alternative assignment will be a 3-5 page typed paper explaining the impact of physical activity on health (this may include physical, mental, social, and/or emotional health). The paper will be graded by the researcher according to the quality of content and a rubric that will be established. The points awarded for this alternative option will be equal to the points awarded as participating in the study (15 points). The due date for this alternative assignment will be Friday, April 27<sup>th</sup>. The instructor of the courses will be given a list of the students who completed this option after they have been graded.

**Who will see the information that I give?**

The information you provide will remain confidential. Your name will never be used throughout the study or in the final report. Collected data will not be released to anyone other than the principle investigator and members of the research team. You can choose to not answer any of the questions throughout the program. You may withdraw your consent at any time. Information gathered from this study may be used in publication in research or professional journal articles following the study, but your name will not be associated in any way with the data.

We will keep private all research records that identify you. Your information will be combined with information from other people taking part in the study. The information collected about you will be stored in a locked file cabinet in the principle investigator's office. We need to keep your name and your data connected until all information has been collected. We will then destroy any links to your name, and the data will only contain participant numbers.

The data from this project are owned by North Dakota State University and the investigators. You are able to see the data you have provided by submitting a written request to the principle investigator, Donna Terbizan, at the Benson-Bunker Fieldhouse, Room 1. Data obtained from this study will be kept for seven years following the study.

**Can my taking part in the study end early?** If you fail to complete this informed consent, or the PAR-Q, or do not show up to either of the assessment periods you may be removed from the study. If the PAR-Q suggests that it is unsafe for you to participate in physical activity, you will not be able to take part in the study. But you can complete the alternative assignment to receive extra credit points.

**Will I receive any compensation for taking part in this study?**

You will have an opportunity to earn 15 points of extra credit if you choose to participate in this study. You can discontinue from the study at any time, and will not be penalized. However, to receive extra credit you need to complete the entire study. If you do not wish to participate in the study, you will be given an opportunity to earn extra credit points by completing the alternative assignment described above. There will be no additional monetary award for participation.

**What happens if I am injured because of this research?**

If you receive an injury in the course of taking part in the research, you should contact Donna Terbizan at (xxx) xxx-xxxx or Nikki Demers at (xxx) xxx-xxxx. Treatment for the injury will be available including first aid, emergency treatment and follow-up care as needed. Payment for this treatment must be provided by you and your third party payer (such as health insurance or Medicare). This does not mean that you are releasing or waiving any legal right you might have against the researcher or NDSU as a result of your participation in this research.

**What if I have questions?**

Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, please contact Nikki Demers at (xxx) xxx-xxxx, nikki.demers@ndsu.edu or Dr. Donna Terbizan at (xxx) xxx-xxxx, d.terbizan@ndsu.edu.

**What are my rights as a research participant?**

You have rights as a participant in research. If you have questions about your rights, or complaints about this research or to report a research-related injury”, you may talk to the researcher or contact the NDSU Human Research Protection Program by:

- Telephone: 701.231.8908
- Email: ndsu.irb@ndsu.edu
- Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: [www.ndsu.edu/research/irb](http://www.ndsu.edu/research/irb).

**Documentation of Informed Consent:**

You are freely making a decision whether to be in this research study. Signing this form means that

4. You have read and understood this consent form
5. You have had your questions answered, and
6. You have decided to be in the study.

You will be given a copy of this consent form to keep.

\_\_\_\_\_  
Your signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Your printed name

\_\_\_\_\_  
Signature of researcher explaining study

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name of researcher explaining study

## APPENDIX K. ALTERNATIVE ASSIGNMENT RUBRIC FOR ACTIVITY COURSE

Name: \_\_\_\_\_ Points:     /15

This alternative assignment is an individually typed essay about the benefits that can be rendered from exercise. In this essay, you may refer to how exercise may benefit emotional, physical, spiritual, or any other area of wellness. You can pick one area of wellness to talk about or choose to refer to multiple areas. Please follow the particular essay requirements below to earn the maximum amount of points. Your work will be graded strictly according to the rubric provided, so follow it carefully. If you have any questions pertaining to this assignment, contact Nikki Demers at [nikki.demers@ndsou.edu](mailto:nikki.demers@ndsou.edu).

The essay must be typed and double-spaced. It must be between three to five pages in length. Essays that are shorter or longer than the requirements will lose at least 1 point.

### \_\_\_\_\_ **Content (11 points)**

- Clear introduction that sets up the essay, and a clear conclusion that summarizes the main argument of the essay. (2 points)
- Demonstrated an understanding of one or more of the benefits on exercise (4 points)
- Chose adequate sources of supporting information (2 points)
- Explained and provided supporting evidence for arguments (e.g., quotations, paraphrases, examples, statistics, etc.) (3 points)

### \_\_\_\_\_ **Writing (4 points)**

- Used proper grammar
- Used a minimum of 3 sources (1 point)
- Page limit requirement met
- Reference page included (1point)
- Clearly stated ideas
- Writing was error free and complete sentences were used (1 point)
- There are clear, separate topics that start with appropriate topic sentences
- There are clear, developed paragraphs (1 point)

## APPENDIX L. ALTERNATIVE ASSIGNMENT RUBRIC FOR LECTURE COURSE

Name: \_\_\_\_\_ Points:     /12

This alternative assignment is an individually typed essay about the benefits that can be rendered from exercise. In this essay, you may refer to how exercise may benefit emotional, physical, spiritual, or any other area of wellness. You can pick one area of wellness to talk about or choose to refer to multiple areas. Please follow the particular essay requirements below to earn the maximum amount of points. Your work will be graded strictly according to the rubric provided, so follow it carefully. If you have any questions pertaining to this assignment, contact Nikki Demers at [nikki.demers@ndsu.edu](mailto:nikki.demers@ndsu.edu).

The essay must be typed and double-spaced. It must be between three to five pages in length. Essays that are shorter or longer than the requirements will lose at least 1 point.

### \_\_\_\_\_ **Content (8 points)**

- Clear introduction that sets up the essay, and a clear conclusion that summarizes the main argument of the essay. (2 points)
- Demonstrated an understanding of one or more of the benefits on exercise (2 points)
- Chose adequate sources of supporting information (2 points)
- Explained and provided supporting evidence for arguments (e.g., quotations, paraphrases, examples, statistics, etc.) (2 points)

### \_\_\_\_\_ **Writing (4 points)**

- Used proper grammar
- Used a minimum of 3 sources (1 point)
  
- Page limit requirement met
- Reference page included (1point)
  
- Clearly stated ideas
- Writing was error free and complete sentences were used (1 point)
  
- There are clear, separate topics that start with appropriate topic sentences
- There are clear, developed paragraphs (1 point)

## APPENDIX M. DEMOGRAPHIC DATA

Demographic Data	Treatment	Control
Total Participants	53	24
Gender		
Male	29 (57%)	1 (4%)
Female	22 (43%)	23 (96%)
Age		
18	10 (20%)	1 (4%)
19	28 (55%)	5 (21%)
20	5 (10%)	13 (54%)
21	1 (2%)	5 (21%)
23	1 (2%)	
24	3 (6%)	
25	1 (2%)	
36	1 (2%)	
39	1 (2%)	
Class Status		
Freshman	33 (65%)	1 (4%)
Sophomore	11 (22%)	16 (64%)
Junior	5 (10%)	8 (32%)
Senior	2 (4%)	
*Two students from the treatment group did not report and are not included in this data.		
Major College		
Ag, Food Systems and Natural Resources	3 (6%)	
Business	4 (9%)	
Engineering and Architecture	12 (26%)	
Human Development And Education	4 (9%)	25 (100%)
Pharmacy, Nursing and Allied Science	15 (32%)	
Science and Mathematics	9 (19%)	
*Six students in the treatment group did not list a major, and are not included in this data.		

## Demographic Data

	Treatment	Control
Ethnicity		
Black	3 (6%)	
Asian	4 (8%)	
Caucasian	42 (80%)	20 (80%)
Other	1 (2%)	2 (8%)
Not reported	3 (6%)	1 (4%)
Living Arrangements		
Off campus	12 (24%)	13 (54%)
On campus	39 (76%)	11 (46%)
Weekly Hours Worked		
0	30 (59%)	10 (42%)
1-9	2 (4%)	2 (8%)
10-19	14 (27%)	7 (29%)
20-29	4 (8%)	3 (13%)
30-40	1 (2%)	2 (8%)
Campus Meal Plan		
Yes	33 (65%)	8 (33%)
No	18 (35%)	16 (67%)

**APPENDIX N. ADDITIONAL PRE/POST DATA**

Pre/Post Depression Control Group		
	Pre (n)	Post (n)
Borderline	6	8
Mild	4	2
Minimal/None	15	12
Moderate	0	1

Pre/Post Depression scores Treatment Group		
	Pre (n)	Post (n)
Borderline	11	11
Mild	8	4
Minimal/None	30	28
Moderate	3	
Severe		1

Pre/Post Anxiety scores Control Group		
	Pre (n)	Post (n)
Borderline	9	7
Extreme	1	
Mild	6	6
Minimal	4	4
Moderate	3	3
Severe	2	2

Pre/Post Anxiety scores Treatment Group		
	Pre (n)	Post (n)
Borderline	17	19
Extreme	1	
Mild	17	13
Minimal/None	10	8
Moderate	5	2
Severe	2	2



Treatment Group V <sub>O</sub> <sub>2</sub> Pre/Post		
	Pre (n)	Post (n)
Poor	3	1
Fair	1	
Average	7	1
Good	4	6
Excellent	24	30

Control Group V <sub>O</sub> <sub>2</sub> Pre/Post		
	Pre (n)	Post (n)
Poor		1
Fair	2	
Average	4	3
Good	3	3
Excellent	12	13