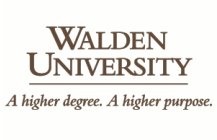

2019

Exercise Adherence and Depression

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Walden University
2019

Abstract

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by

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MPhil, Walden University, 2019

MS, University of Wyoming, 2001

BS, Colorado State University, 1998

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

In this study, exercise adherence levels were examined from archival data collected from 2004 to 2006 to determine if an association existed with the levels of depression among individuals over 49 in 3 rural community centers. Abundant research has shown that exercise is effective in alleviating depression but has not shown how levels of exercise adherence may impact the efficacy of exercise in the treatment of depression. The focus of the study was to determine if an increase in exercise adherence may be associated with a decrease in the symptoms of depression. An ANCOVA was used to determine if differences in levels of depression were significantly associated between low and high exercise adherence. The results did not provide evidence that a high level of exercise adherence is associated with lower symptoms of depression. An independent samples *t* test was used to determine if gender makes any difference in exercise adherence. The results did not provide evidence that gender made any difference in exercise adherence. An ANOVA was used to determine if the type of exercise was associated with exercise adherence. The results provided significant evidence that select exercises were adhered to more than others. A new study comparing varying levels of exercise adherence, not merely low exercise adherence and high exercise adherence, would allow for a more precise measurement of the association between exercise adherence and depression. It is hoped that providing further insight into an adjunct treatment of depression will result in an increased efficacy of treatment and a positive social change for society.

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Chapter 1: Introduction to the Study

Introduction

Ample research has indicated that exercise is an effective means of reducing symptoms of depression, but little research is available regarding whether prescribing regimented weekly exercise routines as a part of a client's therapy is an effective form of therapy (Anderson & Shivakumar, 2013; Tkachuk & Martin, 1999). Exercise has been shown to lessen the symptoms of depression and improves well-being in comparison to non-exercising individuals (Jazaieri, Goldin, Werner, Ziv, & Gross, 2012; Rejeski, Thompson, Brubaker, & Miller, 1992). The use of exercise as therapy may provide practitioners with an alternative treatment for depression where higher levels of exercise adherence may be associated with fewer symptoms of depression (Schuch & Fleck, 2013). Using exercise to reduce symptoms of depression may also have a role in prevention, allowing the practitioner to manage the depression over time as part of a treatment plan (Johansson, Hassmen, & Jouper, 2011).

Background

The purpose of the study was to determine if higher levels of adherence to an exercise program are associated with fewer symptoms of depression. Providing clients, and the general population as well, with insight into the relationship between exercise adherence and the symptoms of depression may lead to the development of a potential treatment that is able to decrease the use of medications, lessen the length of therapy, and reduce the overall prevalence of depressive symptoms in society. As psychologists produce successful results in clinical settings, adoption and adherence to the use of

exercise as part of a healthy lifestyle may provide an additional means of treating the symptoms of depression and provide further research that leads to efficient and effective treatment. While developing this study, it was my hope that providing this insight would contribute to treatment of the symptoms of depression and ultimately result in positive social change.

The literature has largely focused on the effectiveness of the use of exercise in treating depression and other mental illness (Roman, 2010; Guiney & Machado, 2013). Findings from various studies support the use of exercise to treat depression but have not shown the relationship between levels of exercise adherence and any significant changes in the symptoms of depression. In this study, I will discuss how an increase in adherence rates with exercise is associated with the symptoms of depression and provide a stepping-stone for future research on other therapeutic effects exercise may have on the mind and body.

Problem Statement

The typical recommendation in the majority of research about the use of exercise is to simply begin an exercise program, but the reported efficacy of such programs have not been sufficient enough for practitioners to readily promote in a clinical setting (Salmon, 2001). A weekly regimen of exercise for clients not only provides a schedule to ensure adherence but may also provide evidence that higher adherence rates with exercise is associated with a decrease in the symptoms of depression with an older population (Goyal et al., 2014). A majority of the research on the subject has shown that there is a therapeutic benefit to clients exercising (Chekroud et al., 2018; Jazaieri, Goldin, Werner,

Ziv, & Gross, 2012), but there is little to no mention of practitioners prescribing a program that specifies duration of each episode or how frequently one exercised each week for clients to follow to ensure the efficacy of exercise adherence. This gap in the current research literature is evident, and without any adherence to a structured program there is little hope of determining the effectiveness of exercise in the treatment of the symptoms of depression (Schuch & Fleck, 2013).

Purpose of the Study

To address this gap in the current research literature, I sought to measure the prevalence of depressive symptoms after adherence to an exercise regimen to determine if higher levels of adherence are associated with fewer symptoms of depression in older adults. I performed a quantitative study by comparing the level of depression before (baseline) and after the intervention of high adherence exercise and low adherence exercise. The study measured how changes in the independent variable exercise adherence are associated with changes in the dependent variable of depression. The study also included variables for gender and type of exercise to determine any relation they had with exercise adherence.

Research Questions and Hypotheses

The research questions (RQs) for this quantitative study were as follows.

RQ1: Is an increase in exercise adherence associated with fewer symptoms of depression?

$H_0$1: Adherence to an exercise program is not associated with changes in levels of depression after controlling for baseline depression scores.

$H_1$1: Adherence to an exercise program is associated with changes in levels of depression after controlling for baseline depression scores.

RQ2: Is an increase or decrease in exercise adherence associated with gender?

$H_0$2: Adherence to an exercise program is not associated with changes between genders.

$H_1$2: Adherence to an exercise program is associated with changes between genders.

RQ3: Are select exercises associated with an increase or decrease in exercise adherence?

$H_0$3: Select exercises are not associated with changes in exercise adherence.

$H_1$3: Select exercises are associated with changes in exercise adherence.

The level of depression and exercise adherence were the dependent variables and the independent variables were low exercise adherence, high exercise adherence, gender, and type of exercise programs. The covariate for the ANCOVA, when assessing changes in depression from the change in exercise adherence, was the base line depression scores. I used an ANOVA to assess changes in exercise adherence from the effect of gender and select exercises. Alpha was equal to .05 with a medium effect size (.25).

Measuring changes in depression in the ANCOVA allowed me to determine whether the difference of the adjusted means was significant enough to be considered associated to levels of depression. Measuring changes in exercise adherence in the independent samples *t* test allowed me to determine whether the difference of the group means was significant enough to be considered related to gender. Measuring changes in

exercise adherence in the ANOVA allowed for the analysis of the difference of the group means to determine if it was significant enough to be considered related to select exercises.

Theoretical Framework

I used the transtheoretical model (TTM) as the framework for this study. Researchers commonly use the TTM to assess adherence rates to various treatments and medication (Johnson et al., 2006b). Using the TTM assisted in determining the significance of the external stimuli (exercise) and its association to the symptoms of depression. I outline further evidence of the appropriateness of the TTM in the next chapter, and details of the TTM are more thoroughly addressed there. As the literature shows in Chapter 2, exercise is effective in alleviating depression, but how levels of exercise adherence are associated with levels of depression was my focus in addressing the gap in the literature.

Nature of the Study

This was a quantitative study. Quantitative research is required for the comparison of measurable changes in variables over time, often with an intervention (Dallery & Soto, 2013). Comparing levels of depression between low and high exercise adherence to a consistent exercise regimen allowed for a quantitative analysis of the relation exercise adherence has with depression. Selective exercises and gender were also compared using a quantitative analysis of the relation they have with exercise adherence. I drew the original dataset from a study designed to determine the effects of

best practices exercise, or the best research combined with clinical expertise regarding exercises that are most effective, on various mental health aspects (well-being, health attitudes, health behavior, and depression) in comparison to individuals engaging in best practices exercise and a control group that did not engage in the best practice exercises (APA, 2017). The control group was asked to exercise and participate at least three times per week but could not participate in the best practices program (treatment exercises). I hoped that this study would provide a comparison of levels of adherence with the exercise programs that would result in additional insight into whether exercise adherence was associated with levels of depression.

I obtained the data from a national impact study by Susan L. Hughes conducted from 2004 to 2006, which looked at best practice for physical activity programs for older adults (2009). The database, study, and results are available via the inter-university consortium for political and social research on the Walden University website, and the results of her research will be reviewed in Chapter 2. I used an ANCOVA, *t* test, and ANOVA to estimate the difference among the means of individuals who adhered and partially adhered with the exercise program. In this study, I compared the means of exercise adherence, gender, and select exercises to determine if there were significant differences.

Definitions

Antidepressant: A medication or substance used to counteract depression. A pharmacologic agent used in treating depression (Lathrop, 2008).

Depression or symptoms of depression: A mental state or chronic mental disorder characterized by feelings of sadness, loneliness, despair, low self-esteem, and self-reproach; accompanying signs include psychomotor retardation (or less frequently agitation), withdrawal from social contact, and vegetative states such as loss of appetite and insomnia (Lathrop, 2008).

Exercise: Exertion of the body for the sake of restoring the organs and functions to a healthy state or in the attempt to keep them healthy (Lathrop, 2008).

Exercise adherence: An individual maintaining an exercise agenda that is to be complied with over a specific time period (Chapman, Campbell, & Wilson, 2015).

Exercise regimen: A systematic plan designed to improve and maintain the health of a patient by detailing specific exercises or activities to be completed (Merriam-Webster Dictionary, 2015).

Stress: A physical or psychological stimulus which, when impinging upon an individual, produces strain or disequilibrium (Lathrop, 2008).

Assumptions

In the study, I assumed that the changes in depression are due to an intervention of exercise and all other factors are not influential. I also assumed that the type of therapy (as may be different among the subjects depending on their needs and specific situation) used in coordination with the exercise is not a contributing factor in the reduction or elevation of the symptoms of depression. These assumptions were necessary to inform readers of the potential for different outcomes based on types of therapy used,

and there was also the potential for outside influences that may have an impact on levels of depression among the subjects studied.

Scope and Delimitations

The focus of the study was on how adherence to exercise interacts with levels of depression. Although there have been numerous studies on the validity of the use of exercise in the treatment of depression, there has been very little research on how levels of exercise adherence are associated with levels of depression (Anderson & Shivakumar, 2013; Tkachuk & Martin, 1999; Jazaieri, Goldin, Werner, Ziv, & Gross, 2012; Rejeski, Thompson, Brubaker, & Miller, 1992). Individuals participating in a regimen of adhered to weekly exercise should provide evidence of whether exercise adherence is associated with levels of depression.

The population included in Hughes et al.'s (2009) original study conducted over a 2-year period consisted of adults aged 50 or older volunteering from senior centers and community centers who were not previously engaged in any physical activity but were released for physical exercise by their physicians. Participants were required to be able to participate in multicomponent exercise classes over a 10-week period that consisted of flexibility training, strength training, and aerobic conditioning.

The original study selected older non-active individuals to ensure there was no generalization on the effect exercise had on individuals in which there were different levels of active lifestyles. The original study excluded younger more active individuals to help ensure the intervention was performed on individuals without an active lifestyle. The use of sedentary adults provided validity for the effects seen in the study to be

generalized to the general population of inactive individuals and ultimately used in a clinical setting when appropriate for the individual.

Limitations

This study did not measure all age ranges to give a full range of outcomes from the intervention of exercise. The study also did not consider each individual's outlook, levels of optimism or pessimism, or other factors that may affect depression, perceived depression, or acceptance of exercise as an effective form of therapy.

A bias that may have impacted the study is the potential for the results to overestimate the association of exercise on individuals with depression. Although exercise is expected to be effective for all ages, it may be more effective for older and more sedentary adults. As such, the results for younger more active individuals may not be associated with levels of depression. In addressing these limitations, it is important to ensure all participants are willing and able to participate. In addition, acknowledgement and disclosure of the potential for overestimation of the effectiveness of exercise is essential to ensure results are not generalized for all ages and level of activities.

Significance

I conducted this quantitative study to provide insight into how variation in exercise adherence is associated with symptoms of depression. Understanding how exercise interacts with the symptoms of depression may provide new insight for the treatment of depression.

The evidence tends to support the idea that exercise is able to alleviate depression, but the exercise adherence rate and the corresponding levels of depression have not been

addressed to date (Deslendes, 2014; Silveira, Moraes, Oliveira, Coutinho, Laks, & Deslandes, 2013). Introduction of exercise to alleviate depression in a clinical setting may provide clients with the knowledge and skills necessary to alleviate and potentially prevent the onset of depression. The use of a prescribed exercise regimen as part of the treatment for patients with depression may also result in positive social change by reducing the need for medications and providing individuals with the opportunity to manage their depression. Analysis of individuals displaying symptoms of depression with high levels of adherence in an exercise regimen is expected to be associated with diminished symptoms of depression.

Summary

In conclusion, the purpose of the study was to determine if an increase in exercise adherence is associated with the symptoms of depression. Although exercise has been shown to be an effective form of therapy, there is little to no evidence on how the level of adherence interacts with depression (Schuch & Fleck, 2013). I examined the level of adherence with exercise in senior adults participating in exercise programs to determine if there was a significant association with the levels of depression. A look at the literature will provide insight as to the effectiveness of exercise, but also define the gap that researchers have not addressed.

Chapter 2: Literature Review

Introduction

Depression affects approximately 16% of people in the United States during their lifetime, is the most common among diseases in the United States and is ranked fourth on a global scale (Thompson et al., 2014). The majority of clients today displaying symptoms of depression are treated with medications or by the intervention of traditional therapy sessions using a wide variety of approaches (Craft & Perna, 2004). Although the use of exercise in the treatment of depression has been accepted as efficacious, the level of exercise adherence has not been analyzed to determine if any association exists with depression as the rate of adherence increases. Practitioners readily encourage clients to exercise but are not instructing clients on the frequency of when activities or exercises should be performed (Sarris, O'Neil, Coulson, Schweitzer, & Berk, 2014). In this study, I attempted to determine if increased levels of adherence to exercise programs is associated with lower levels of depression.

Although there are numerous studies on the treatment of depression with exercise, few have addressed how the level of exercise adherence is associated with levels of depression. Exercise not only treats depression, but also has many other physical and mental health benefits (Guiney & Machado, 2013). The implementation of exercise into a clinical setting may provide an alternative to medication and aid in the effectiveness of traditional therapy.

Literature Search Strategy

The articles and studies I reviewed are from peer-reviewed journals. I used Walden University's library to access academic search engines including PsycINFO, Sage, Google Docs, and PsycArticles. Key search terms used were *exercise and depression, exercise and mental health, fitness and depression, exercise adherence, exercise adherence and depression, exercise frequency and depression, depression,* and *fitness and mental health*. I also searched for literature about the use of exercise for depression by using the terms *therapeutic treatments for depression, incidence of depression, exercise, depression, and treatment,* and *depression treatments*. The majority of references I used were taken from the articles' reference lists, as many of these included the original studies involving the use of exercise to reduce depression as well as other mental health issues. The focus on the search was on peer reviewed sources published from 2010 to present and from peer reviewed sources, but I included a few earlier articles considered as seminal literature. Most of the studies I found focused on the efficacy or lack of efficacy of exercise in treating depression but did not address how levels of depression changed with levels of adherence to the exercise programs (Schuch & Fleck, 2013).

Theoretical Foundation

I used the TTM as the theoretical foundation. The TTM was developed in 1977 by James Prochaska and Carlo Di Clemente and is based on the analysis and use of different theories of psychotherapy (Prochaska & Norcross, 2010). The TTM is

commonly used to assess adherence rates to various treatments and medication (Johnson et al., 2006b). Transtheoretical models often use 5 stages of change and 10 processes of change to help monitor, assess, and maintain the treatment process. The TTM addresses behavioral changes through the stages of change, which are referred to as *precontemplation, contemplation, preparation, action, maintenance,* and *termination* (Prochaska & Velicer, 1997). The process of change in behavior involves a variety of strategies, which include conscious-raising, dramatic relief, self-reevaluation, social liberation, self-liberation, helping relationships, counter-conditioning, reinforcement management, and stimulus control (Prochaska & Velicer, 1997). Fallon, Hausenblas, and Nigg (2005) also used the TTM to discuss the interaction between behavior and exercise and how to maintain exercise behavior. The TTM provides the use of positive behavior (exercise) as an intervention strategy and was appropriate in their study because it helped the researchers identify the relationship between exercise adherence and depression (Fallon, Hausenblas, & Nigg, 2005).

Johnson et al. (2006a) used the TTM while looking at how participants who were prescribed a cholesterol reducing medication adhered to the regimen. The TTM allowed the researchers to compare adherence rates between the intervention group and the control group. The theory provides a means of looking at how actions of an individual's adherence may affect their mental status, thus providing a method of exploring how an individual choosing to adhere to exercise is doing so in their attempt to reduce depression.

The TTM allowed me to explore how the adherence to an exercise program may provide a means of mitigation in one's level of depression. I used the TTM to help to determine if adherence to an exercise program is able to have an impact on the symptoms of depression. This study built upon current literature that simply shows how effective exercise is in alleviating depression by providing further evidence that consistent adherence to an exercise program should be utilized by practitioners in their treatment choices.

Current Treatments for Depression

Craft and Perna (2004) discussed the ever-increasing health care costs associated with treating depression primarily with pharmacology. Medications are currently a common method of treatment for the symptoms of depression, as they have been shown to be effective in the prevention and treatment of depression (Craft & Perna, 2004). Depression is also often treated with cognitive behavioral therapy (CBT) either in addition to pharmacology or as a stand-alone treatment (Cuijpers, Berking, Andersson, Quigley, Kleiboer, & Dobson, 2013). Psychodynamic psychotherapy has also been shown to be an effective treatment for depression, but a variety of therapies including behavioral activation therapy, nondirective supportive therapy, interpersonal psychotherapy, problem-solving therapy, and other psychotherapies are commonly used to treat depression (Cuijpers et al., 2013). A behavioral approach of exercise to alleviate depression may not only reduce the use of medications but may also provide self-help therapies that ultimately reduce the costs and suffering affecting society (Sarris, O'Neil, Coulson, Schweitzer, & Berk, 2014). In this study, I sought to understand effect exercise

adherence has on depression with the intention of filling the gap in the literature by exploring the association between adherence and depression.

Effects of Exercise

Exercise affects hormonal and neurological interactions that have been shown to affect mental health (Ida et al., 2013). Ida et al. (2013) showed a decrease in cortisol levels and depressive symptoms after exercise in chronic depressive patients. The researchers looked at how one 15-minute interval on an exercise bike was able to effectively reduce depression in comparison to a control group that sat quietly for one 15-minute session (Ida et al., 2013). A single session of exercise was able to decrease cortisol levels, which was correlated with a decrease in the subjective depression score (Ida et al., 2013). A similar study by Gutierrez et al. (2012) showed a reduction in depression and anxiety in postmenopausal women with the use of a controlled exercise program. The researchers reported that a group of 60 women aged 60 to 70 were divided into an exercise group and a control group of no exercise. The use of exercise to help regulate chemical and hormonal levels in the body may be a key factor in avoidance of antidepressants and hormone supplementation, which are often prescribed in a clinical setting to treat depression. The study showed significant improvement in the levels of depression, even among the aging population. Exercise has also been shown to affect the neuroimmune system by accentuating the positive effects and lessening the negative effects of depression, thus providing further evidence that exercise is a key component in alleviating depression (Eyre, Papps, & Baune, 2013).

Shin, Kang, Park, and Heitkemper (2009) and Shin and Kim (2005) used an exercise intervention and showed that after the intervention, exercise alleviated levels of depression in 48 low-income elderly women in urban communities in South Korea. The researchers confirmed that exercise is effective in decreasing depressive symptoms, but what was interesting is that the study involved low-impact and non-strenuous exercises (Shin, Kang, Park, & Heitkemper, 2009). There was no significant improvement in physical fitness, but the activities were still able to provide an effective intervention by lessening the presence of depression (Shin et al., 2009). Thus, exercise has shown to be effective even for individuals who are limited in their physical abilities, as is often seen in the elderly or disabled. As such, incorporation of exercise into a clinical setting may be an effective alternative or supplemental intervention for a wide range of members of society regardless of their age, mobility, or level of fitness.

A Focus on Exercise Adherence

The use of exercise to treat depression has been discussed as far back as before the turn of the century, but actual intervention in a clinical setting as a prescribed intervention has never been fully embraced by practitioners (Salmon, 2001). The use of exercise for the treatment of depression has been shown to be effective since the late 1970s (Roman, 2010). A supervised exercise plan has also been shown to be effective for mild to moderate-severe depression, giving rise to the need for clinical implementation to ensure adherence (Oeland, Laessoe, Olesen, & Munk-Jorgensen, 2010; Roman, 2010). Exercise programs have also been shown to be effective in treating

numerous psychological disorders in addition to depression, including anxiety and posttraumatic stress disorder (Libby, Pilver, & Desai, 2012; Wilcox et al., 2006).

Unfortunately, these studies have not addressed the level of adherence with the exercise programs. Thus, I designed this study to provide evidence of how higher levels of adherence are associated with levels of depression. The vast majority of studies focus on the efficacy of exercise in the treatment of depression, but most fail to discuss adherence rates with exercise regimens and how they relate to levels of depression.

There are also studies that report individuals with improvement in levels of depression, but when averaged among other participants the results were shown to be to be insignificant (Trivedi et al., 2011; Chalder et al., 2012). These studies suggest some individuals have positive results, but the group as a whole does not. Adherence with the exercise program for each participant may be the determining factor of whether the results are significant. The studies typically show promising results for the use of exercise in the treatment of depression, but there are studies that have shown no significant improvement in levels of depression (Schuch & Fleck, 2013). These studies do not take into consideration the level of adherence with the exercise programs, thus possibly giving rise to an insignificant reduction in depression and the need for this dissertation (Schuch & Fleck, 2013). The data set I used in this study allowed for an analysis of the how the levels of adherence are associated with levels of depression.

There are correlations between a sedentary lifestyle and the presence of depression, giving rise to elevated levels of depression not only in the general population but also in the elderly (Martinsen, 2008). Although the research tends to focus on seniors

and adults in general, as does this dissertation, there are adolescent studies also providing similar results (Sund, Larsson, & Wickstrom, 2011). In their study, Sund, Larsson, and Wickstrom (2011) allowed adolescents to self-report their level of activity, leaving the opportunity for exaggeration and lack of adherence to the exercise program. A study by Hughes et al. (2009) on best practice exercise showed that 60% of seniors fail to participate in exercise, giving rise to an ever-increasing population with the potential to develop depression. Although there are studies that have shown minimal or insignificant effects of exercise on depression, there is substantial contradiction within these studies as there is evidence of efficacy per the patients and practitioners (Schuch & Fleck, 2013). Patient self-reports were indicative of the therapy being effective and providing an overall decrease in depression (Schuch & Fleck, 2013). Practitioners also reported in their observations that the symptoms of depression to improved, contradicting the studies negating the positive effects of treating depression with exercise (Schuch & Fleck, 2013). Again, these researchers were not comparing adherence rates with the exercise programs to the change in depressive symptoms, leaving the potential for low adherence rates to result in insignificant results (Schuch & Fleck, 2013). The failure to compare adherence rates with exercise to the levels of depression may allow for inaccurate assessments and assumptions. If the level of adherence to an exercise program is unknown, then there is no conceivable method in which to determine if exercise is associated with lower levels of depression.

Guiney and Machado (2013) and Voss, Nagamatsu, Liu-Ambrose, and Kramer (2011) discussed the evidence of a therapeutic benefit from the intervention of exercise

on both the mind and body. These studies reported the positive effects of exercise on individuals throughout the lifespan and how it helps to retain cognitive function as individuals age over time (Voss et al., 2011). Guiney and Machado (2013) confirmed the findings by Rethorst et al. (2013) that these studies provided evidence that exercise is effective in the prevention and alleviation of mental and physical health ailments. The study looked at a group of 105 adult participants who were taking medication for depression without any reported benefit and who were not exercising as they were introduced to a low-dose and high-dose exercise regimen to determine the effect on baseline cytokine levels (Rethorst et al., 2013). Researchers were able to show the cytokines may be used as markers of the effectiveness of exercise on depression where medication is not effective (Rethorst et al., 2013). Again, the study failed to discuss rates of adherence with the exercise activities and only discussed the ability to predict the effectiveness of exercise where medication has failed to be a therapeutic treatment.

A study by Greenwood et al. (2012) provided evidence of physical activity being able to decrease mental health issues such as anxiety and depression. The study used 344 rats to determine the effects on mental health of having an exercise wheel or a lack of a wheel. Voluntary wheel access was provided for six weeks to determine amount of use when exposed to stressors. Exercise was shown to activate certain areas of the brain that may be responsible for anti-anxiolytic and antidepressant functions that alleviate the need for pharmacological therapy (Greenwood et al., 2012). Although the study provided evidence of providing relief from depression, the study did not address what level of

participation or adherence the rats exercised in comparison to the corresponding level of relief.

A similar study also looked at how depression was alleviated by the use of specific exercises such as Qigong, which is a form of relaxation that involves breathing, mental focus, and deliberate movement (Johansson, Hassmen, & Jouper, 2011). A group of 59 individuals participating in Qigong exercise or part of the Control group were assessed using the Profile of Mood States to determine differences in levels of depression (Johansson et al., 2011). This study confirmed the positive effects of exercise on the body, but also a reduction in the symptoms of depression. Again, a more thorough analysis of the levels of exercise adherence would provide additional insight in determining if there is a relation between adherence and levels of depression.

Jazaieri, Goldin, Werner, Ziv, and Gross (2012) and Rejeski, Thompson, Brubaker, and Miller (1992) have also provided evidence that not only does exercise improve mental well-being, but also lessens symptoms of depression in comparison to non-exercising individuals. Fifty-six participants were treated with either mindfulness-based stress reduction or aerobic exercise and compared the results to a nonintervention group. Both mindfulness-based stress reduction and aerobic exercise both provided improvement in comparison to the nonintervention group (Jazaieri, Goldin, Werner, Ziv, & Gross, 2012). Clinical symptoms of depression were shown to decrease, and individual self-rated level of well-being improved (Jazaieri et al., 2012). In addition to researchers recognizing the benefits of exercise for the treatment of depression, there were patients also reporting enhanced mood and fewer bouts of depressive symptoms

(Jazaieri et al., 2012). The study did not analyze adherence rates other than to note that participants averaged 3.4 hours per week, and the authors suggested future studies should measure intensity and minutes per session to determine actual efficacy (Jazaieri et al., 2012).

Rejeski et al. (1992) also reported that individuals with stress not only alleviated their symptoms with exercise, but also were able to reduce thought processes that contributed to stress. The study presented a group of 48 women that were exposed to either attention control or aerobic exercise to determine changes in stress between the two interventions. Individual blood pressure was reduced when exposed to stressors for those individuals that exercised in comparison to those who did not exercise (Rejeski, Thompson, Brubaker, & Miller, 1992). This was a one time, 40-minute episode of exercise, thus difficult to determine effect over a period of time and further evidence of the need to determine the effect of efficacy (Rejeski et al., 1992).

An examination of gender may also provide insight as to any association it may have with exercise adherence. A study by Blanchard, Rodgers, Courneya, Daub, and Knapik (2002) examined the interaction of exercise adherence and cardiac rehabilitation. The study was conducted with 98 patients undergoing Phase 11 cardiac therapy. The study provided evidence that men were more effective in overcoming barriers to recovery, thus gender was associated with higher exercise adherence (Blanchard, Rodgers, Courneya, & Knapik, 2002). A similar study by Cnossen et al. (2014) also looked at exercise performance and adherence for exercises designed to alleviate complications from radiation treatment. A group of 34 participants were asked to

complete the exercise program to prevent difficulties with swallowing, speaking, or shoulder issues that resulted in a 64% adherence rate (Cnossen et al., 2014). The study was not able to provide evidence that a significant association existed between exercise performance and gender.

The select exercises in the original study utilized in the treatment of participants was analyzed to determine if any relationship existed with exercise adherence. A study by Van Role, Bautmans, Coudyzer, Boen, and Delecluse (2015) looked at how 56 older individuals adhered to low and high resistance exercises over a 12-week period. The study provided no association among low resistance exercises, high resistance exercises, and exercise adherence (Van Role, Bautmans, Coudyzer, & Delecluse, 2015). Another study by Rydwik et al. (2013) assessed 2593 individuals over 65 years to determine participation in fitness-enhancing exercises by a geriatric population. The study provided that women younger than 80 preferred health-enhancing exercises over fitness-enhancing exercises (Rydwik et al., 2013). This preference allowed for an increase in participation of the health-enhancing exercises.

Summary

The introduction of exercise as a means of lessening the effects of depression began in the late 1970s (Roman, 2010). With an ever-increasing population that is aging, the potential for depression is creating a need for efficacious interventions beyond medication (Hughes et al., 2009). The benefits of exercise are many for both mind and body, providing improved health and mood in comparison to non-exercising individuals (Rejeski et al., 1992). Gender and select exercises were assessed to determine if either

factor had an association with exercise adherence. Adherence with an exercise program may prove to be a more effective treatment and prevention of depression than traditional therapy, giving rise to the need for further analysis of the association between levels of exercise adherence and the resulting levels of depression.

Chapter 3: Research Design

Introduction

The purpose of the study was to determine if higher levels of adherence with an exercise regimen is associated with fewer or less severe symptoms of depression. I drew the data set from a study by Hughes et al. (2009) who examined different types of exercises to determine best practice exercises. The population of the study was drawn at senior and community centers for individuals 50 years and older using various exercises as the intervention. I analyzed the data for levels of adherence to the exercise programs and their corresponding levels of depression that were collected in the original study.

Research Design and Rationale

The data in this dissertation originated from a study by Hughes et al. (2009) who used a randomized trial to determine the most effective exercise among senior participants. I used the data to compare levels of exercise adherence with the reported levels of depression at baseline as well as the 5-month and 10-month intervals (Hughes et al., 2009). The independent variables in my study were exercise adherence, gender, and type of exercise. One of the many dependent variables of the original study was depression, determined by the use of the CES-D; depression was also one of the dependent variables, along with exercise adherence, in my research. The purpose of this dissertation was to determine if the variation in exercise adherence was associated with the levels of depression among the participants.

I use an ANCOVA to measure the potential variations among the different levels of exercise adherence while considering any variations at the baseline levels (covariate).

Thus, the baseline levels became the covariate and the adjusted means were analyzed to determine differences. The ANCOVA, *t* test, and ANOVA allowed me to determine whether increases in exercise adherence (low or high) were significantly related to levels of depression for participants after controlling for the variance provided by the covariate; they also provided insight regarding any association gender or type of exercise may have with exercise adherence.

Methodology

Population

The original study consisted of 995 applicants of which 66 were not eligible. The baseline interviews provided 544 participants (289 treatment individuals and 255 control individuals combined for a total of 544) out of the available 995 applicants. The reduction in participant numbers was due to a loss of interest, or applicants' inability to follow-up. From the 544-participant group, the 5-month interviews resulted in 374 participants, and the 10-month interviews had an increase in participation rates, which resulted in 384 participants. The participants consisted of 77% women and 23% men, and 16% of all participants were minorities. Annual household income for 53% of participants was less than $50,000. The age range of participants was from 51 to 88 years with 47% from 50 to 64 years, 37% from 65 to 74 years, and 15% older than 75 years. At least 86% of participants attended college at some level. There was one participant with a chronic medical condition, and 72% were either obese or overweight.

None of the participants were previously engaged in exercise activities. The control group was able to participate in exercise activities with the treatment group, but

not the best practice activities such as line dancing, strength training, and yoga. The programs varied at each of the three locations, but were required to include aerobic activities, flexibility exercises, and strength training activities. Data were collected from the three different locations by in-person and over the phone interviews at 5-month and 10-month intervals. All three locations were in middle-class areas and worked with area facilities to provide access to gyms and fitness facilities. The treatment sites were located within the United States of America at Raleigh, North Carolina; Madison, Wisconsin; and Silver Spring, Maryland. Outcomes were obtained for 228 treatment participants and 145 control participants at the 5-month interval and obtained 229 treatment participants and 149 control participants at the 10-month interval. The control group was also previously sedentary but was instructed to start exercising as long as they did not perform the best-practices exercises (as identified in the original study) during the 10-week period.

Sampling and Sampling Procedures

The original researchers recruited participants by utilizing three different facilities that had diverse members of whom the majority would be seniors. The participants were found by the use of newspapers, flyers, and posters at each site. Participants were required to be older than 49 years of age and could not have been previously involved in exercise activities but were required to be able to walk without assistance. Participants willingly agreed to participate by signing an informed consent form and were also required to have physician approval to participate in the study. Participants were paid with $10 gift cards at the 5- and 10-month intervals after completing their interviews.

I used an ANCOVA to determine if there were significant adjusted mean differences in levels of depression among levels of exercise adherence. Any mean difference between genders and mean differences among the various select exercises were assessed using an independent samples *t* test and ANOVA respectively. The sample size was determined with the use of a G* Power analysis software utilizing an *a priori* analysis for a given power, alpha (α), and effect size (Cohen, 1988). The α for these analyses was set at .05. To attain a power level of .95 and a medium effect size ($f^2 = .25$), the total sample size needed to be at least 323 in order to detect a significant model. Therefore, I determined that the sample of 384 participants that completed the 10-month post interview in the original study sufficed to answer the proposed research questions.

Use of Archival Data

Collection of data. Recruitment for the original study was limited to facilities that provided best practices programs and were able to provide training services at least three times per week. The three locations selected were all in middle-class neighborhoods and used only certified exercise instructors to conduct the exercise programs. Participants were required to be able to walk without assistance, had medical clearance to participate, were not currently involved in an exercise program, and consented to participation in the study (Hughes et al., 2009). The researchers collected data via in-person interviews and telephone calls.

Gaining access to the data set. The Inter-university Consortium for Political and Social Research (ICPSR) requires requestors of the data set to complete an agreement for the use of confidential data, specify reasons for the request, and obtain IRB approval or

notice of exemption for their research. The Walden IRB approval number is 05-10-17-0299236. General requirements are appointment at a research institution or under the jurisdiction of the receiving institution and degree requirements. Items that must be submitted are the project description, IRB approval, approved security plan, and roster of research and IT staff that plan to access the data or computer where data is located. A confidentiality pledge for all users is required and a CV for each user may be required.

Exercise. In the original study, the researchers used exercise programs as an intervention to determine the effect on body mass index, depression, and health-related quality of life. The intervention was implemented at the three community-based locations using multiple-component physical activities that included flexibility activities, resistance training, and low-impact aerobic exercises. Participation in these activities occurred three times per week for a 10-month time span. Hughes et al. (2009) were attempting to determine what form of exercise was the best practice physical activity for inactive adults. They looked at a plethora of variables to determine efficacy of each exercise program to determine the effect each exercise program had on health, stress, fitness, and participants' outlook on their lives (Hughes et al., 2009). In my study, analysis of the selective exercises, gender, and exercise adherence allowed me to determine whether there is an association with these variables and depression.

Operationalization. For this study, the variables I focused on were adherence rates with the exercise programs and the levels of depression associated with those adherence rates. Exercise adherence was assessed using the Community Health Activities Model Program for Seniors (CHAMPS; Stewart et al., 2001). CHAMPS was

developed to provide reliable and valid measures of weekly exercise frequency and duration by utilizing a self-report questionnaire for seniors (Stewart et al., 2001). The CHAMPS questionnaire is a 41-item assessment used to determine participation rates in the different physical and non-exercise activities.

The individuals with high levels of adherence were compared to individuals of low adherence to determine if significant differences in the levels of depression existed. The control group was also expected to attend and exercise at a minimum of three sessions per week, but its members were not allowed to do the treatment exercises. Exercise adherence was measured for the control group, but the exercises were different than those of the treatment group. Each of the participation rates were assessed to determine whether or not each participant adhered to the exercise regimen. Individuals who reported exercise frequencies less than 20% were considered low adherence. Individuals who had exercise frequencies greater than 20% were considered high adherence. I determined that participants adhering to 20% of the exercises comprised the median (19.23%), which I used to set a determining factor between low adherence and high adherence. The median was assessed by a frequency distribution that provided identification of 50% of participants being below 20% adherence rate and 50% of participants were above 20% adherence rate.

In order to utilize these values in the analysis, a new variable (R) was created to display low and high adherence among participants. Providing a level of adherence allowed for an analysis of the data to determine if adherence to the exercise programs was associated with lower levels of depression. Gender type was analyzed to determine

if either one had an effect on exercise adherence. Any differences in exercise adherence between males and females were assessed to provide further insight as to their relationship. Select exercises was also analyzed to search for any association between the select exercises and exercise adherence. The analysis provided insight as to whether the treatment exercises are more or less effective than other exercises in regard to exercise adherence. For the measurement of depression, the original study researchers used the Center for Epidemiological Studies Depression Scale (CES-D 10) Short Form. The CES-D 10 Short Form is a 10-item assessment used to assess feelings and emotional states of participants in a shorter time period than the 20-item assessment (Yu, Lin, & Hsu, 2013). The short form of the CES-D 10 is often used with the elderly or ill, as it decreases the assessment time and thus is more appropriate for these groups (Yu, Lin, & Hsu, 2013). The levels of depression were then compared to levels of exercise adherence in this elder population to determine any association between exercise adherence and depression.

Data analysis plan. The software used to analyze the data is the IBM Statistical Product and Service Solutions (IBMSPSS) Package 21.0. The dependent variable is depression as measured by the CES-D 10 analysis. The independent variable is exercise adherence. The analysis determined differences between levels of adherence to the exercise programs and how these variations are related to levels of depression. An analysis was also performed with exercise adherence as the dependent variable and gender and specific types of exercise as the independent variables.

The demographic data was analyzed with descriptive statistics to compare means, frequencies, and standard deviations between low exercise adherence and high exercise adherence. The following research questions and hypothesis were addressed:
RQ1: Is an increase in exercise adherence associated with fewer symptoms of depression? RQ2. Is an increase or decrease in exercise adherence associated with gender? RQ3. Are select exercises associated with an increase or decrease in exercise adherence?

Hypotheses

H_0 Adherence to an exercise program is not associated with changes in levels of depression after controlling for baseline depression scores.

H_1 Adherence to an exercise program is associated with changes in levels of depression after controlling for baseline depression scores.

H_0 Adherence to an exercise program is not associated with changes between genders.

H_1 Adherence to an exercise program is associated with changes between genders.

H_0 Select exercises are not associated with changes in exercise adherence.

H_1 Select exercises are associated with changes in exercise adherence.

The use of an ANCOVA allowed for the comparison of means of levels of depression among the participants with low exercise adherence and high exercise adherence while adjusting for the covariate (baseline scores), and an ANOVA allowed for a comparison of exercise adherence with gender differences and the select exercises. The key to examining the analysis was to determine if differences in levels of exercise adherence are associated with levels of depression. It is assumed that as the level of exercise adherence increases; the symptoms of depression (or score) will decrease.

Threats to Validity

An external validity concern is the participation of seniors that purportedly have chronic medical conditions that may influence their ability to regularly participate in the exercise programs, or their ability to properly or completely performs the exercises on a weekly basis (adherence). Adherence and frequency rates were collected in order to compare effective participants in the program with effective participants in the control group, and correspondingly may not apply to the general population. Participants were asked to participate at least three days per week for adequate frequency.

Internal validity is a concern where participants in the original study were frequently asked to self-assess or determine self-efficacy regarding their performance in the exercise programs. These self-assessments are able to allow for variations in perceived performance, which can be subjective from one participant to the next. In

order to minimize this concern, there were additional assessments not reported by the participants that were more objective.

Ethical Procedures

The data set from the original study is restricted from access to ensure confidentiality and authorized parties interested in accessing the information must sign a Use of Confidential Data agreement. The IRB must approve access to the data to ensure the data is being utilized in an appropriate and ethical manner and the rights of the participants are not infringed upon.

As the participants are considered a special group because of their age, participants were required to consent to the program in addition to obtaining approval from their medical provider. The brochures and fliers utilized recruited participants based on the age requirement, lack of involvement in current exercise programs, and the ability to participate on their own volition. Any requests to discontinue or refusal to participate in certain activities resulted in removal from the study so as to ensure participant's needs were addressed, but at the same time their individual data was not utilized in the study so as to avoid misinterpretation of the data.

The data set does disclose participant identification and thus requires approval to access. To avoid disclosure of the data, authorized users are required to have a data security plan to ensure only authorized individuals are viewing the data. The security plan requires the data must be encrypted to ensure any unauthorized access to devices containing the data set are not able to read the information in such a breach of security. Each user must also sign a confidentiality pledge agreeing not to share or disseminate the

information. The data set is password protected so changes cannot be made without authorization. The data is secured in a locked room and will not have a network or interface card installed to prevent access to any networks. Data will only be accessible by the student and dissertation committee members and this access will require a login with a user id and password. Data will not be copied or moved from the secure location.

The Data Use Agreement requires renewal or all data to be destroyed at the end of the designated time period allowed. The physical location where the computer and data are located are secured at all times and only the student has access to this site. Any data backups excluded the data set. Only the student has permission to access the computer containing the data set. Any printed copies will be held in the same secure location as the computer. Any printed copies will be destroyed by the use of a shredder and any digital copies will be held in a secure location such as the locked office where the computer resides. All temporary analysis files will be deleted on June 30 and December 31 of each year. Data will not be moved from the secured location, which is my office that is under lock and key. BestCrypt software has been installed on the computer to ensure the data is encrypted. BestCrypt will also be utilized to provide secure erasure of the data at the end of the contract period.

Summary

The study examined how exercise programs affect the health among participants 50 years and older. This quantitative research study was intended to determine the association of variations in levels of adherence with the exercise programs. The use of an ANCOVA was structured to provide the necessary statistical results needed to answer the research

question and hypothesis regarding the relation between exercise adherence and levels of depression. Chapter 4 presents the results of the current study.

Chapter 4: Results

Introduction

The purpose of this quantitative study, using a secondary data set, was to determine if any relationship existed between the level of exercise adherence and reported levels of depression. I measured exercise adherence with CHAMPS (Stewart et al., 2001). Depression was measured using the CES-D Short Form (Yu, Lin, & Hsu, 2013). Gender was analyzed to determine any possible relationship with exercise adherence between men and women, and I selected a list of 30 exercises to determine if a relationship existed with exercise adherence and select exercises.

The purpose of the study was to determine the association between exercise adherence, gender, specific exercises, and depression. I used the first research question and hypotheses to examine whether higher levels of adherence to an exercise program were associated with fewer symptoms of depression. With the second question and associated hypotheses, I looked at the relationship between gender and exercise adherence to determine if one gender was more likely to adhere to an exercise program. For the third question and hypotheses, I compared each of the select exercises to exercise adherence to determine if certain exercises were adhered to more than others. The following research questions and hypothesis were addressed:

RQ1: Is an increase in exercise adherence associated with fewer symptoms of depression? RQ2. Is an increase or decrease in exercise adherence associated with gender? RQ3. Are select exercises associated with an increase or decrease in exercise adherence?

Hypotheses

H_0 Adherence to an exercise program is not associated with changes in levels of depression after controlling for baseline depression scores.

H_1 Adherence to an exercise program is associated with changes in levels of depression after controlling for baseline depression scores.

H_0 Adherence to an exercise program is not associated with changes between genders.

H_1 Adherence to an exercise program is associated with changes between genders.

H_0 Select exercises are not associated with changes in exercise adherence.

H_1 Select exercises are associated with changes in exercise adherence.

I performed preliminary analyses of the sample using descriptive statistics that included mean comparisons, frequencies, and standard deviations. Additional analyses of mean scores were conducted using ANOVA, independent samples *t* test, and ANCOVA. In this chapter, I present descriptive and demographic characteristics of the sample and the corresponding results for the statistical analyses performed. The data were compared at baseline, 5 months, and 10 months with the use of an ANCOVA in the analysis of depression in order to account for variability in baseline scores. I used a *t* test and ANOVA to analyze gender and specific exercises and were processed separately for each time interval to account for any variation in baseline scores.

Data Collection

I used archival data in this study. The dataset was accessed from the Inter-University Consortium for Political and Social Research (ICPSR) under reference number 23240. Upon approval, the ICPSR transferred the data via email once it received verification of my IRB approval. The original study consisted of 995 applicants of which 66 were not eligible. The baseline interviews included 544 participants (289 treatment individuals and 255 control individuals for a combined 544) out of the available 995 applicants. The reduction in participant numbers was due to a loss of interest, or participants' inability to follow-up. From the 544-participant group, the 5-month interviews resulted in 374 participants, and the 10-month interviews had an increase in participation, which resulted in 384 participants. The researchers recruited participants from three different facilities that served seniors. The participants were recruited through newspapers, flyers, and posters at each site. The participants must have been 49 years or older. Data were collected using questionnaires, scaled measurements, and self-reported observations.

Sample Descriptive and Demographic Characteristics

For my study, the dataset provided complete and valid information on 544 men and women age 49 and older who were analyzed by looking initially at the frequency in which they adhered to the exercises. The participation rates were measured to determine whether or not each individual adhered to the exercise regimen. Individuals who reported

exercise frequencies less than 20% were considered low adherence. Individuals who reported exercise frequencies greater than 20% were considered high adherence. Identifying a level of adherence allowed for an analysis of the data to determine if adherence to the exercise programs was associated with lower levels of depression. The sum of each participant's total exercise related activities was divided by the maximum level of frequency to provide a percentage of each participant's level of exercise. I determined the median of these percentages by performing a frequency distribution of the percentage of all exercise related activities for each participant. Specifically, I determined that participants adhering to 20% of the exercises was the median (19.23%), which I used to set a determining factor between low adherence and high adherence, as approximately one half of the participants were less than 20% adherence and one half of the participants were above the 20% adherence. In order to use these values in the analysis, a new variable (*R*) was created to display low and high adherence among participants. Low and high parameters were needed in order to determine the level of participation that was considered compliant (high exercise adherence) and non-compliant (low exercise adherence) with adherence to an exercise program. Participants who adhered to the exercises less than 20% were allocated a score of zero (0) for low adherence to exercise, and all those above 20% were allocated a one (1) for high adherence to exercise as displayed in Table 1.

Table 1

Differentiation Between Low and High Exercise Adherence

		Participant frequency	Percent
Adherence	0-low	276	50.7
	1-high	268	49.3
	Total	544	100

ANCOVA

For the ANCOVA, the descriptive statistics allowed me to determine which participants were at low exercise adherence in comparison to those participants at high exercise adherence (see Table 1). The potential influence of the variability in baseline depression scores in comparison with scores at 5 months and 10 months was addressed by allocating these baseline scores as the covariate. Using the ANCOVA, I analyzed depression scores as described below at 5 months while taking into account for baseline levels (the covariate). Table 2 provides depression scores for participants at low exercise adherence ($M = 8.93$, $SD = 3.02$, $N = 181$) and high exercise adherence ($M = 8.66$, $SD = 2.77$, $N = 193$).

Table 2

Mean Depression Scores at 5 Months

	R*	Mean	Std. Deviation	*N**
Depression	Under 20% - Low	8.93	3.02	181
	Over 20% - High	8.66	2.77	193
	Total	8.79	2.89	374

"Note." R*: Variable created to show differentiation between low and high exercise adherence. *N*: Participants in each group.

The Levene's test of equality of error variances shown in Table 3 displays the results of whether the dependent variable is equal across groups F (1, 372) =.32, p = .58. The results of the ANCOVA at 5 months provided no significance with respect to exercise adherence and depression at baseline, F (1, 373) = .82, p = .37, R^2 = .00 and as such, no Tukey's HSD was performed to evaluate the pair-wise differences among the means (Table 3).

Table 3

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	9.32[a]	2	4.66	.56	.57	.00
Intercept	2421.30	1	2421.30	288.75	.00	.44
CESD_base	2.50	1	2.50	.30	.59	.00
R	6.90	1	6.90	.82	.37	.00
Error	3110.99	371	8.39			
Total	32009.00	374				
Corrected Total	3120.31	373				

"Note." a: R squared = .003 (Adjusted R Squared = -.002)

Depression scores were analyzed again, but at 10 months, while taking into account for baseline levels (the covariate). Table 4 provides depression scores for participants at low exercise adherence (M = 8.45, SD = 2.89, N = 183) and high exercise adherence (M = 8.59, SD = 3.12, N = 196).

Table 4

Mean Depression Scores at 10 Months

	R*	Mean	Std. Deviation	*N**
Depression	Under 20% - Low	8.45	2.89	183
	Over 20% - High	8.59	3.12	196
	Total	8.52	3.01	379

"Note." *R: Variable created to show differentiation between low and high exercise adherence. **N*: Participants in each group.

The Levene's test of equality of error variances reports the results of whether the dependent variable was equal across groups F (1, 377) =.95, p = .33.

The results of the ANCOVA at 10 months provided no significance with respect to exercise adherence and depression at baseline, F (1, 378) = .20, p = .65, R^2 = .00, and as such, no Tukey's HSD was performed to evaluate the pair-wise differences among the means (Table 5).

Table 5

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.	Partial Eta Squared
Corrected Model	10.81[a]	2	5.40	.60	.55	.00
Intercept	2563.28	1	2563.28	282.99	.00	.43
CESD_base	8.99	1	8.99	.99	.32	.00
R	1.84	1	1.84	.20	.65	.00
Error	3405.79	376	9.06			
Total	30927.00	379				
Corrected Total	3416.60	378				

"Note." a: R squared = .003 (Adjusted R Squared = -.002)

T TEST FOR GENDER

For the series of Independent Samples T-Test's conducted, exercise adherence (allexsum) and gender were compared to determine if any significant relationship existed. The variable allexsum is the frequency of all exercise-related activities per week. Three separate analyses were done to compare baseline scores to the scores at 5 months and 10 months. The descriptive statistics in Table 6 report the analysis to compare baseline for males ($M = 18.79$, $SD = 12.70$, $N = 544$), at 5 months ($M = 21.85$, $SD = 11.76$, $N = 374$),

and 10 months exercise adherence (M = 21.31, SD = 17.71, N = 380). Table 6 also reports the analysis to compare baseline for females (M = 17.34, SD = 11.58, N = 544), at 5 months (M = 21.38, SD = 12.52, N = 374), and 10 months exercise adherence (M = 21.18, SD = 13.59, N = 380).

Table 6

Descriptive Statistics

	Mean Males	Mean Females	*SD* Males	*SD* Females	*T*	*p*
Exercise Adherence @ Baseline	18.79	17.34	12.70	11.58	1.20	.23
Exercise Adherence @ 5 Months	21.85	21.38	11.76	12.52	.31	.75
Exercise Adherence @ 10 Months	21.31	21.18	17.71	13.59	.07	.95

The Levene's Test for Equality of Variances concluded that the assumption of equal variances holds as there was no significance for baseline (.120) and at 5 months (.413). The assumption of equal variances did not hold at 10 months (.014) and is reported as such. The mean exercise adherence scores for males and females at baseline did not differ t (542) = 1.20, p = .23. The mean exercise adherence scores for males and females at 5 months also did not differ t (372) = .31, p = .75. And the final analysis for the mean exercise adherence scores for males and females at 10 months did not differ t (378) = .07,

$p = .95$. There is no significant difference in adherence to exercise between males and females.

ANOVA FOR SELECT EXERCISES

The ANOVA analyses of exercise adherence and select exercises were compared to determine if any significant relationship existed. Three separate analyses were done again to remove any potential for variation effect from the baseline scores on scores at 5 months and 10 months. Each of the select exercises (IV's) have varying levels of participation (some were more or less popular than others) in the exercises and the *Means* of exercise adherence (DV) are compared across these levels of participation for each exercise. The select exercises are a variety of exercises the participants chose to utilize in the program and are reported as the number of hours each exercise is performed at baseline, 5 months, and 10 months.

ANOVA AT BASELINE. The descriptive statistics in Table 7 report the initial analysis to compare baseline exercise adherence (dependent variable) with each of the individual selected exercises (independent variables). This analysis is comparing the frequency of all exercise-related activities per week to determine if any of the specific exercises were adhered to more than others.

Table 7

Descriptive Statistics for Select Exercises and Exercise Adherence at Baseline

Select Exercise	*N**	Mean Hours Exercise	Std. Deviat.	Std. Err	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
Hours/Wk Danced	85	19.20	11.32	1.23	16.76	21.64
Hours/Wk Golf Cary Eqp	16	21.81	16.97	4.24	12.77	30.86
Hours/Wk Golf Ride Cart	8	23.50	12.58	4.45	12.98	34.02
Hours/Wk Played Tennis	9	24.44	13.77	4.59	13.86	35.03
Hours/Week Pl. Dbl Tnns	5	23.40	10.50	4.69	10.36	36.44
Hours/Week Skated	4	17.75	7.81	3.90	5.33	30.17
Hours/Week Jogged	43	27.05	11.27	1.72	23.58	30.52
Hours/Wk Walked Uphill	277	22.03	12.37	.74	20.57	23.49
Hours/Wk Brisk Walk	241	21.68	11.53	.74	20.21	23.14
Hours/Wk Leisure Walk	297	20.51	12.16	.71	19.12	21.89
Hours/Wk Rode a Bike	99	23.89	13.50	1.36	21.19	26.58
Hours/Wk Othr Arb Mch	41	24.90	12.25	1.91	21.04	28.77
Hours/Wk Water Exerc	32	22.66	14.28	2.52	17.51	27.80
Hrs/Wk Swam Mod./Fast	19	26.58	15.55	3.57	19.08	34.07
Hours/Wk Swam Gently	14	22.93	17.57	4.69	12.79	33.07
Hrs/Wk Stretching Exerc	260	21.63	11.71	.73	20.19	23.06
Hrs/Wk Yoga or Tai-Chi	61	21.21	13.69	1.75	17.71	24.72
Hrs/Wk Did Aerobics	41	21.61	13.28	2.07	17.42	25.80
Hrs/Wk Hvy Strgth Trn.	86	23.42	11.01	1.19	21.06	25.78
Hrs/Wk Lght Strgth Trn.	145	21.71	12.08	1.00	19.73	23.69
Hrs/Wk Gen. Cndit Exerc	80	24.11	12.83	1.43	21.26	26.97
Hrs/Wk Bktbl/Scer/Rqtb.	16	21.31	7.17	1.79	17.49	25.13
Hrs/Wk Other Physcl Act	106	18.96	14.14	1.37	16.24	21.69

"Note." **N*: # of Attempts

The Levene test was also utilized to test the homogeneity of variances as provided in Table 8.

Table 8

Test of Homogeneity of Variances at Baseline

Exercise	Levene Statistic	*df*1	*df*2	Sig.
Hrs/Wk Danced	.29a	3	79	0.83
Hrs/Wk Golf Carry Equipment	5.79a	3	11	0.01
Hrs/Wk Golf Riding Cart	N/A			
Hrs/Wk Tennis Singles	0.03	1	7	0.86
Hrs/Wk Tennis Doubles	N/A			
Hrs/Wk Skated	N/A			
Hrs/Wk Jogged	2.34a	3	38	0.09
Hrs/Wk Walked Uphill	1.46	5	271	0.20
Hrs/Wk Brisk Walk	1.05	5	235	0.39
Hrs/Wk Leisure Walk	N/A	5	291	0.11
Hrs/Wk Rode Bike	1.26a	2	94	0.29
Hrs/Wk Other Aerobic Machine	.74a	2	37	0.48
Hrs/Wk Water Exercise	3.17a	3	27	0.04
Hrs/Wk Swam Moderate/Fast	.67a	2	15	0.53
Hrs/Wk Swam Gently	7.78	2	11	0.01
Hrs/Wk Stretching Exercise	0.81	5	254	0.54
Hrs/Wk Yoga or Tai-Chi	.53a	2	56	0.59
Hrs/Wk Aerobics	3.77a	2	36	0.03
Hrs/Wk Heavy Strength Training	.71a	2	82	0.49
Hrs/Wk Light Strength Training	.19a	2	141	0.82
Hrs/Wk General Conditioning Exercise	4.78a	3	75	0.01
Hrs/Wk Basketball/Soccer/Raquetball	2.67	2	13	0.11
Hrs/Wk Other Physical Activity	2.93	5	100	0.02

"Note." a. Groups with only one case are ignored in computing the test of homogeneity of variance for frequency of all exercise-related activities per week.

The ANOVA analysis for each individual exercise (IV) and the dependent variable exercise adherence (allexsum) is reported in Table 9 and provides the descriptive statistics for each of the select exercises.

Table 9

ANOVA at Baseline for Significance of Each Exercise

Select Exercise	Sum of Squares	*df*	Mean Square	*F*	Sig.
Hours/Wk Danced	931.99	5	186.39	1.49	.20
Hours/Wk Golf Carry Eqp.	2932.14	4	733.03	5.82	.01
Hours/Wk Golf Ride Cart	713.33	4	178.33	1.36	.41
Hours/Wk Played Tennis	32.51	1	32.51	.15	.71
Hours/Week Pl. Dbl. Tnis	305.20	2	152.60	2.24	.31
Hours/Week Skated	126.75	1	126.75	4.53	.17
Hours/Week Jogged	187.77	4	46.94	.34	.84
Hours/Wk Walked Uphill	3395.01	5	679.00	4.74	.00
Hours/Wk Brisk Walk	2900.72	5	580.14	4.70	.00
Hours/Wk Leisure Walk	4037.44	5	807.49	5.91	.00
Hours/Wk Rode a Bike	413.62	4	103.41	.55	.69
Hours/Wk Othr Arb Mach	270.38	3	90.13	.58	.63
Hours/Wk Water Exercise	894.39	4	223.59	1.11	.37
Hrs/Wk Swam Mod./Fast	1564.08	3	521.36	2.80	.08
Hours/Wk Swam Gently	300.87	2	150.44	.44	.65
Hrs/Wk Stretching Exerc	1609.98	5	321.99	2.41	.04
Hrs/Wk Yoga or Tai-Chi	855.54	4	213.89	1.15	.34
Hrs/Wk Did Aerobics	746.14	4	186.54	1.06	.39
Hrs/Wk Heavy Strgth Tran	249.18	3	83.06	.68	.57
Hrs/Wk Light Strgth Train	15.54	3	5.18	.04	.99
Hrs/Wk Gen. Cndit. Exerc	2415.19	4	603.80	4.27	.00
Hrs/Wk Bktbl/Socr/Raqtb.	99.72	2	49.86	.97	.41
Hrs/Wk Other Physical Activities	716.95	5	143.39	.71	.62

Post hoc tests were not performed for frequency of all exercise-related activities per week when there are fewer than three groups. The Tukey HSD was used to evaluate the differences among means for each of the exercise variables analyzed. Significant differences in means were discovered at various hours of participation for: hours/week walked uphill, hours/week did brisk walking, and hours/week leisure walked. Non-significant differences in means were discovered for hours/week swam gently, hours/week doing stretching exercises, hours/week played basketball/soccer/racquetball, and hours/week did other physical activity. The select exercises that are significantly associated with exercise adherence are hours per week playing golf and carrying own equipment, hours per week walked uphill, hours per week did brisk walking, hours per week leisure walked, hours per week did stretching exercise, and hours per week did general conditioning exercise.

ANOVA AT 5 MONTHS. The descriptive statistics in Table 10 report the initial analysis to compare exercise adherence (DV) at 5 months with each of the individual selected exercises (IV). This analysis is comparing the frequency of all exercise-related activities per week to determine if any of the specific exercises were adhered to more than others.

Table 10

Descriptive Statistics for Select Exercises and Exercise Adherence at 5 Months

Select Exercise	*N**	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
Hours/Wk Danced	54	26.92	19.49	2.65	21.60	32.24
Hours/Wk Golf Carry Eq.	12	26.00	11.54	3.33	18.66	33.33
Hours/Wk Golf Ride Cart	5	26.60	17.95	8.02	4.30	48.89
Hours/Wk Played Tennis	6	35.66	15.34	6.26	19.56	51.77
Hours/Week Pl. Dbl. Tns	4	20.25	7.36	3.68	8.52	31.97
Hours/Week Skated	7	32.85	12.40	4.68	21.38	44.32
Hours/Week Jogged	36	33.77	22.96	3.82	26.00	41.54
Hours/Wk Walked Uphill	201	24.41	13.80	.97	22.49	26.33
Hours/Wk Brisk Walk	207	23.66	13.61	.94	21.79	25.52
Hours/Wk Leisure Walk	210	23.18	13.62	.94	21.33	25.03
Hours/Wk Rode a Bike	66	27.83	13.20	1.62	24.58	31.07
Hours/Wk Aerb.Mach.	45	29.48	23.12	3.44	22.54	36.43
Hours/Wk Water Exerc.	31	28.54	23.89	4.29	19.78	37.31
Hrs/Wk Swam Mod./Fast	19	33.78	29.81	6.84	19.41	48.16
Hours/Wk Swam Gently	16	25.62	11.75	2.93	19.36	31.88
Hrs/Wk Stretching Exerc.	297	22.99	12.47	.72	21.56	24.41
Hrs/Wk Yoga or Tai-Chi	51	23.15	8.10	1.13	20.87	25.43
Hrs/Wk Did Aerobics	165	22.90	13.22	1.02	20.87	24.93
Hrs/Wk Hvy Strgth Train	91	25.68	10.56	1.10	23.48	27.88
Hrs/Wk Liht Strgth Train	232	23.08	12.59	.82	21.45	24.71
Hrs/Wk Gen. Condit. Exc	158	25.15	13.74	1.09	22.99	27.31
Hrs/Wk Bktbal/Scer/Rqtb	11	27.72	6.95	2.09	23.05	32.40
Hrs/Wk Other Physcl Act	63	24.53	18.97	2.39	19.76	29.31

"Note." **N*: # of Attempts

The Levene's test was also utilized to test the homogeneity of variances as provided in Table 11.

Table 11

Test of Homogeneity of Variances at 5 Months

Exercise	Levene Statistic	*df*1	*df*2	Sig.
Hrs/Wk Danced	.61[a]	2	49	0.55
Hrs/Wk Golf Carry Equip.	.35[a]	2	7	0.71
Hrs/Wk Golf Ride Cart	N/A			
Hrs/Wk Tennis Singles	N/A.[a,b]			
Hrs/Wk Tennis Doubles	N/A			
Hrs/Wk Skated	1.37[a]	1	4	0.31
Hrs/Wk Jogged	1.84[a]	2	30	0.17
Hrs/Wk Walked Uphill	2.39	5	195	0.04
Hrs/Wk Brisk Walk	1.18	5	201	0.31
Hrs/Wk Leisure Walk	5.42	5	204	0
Hrs/Wk Rode Bike	.72[a]	3	61	0.54
Hrs/Wk Other Aerobic Machine	2.90	2	42	0.06
Hrs/Wk Water Exercise	0.78	3	27	0.51
Hrs/Wk Swam Mod./Fast	.47[a]	2	15	0.63
Hrs/Wk Swam Gently	3.49	3	12	0.05
Hrs/Wk Stretching Exercise	0.26	4	292	0.89
Hrs/Wk Yoga or Tai-Chi	2.20[a]	2	47	0.12
Hrs/Wk Aerobics	0.67	2	162	0.51
Hrs/Wk Heavy Strength Train.	3.49[a]	2	87	0.03
Hrs/Wk Light Strength Train.	2.33[a]	2	228	0.09
Hrs/Wk Gen. Condit. Exercise	3.44[a]	2	154	0.03
Hrs/Wk Bsktball/Soccer/Raqtball	.73[a]	1	8	0.41
Hrs/Wk Other Phsyical Activity	3.42	5	57	0.01

"Note." a. Groups with only one case are ignored in computing the test of homogeneity of variance for frequency of all exercise-related activities per week. b. Test of homogeneity of variances cannot be performed for frequency of all exercise-related activities per week because only one group has a computed variance.

The ANOVA analysis for each individual exercise and exercise adherence (allexsum) are reported in Table 12.

Table 12

ANOVA at 5 Months for Significance of Each Exercise

Select Exercise	Sum of Squares	*df*	Mean Square	*F*	Sig.
Hours/Wk Danced	1806.06	4	451.51	1.20	.32
Hours/Wk Golf Carry Eqp.	706.80	4	176.70	1.62	.26
Hours/Wk Golf Ride Cart	1289.20	4	322.30		
Hours/Wk Played Tennis	70.53	1	70.53	.25	.64
Hours/Week Pl. Dbl. Tens	30.25	1	30.25	.45	.56
Hours/Week Skated	61.60	2	30.80	.14	.87
Hours/Week Jogged	1401.35	5	280.27	.49	.77
Hours/Wk Walked Uphill	2555.19	5	511.03	2.80	.01
Hours/Wk Brisk Walk	2408.41	5	481.68	2.70	.02
Hours/Wk Leisure Walk	3664.17	5	732.83	4.25	.00
Hours/Wk Rode a Bike	420.94	4	105.23	.58	.67
Hours/Wk Other Arb Mch	805.26	2	402.63	.74	.48
Hours/Wk Water Exercise	247.64	3	82.54	.13	.94
Hrs/Wk Swam Mod./Fast	337.30	3	112.43	.10	.95
Hours/Wk Swam Gently	424.50	3	141.50	1.03	.41
Hrs/Wk Stretching Exerc	1693.13	4	423.28	2.78	.02
Hrs/Wk Yoga or Tai-Chi	297.96	3	99.32	1.56	.21
Hrs/Wk Did Aerobics	1025.99	2	512.99	3.00	.05
Hrs/Wk Heavy Strgth Trn.	580.16	3	193.38	1.77	.15
Hrs/Wk Light Strgth Train.	442.80	3	147.60	.93	.42
Hrs/Wk Gen. Condit. Exrc	1177.65	3	392.55	2.12	.10
Hrs/Wk Bsktbal/Scer/Rqtb	88.65	2	44.32	.89	.44
Hrs/Wk Other Physical Activity	2711.45	5	542.29	1.57	.18

Post hoc tests were not performed for frequency of all exercise-related activities per week when there are fewer than three groups. The Tukey HSD was used to evaluate the differences among means for each of the exercise variables analyzed. Significant differences in means were discovered at various hours of participation for hours/week did brisk walking, leisure walking, stretching exercise, and aerobics. Non-significant differences in means were discovered for hours/week walked uphill, used other aerobic machine, water exercise, swam gently, and other physical activity. The select exercises that are significantly associated with exercise adherence are hours per week walked uphill, hours per week did brisk walking, hours per week leisure walked, and hours per week did stretching exercise.

ANOVA AT 10 MONTHS. The descriptive statistics in Table 13 report the initial analysis to compare exercise adherence (DV) at 10 months with each of the individual selected exercises (IV). This analysis is comparing the frequency of all exercise-related activities per week to determine if any of the specific exercises were adhered to more than others.

Table 13

Descriptive Statistics for Select Exercises and Exercise Adherence at 10 Months

Select Exercise	*N**	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
Hours/Wk Danced	54	27.11	22.25	3.02	21.03	33.18
Hours/Wk Golf Cry Eqp	18	30.66	22.96	5.41	19.24	42.08
Hours/Wk Golf Ride Cart	5	42.00	40.13	17.94	-7.82	91.82
Hours/Wk Played Tennis	9	29.11	12.94	4.31	19.15	39.06
Hours/Week Pl. Dbl Tens	4	21.00	10.36	5.18	4.51	37.48
Hours/Week Skated			N/A	N/A	N/A	N/A
Hours/Week Jogged	40	29.92	17.74	2.80	24.25	35.59
Hours/Wk Walked Uphill	158	26.63	15.95	1.26	24.13	29.14
Hours/Wk Brisk Walk	189	25.67	15.43	1.12	23.45	27.88
Hours/Wk Leisure Walk	191	22.45	13.84	1.00	20.47	24.43
Hours/Wk Rode a Bike	67	31.37	19.81	2.42	26.53	36.20
Hours/Wk Othr Arb Mch	45	29.48	23.12	3.44	21.02	35.19
Hours/Wk Water Exerc	31	23.70	13.06	2.34	18.91	28.50
Hrs/Wk Swam Mod./Fast	27	29.25	14.59	2.80	23.48	35.03
Hours/Wk Swam Gently	23	28.08	13.80	2.87	22.11	34.05
Hrs/Wk Stretching Exerc	287	23.81	14.55	.85	22.12	25.50
Hrs/Wk Yoga or Tai-Chi	61	26.93	17.72	2.26	22.39	31.47
Hrs/Wk Did Aerobics	143	24.38	15.00	1.25	21.90	26.86
Hrs/Wk Hvy Strgth Tran.	85	27.52	14.77	1.60	24.34	30.71
Hrs/Wk Lght Strgth Train	205	24.28	15.12	1.05	22.20	26.37
Hrs/Wk Gen. Cndit. Exrc	131	25.35	14.04	1.22	22.92	27.77
Hrs/Wk Bskbl/Scer/Rqtb	9	30.77	4.94	1.64	26.97	34.57

Hrs/Wk Other Physcl Act	87	25.39	19.39	2.07	21.25	29.52

"Note." *N: # of Attempts

The Levene's test was also utilized to test the homogeneity of variances as provided in Table 14.

Table 14

Test of Homogeneity of Variances at 10 Months

Exercise	Levene Statistic	*df*1	*df*2	Sig.
Hrs/Wk Danced	2.20[a]	3	49	0.1
Hrs/Wk Golf Carry Equp.	7.15	3	14	0.00
Hrs/Wk Golf Ride Cart	N/A			
Hrs/Wk Tennis Singles	N/A.[a,b]			
Hrs/Wk Tennis Doubles	N/A.[a,b]			
Hrs/Wk Skated	N/A	1	4	0.30
Hrs/Wk Jogged	2.19[a]	2	36	0.12
Hrs/Wk Walked Uphill	3.83[a]	4	152	0.01
Hrs/Wk Brisk Walk	5.59	5	183	0
Hrs/Wk Leisure Walk	0.81	5	185	0.54
Hrs/Wk Rode Bike	4.49[a]	2	63	0.01
Hrs/Wk Other Aerobic Machine	5.55	3	32	0.00
Hrs/Wk Water Exercise	2.15[a]	3	26	0.11
Hrs/Wk Swam Mod./Fast	1.07[a]	2	23	0.35
Hrs/Wk Swam Gently	1.10[a]	1	20	0.30
Hrs/Wk Stretching Exercise	1.05[a]	4	281	0.37
Hrs/Wk Yoga or Tai-Chi	2.60[a]	2	56	0.08
Hrs/Wk Aerobics	0.83	2	140	0.43
Hrs/Wk Heavy Strength Train.	.89[a]	2	81	0.41
Hrs/Wk Light Strength Train.	.19[a]	2	200	0.82
Hrs/Wk Gen. Condit. Exercise	.16[a]	2	126	0.84
Hrs/Wk Bsktball/Soccer/Raqtball	.13[a]	1	6	0.72
Hrs/Wk Other Phsyical Activity	0.42	5	81	0.83

*"Note."*a. Groups with only one case are ignored in computing the test of homogeneity of variance for frequency of all exercise-related activities per week. b. Test of homogeneity of variances cannot be performed for frequency of all exercise-related activities per week because only one group has a computed variance.

The ANOVA analysis for each individual exercise and exercise adherence (allexsum) are reported in Table 15.

Table 15

ANOVA at 10 Months for Significance of Each Exercise

Select Exercise	Sum of Squares	*df*	Mean Square	*F*	Sig.
Hours/Wk Danced	8180.10	4	2045.02	5.54	.00
Hours/Wk Golf Cary Eqp.	3812.70	3	1270.90	3.45	.04
Hours/Wk Golf Ride Cart	3654.00	2	1827.00	1.31	.43
Hours/Wk Played Tennis	39.01	1	39.01	.21	.66
Hours/Week Pl. Dbl. Tnns	1.33	1	1.33	.01	.93
Hours/Week Skated	61.60	2	30.80	.14	.87
Hours/Week Jogged	484.88	3	161.62	.49	.68
Hours/Wk Walked Uphill	1826.58	5	365.31	1.45	.20
Hours/Wk Brisk Walk	8284.11	5	1656.82	8.30	.00
Hours/Wk Leisure Walk	1541.12	5	308.22	1.63	.15
Hours/Wk Rode a Bike	420.94	4	105.23	.58	.67
Hours/Wk Othr Arb. Mach	3413.37	3	1137.79	3.04	.04
Hours/Wk Water Exercise	1487.96	4	371.99	2.66	.05
Hrs/Wk Swam Mod./Fast	338.85	3	112.95	.50	.68
Hours/Wk Swam Gently	341.04	2	170.52	.88	.42
Hrs/Wk Stretching Exerc	4098.51	5	819.70	4.07	.00
Hrs/Wk Yoga or Tai-Chi	348.59	4	87.14	.26	.90
Hrs/Wk Did Aerobics	309.31	2	154.65	.68	.50
Hrs/Wk Hvy Strgth Train.	611.54	3	203.84	.93	.43
Hrs/Wk Light Strgth Train.	1121.33	4	280.33	1.23	.29
Hrs/Wk Gen. Condit. Exrc	485.22	4	121.30	.60	.65
Hrs/Wk Bktbl/Scer/Raqtb.	24.08	2	12.04	.42	.67

Hrs/Wk Other Physical Activity	949.71	5	189.94	.49	.78

Post hoc tests were not performed for frequency of all exercise-related activities per week when there are fewer than three groups. The Tukey HSD was used to evaluate the differences among means for each of the exercise variables analyzed. Significant differences in means were discovered at various hours of participation for hours/week did play golf carrying own equipment, brisk walking, and used other aerobic machine. Non-significant differences in means were discovered for hours/week did leisure walk, aerobics, and other physical activity. The select exercises that are significantly associated with exercise adherence are hours per week danced, hours per week played golf carrying own equipment, hours per week did brisk walking, hours per week used other aerobic machine, and hours per week did stretching exercise.

Main Analysis

Three research questions and the supporting hypotheses were analyzed utilizing the dataset. Baseline measurements of depression and exercise adherence were compared against successive measurements at 5 months and 10 months. Gender and select exercises were also analyzed (baseline, 5 months, and 10 months) to determine their relationship with exercise adherence and any potential corresponding relationship with depression.

As seen in Table 2, Hypothesis 1 was not supported by the results. The hypothesis resulted in no significant association between exercise adherence and depression at 5 months, thus the null hypothesis was accepted. There was also no

significant relationship between exercise adherence and depression at 10 months, as shown in Table 4. As there was no significant relationship at 5 months or 10 months, the null hypothesis was accepted.

For Hypothesis 2, all three Independent T-Test's at baseline, 5 months, and 10 months were insignificant (0.23, 0.75, & 0.95) as shown in Table 6. The null hypothesis was accepted, as there was no significant association between gender and exercise adherence.

Hypothesis 3 at baseline resulted in a significant association between some of the select exercises and exercise adherence (9b, 25b, 26b, 28b, 34b, 39b). The corresponding exercises to the aforementioned numbers are hours per week playing golf and carrying own equipment, hours per week walked uphill, hours per week did brisk walking, hours per week leisure walked, hours per week did stretching exercise, and hours per week did general conditioning exercise. Thus, the null hypothesis would be rejected, and the alternative hypothesis would be accepted that select exercises are associated with exercise adherence.

At 5 months, there was a significant association between some of the select exercises and exercise adherence (25b, 26b, 28b, 34b). The corresponding exercises to the aforementioned numbers are hours per week walked uphill, hours per week did brisk walking, hours per week leisure walked, and hours per week did stretching exercise. Thus, the null hypothesis would be rejected, and the alternative hypothesis would be accepted that select exercises are associated with exercise adherence.

At 10 months, there was a significant association between some of the select exercises and exercise adherence (7b, 9b, 26b, 30b, 34b). The corresponding exercises to the aforementioned numbers are hours per week danced, hours per week played golf carrying own equipment, hours per week did brisk walking, hours per week used other aerobic machine, and hours per week did stretching exercise. Thus, the null hypothesis would be rejected, and the alternative hypothesis would be accepted that select exercises are associated with exercise adherence.

The two significant select exercises that were common among the three time periods (baseline, 5 months, and 10 months) are hours per week did brisk walking and hours per week did stretching exercise. The analyses provided evidence that certain exercises are adhered to more than others, giving support to developing a new study that would only utilize exercises with high adherence levels.

Summary

Archival data was used in this study to determine the interaction between depression and exercise adherence. Analyses were also conducted to determine if any association existed between gender and exercise adherence and select exercises and exercise adherence. Results provided no evidence of a relationship between exercise adherence and depression or gender and exercise adherence. A relationship was shown to be present between select exercises and exercise adherence giving evidence to the hypothesis that certain exercises will be adhered more to than others.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to determine if exercise adherence levels are associated with the levels of depression among individuals over 49 in three rural community centers. I used archival data from a study by Hughes et al. (2009) who looked at which type of exercise was considered best practice. Specifically, I used this data to determine if an increase in exercise adherence was associated with a decrease in the symptoms of depression. I used an ANCOVA to determine if differences in levels of depression were significantly associated between low and high exercise adherence. The results showed that a high level of exercise adherence is not significantly associated with lower symptoms of depression. I used an independent samples *t* test to determine if an association between gender and exercise adherence existed and also if a relationship between the type of exercise and exercise adherence was present. The results showed no significant evidence of an association between gender and exercise adherence but did show significant evidence that some of the select exercises were associated with an increase in exercise adherence.

Interpretation of the Findings

In this quantitative research study, I found no evidence that a continuous adherence to exercise provides a decrease in the symptoms of depression. Although the literature does provide substantial evidence of exercise being effective in the reduction of depression, there is no extension of this data to confirm that an increase in exercise results in lower reported levels of depression (Guiney & Machado, 2013; Ida et al., 2013;

Shin & Kim, 2005; Shin et al., 2009). It was also suggested that there may be some relationship between gender and exercise adherence, but the evidence again showed there was no significant difference in exercise adherence levels between men and women. The results, however, did provide significant evidence that some exercises are more likely to be adhered to in comparison to the other exercises offered in the study. These results were not surprising, as I assumed that some exercises are more enjoyable or easier to perform and would result in the participants being more likely or willing to utilize them on a more consistent basis.

Research Question 1

For Research Question 1, I did not reject the null hypothesis. There was no significant association between the adherence to exercise and levels of depression. This evidence indicated that an increase in exercise adherence does not result in lower levels of symptoms of depression.

Research Question 2

For Research Question 2, I did not reject the null hypothesis. There was no significant association between each participant's gender and their corresponding level of exercise adherence. This evidence indicated that men and women have similar levels of exercise adherence.

Research Question 3

For Research Question 3, I rejected the null hypothesis. There was a significant association between multiple select exercises and exercise adherence. This evidence showed that some exercises are adhered to more than others.

Limitations of the Study

In this study, I did not measure specific age ranges and the population was isolated to men and women over the age of 49. I also did not consider each individual's opinion, levels of optimism or pessimism, or other factors that may affect depression, perceived depression, or acceptance of exercise as an effective form of therapy. As the levels of depression were reported verbally from the participants, there also may be a lack of consistent reporting that can be validated. Although I looked at a variety of different types of exercises, I did not look at a comparative effectiveness of each exercise.

A bias that may have an impact on the study is the potential for the results to overestimate the association of exercise on individuals with depression. Another area of concern that developed during the analyses was the idea that the population chosen is often sedentary and not willing or open to the use of exercise as part of their weekly routine. This concern also led us to the notion that many of the participants may not have been able to participate due to mobility issues, as the study was conducted at senior/community centers for individuals older than 49 years of age.

Recommendations

The study did show that participants in this population preferred some of the exercises over others. These exercises were playing golf and carrying own equipment, walking uphill, brisk walking, leisure walking, stretching exercise, general conditioning exercise, dancing, and use of other aerobic machines. Because there was no evidence

that an increase in adherence would lead to low levels of depression, additional research should be conducted to determine what factors are leading to a decrease in depression as referenced in the various articles I reviewed in Chapter 2 (Jazaieri et al., 2012; Rejeski et al., 1992).

The articles I reviewed in Chapter 2 provided sufficient evidence that an increase in any exercise resulted in fewer symptoms of depression, thus giving rise to the idea that an increase in the adherence levels of exercise would also lead to fewer symptoms of depression. However, I did not find evidence of this relationship in this study, indicating the need for additional research that offers a more refined analysis of the effect adherence to an exercise program has on depression. In this study, I neither considered whether patients were actually depressed at the onset of the study, nor determines the most efficacious exercises to be performed so as to provide a more accurate evaluation of the interaction between exercise adherence and depression. Various forms of exercise have been shown to alleviate depression, but this study showed no change in depression when exercises were adhered to by participants (see Greenwood et al., 2012; Roman, 2010). Mean depression scores for baseline, 5 months, and 10 months were lower than the minimum score necessary for being diagnosed as depressed, showing that a substantial portion of participants were not considered depressed. In addition, the study did not account for those participants who were taking medication for depression and only ensured they were healthy enough to participate in physical activities. These numerous issues with the original study may be factors as to why the results were not statistically significant.

A new study should be conducted with research participants who are young enough, and within a more specified age range, to physically participate in all sessions of exercise and were also previously clinically diagnosed as depressed. These parameters would provide a more accurate analysis of the relationship between exercise adherence and depression. Ensuring complete adherence to a variety of select participant preferred exercises, not just a random variety to choose from, by all participants would provide additional credibility to the study by removing the random selection and random adherence to exercise. Also, using participants who were diagnosed as depressed at the onset of the study would allow for a more accurate comparison of changes over the course of a new study. This study may not have determined actual presence of depression with the use of a questionnaire instead of an actual diagnosis, thus allowing for individuals who only had a bout of depression or just a day of depressive symptoms to participate in the study. Including other approaches for the treatment of depression may also prove more beneficial than exercise alone. The approach used in this study may have allowed for participants who were not depressed to skew the analysis when compared to others with a depression diagnosis.

Implications

A prescribed exercise regimen as part of the treatment for patients with depression provided evidence that some exercises were more likely to be adhered to than others. Using only a select set of exercises that are easily adhered to may be effective in determining if exercise adherence is able to alleviate and potentially prevent the onset of depression. Although this study did not show a decrease in depression with an increase

in adherence to exercises, there is substantial historical data showing that exercise is effective in alleviating depression. This study does provide insight for future studies as to the need for understanding the critical roles of the various specific exercises and clarity of whether a patient is clinically depressed. The results from this study should encourage future researchers in this area to include participants who are the same age, have been clinically diagnosed as depressed, and are able to completely adhere to an exercise program with specific exercise options.

Conclusion

In this study, I analyzed how an increase in exercise adherence would interact with levels of depression. Although exercise has been shown to be effective in alleviating depression, there is no significant evidence confirming this approach to allow us to assume that an increase in adherence to an exercise program would lead to a decrease in depression. Ensuring similarly aged patients are diagnosed with depression and only specific exercises are utilized may provide future insight as to the relationship between exercise adherence and depression. Only with continued research and utilization in a clinical setting will the necessary evidence of the possible effectiveness of exercise on mental health issues be provided.

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