THE EFFECTS OF WORKSITE WELLNESS ON PHYSICAL ACTIVITY AND NUTRITION

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THE EFFECTS OF WORKSITE WELLNESS ON PHYSICAL ACTIVITY AND NUTRITION

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To my fantastic parents who have supported me and my education

throughout my entire life. Thanks Momma and Deddy!

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ABSTRACT

The purposes of this study were to conduct an experimental intervention using the Theory of Planned Behavior to explain intentions and behavior regarding nutrition consumption and physical activity. One hundred and seven employees of a university in the United States volunteered and were randomly assigned to the treatment group or the wait-list control group. A population control group (n = 78) was randomly selected from the overall employee population. The treatment group participants were provided a specific nutrition and physical activity challenge for five weeks.

A randomized pre-test post-test experimental design was used. Outcome measures included the number of days five or more fruits and vegetables were consumed, the number of days 10,000 steps were taken, and their respective measures of intention. Analysis of Covariance was used.

Among participants with lower physical activity intention at pre-test, the treatment group had higher intention at post-test than did the control groups but not among those with higher physical activity intention at pre-test.

For the participants who intended to walk one or four days of 10,000 steps per week, the treatment group took more 10,000 step days than did the control groups. For the participants who intended to walk two days of 10,000 steps per week, the treatment group took more 10,000 step days than did population control group, but not the wait-list control group. There was not a group effect among those who intended to walk three days of 10,000 steps per week.

Among those who had lower pre-test nutrition intention, the treatment group had higher nutrition intention at post-test than did the control groups. There was no group effect on post-test nutrition intention among those who had higher pre-test nutrition intention.

Among those with lower pre-test nutrition intention, there was no group effect on the number of days participants consumed five or more fruits and vegetables. Among those with higher pre-test nutrition intention, the treatment group had more days of fruit and vegetable consumption than did the control groups.

Results of this study help verify that the Theory of Planned Behavior is a useful framework for a wellness intervention among employees.

Key Words: Planned Behavior, Intention, Experiment, Random sampling, Employee Fitness, Physical activity, Exercise, Nutrition, Fruit, Vegetables, Walking, Pedometer, College Environment

TABLE OF CONTENTS

Page

LIST OF TABLES ix

LIST OF APPENDICES x

CHAPTER

INTRODUCTION 1

Research Problem 1

How to Build a Wellness Program 14

LITERATURE REVIEW 24

Worksite Literature Review 29

METHODS 45

What is Fit 49? 46

Study Purpose 50

Hypotheses 52

Description of the Sample 53

Instrumentation and Materials for Data Collection 54

Instruments 56

Data Collection Procedures 63

Analysis Procedures 63

RESULTS.. 65

Development of the Indexes 66

Physical Activity 66

Fruit and Vegetable Consumption 67

Participants 69

Selection of Participants 69

Attrition 70

Description of the Participants 70

Intention to Treat 73

Physical Activity Intention 74

10,000 Step Days 78

Nutrition Intention 83

Days of Fruit and Vegetable Consumption 87

Summary of Results 92

Physical Activity Intention 92

10,000 Step Days 93

Nutrition Intention 94

Days of Fruit and Vegetable Consumption......... 95

DISCUSSION.. 96

Physical Activity Intention 96

10,000 Step Days 97

Nutrition Intention 98

Days of Fruit and Vegetable Consumption 98

Outcomes.. 99

Limitations 103

Future Recommendations 104

WORKS CITED 107

APPENDICES.. 121

LIST OF TABLES

Page
Participant Characteristics, FIT 49 Challenge 130

Pre- and Post- Scores for TPB Survey, FIT 49 Challenge 131

Post-test Physical Activity Intention, FIT 49 Challenge 132

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Treatment Group 133

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Wait-List Control Group 134

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Control Group 135

10,000 Step Days, FIT 49 Challenge 136

Summary of Regression Analysis for Variables Predicting 10,000 Step Days 137

Post-test Nutrition Intention, FIT 49 Challenge 138

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Treatment Group 139

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Wait-List Control Group 140

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Control Group 141

Days of Nutrition Consumption, FIT 49 Challenge 142

Summary of Regression Analysis for Variables Predicting Days of Nutrition Consumption 143

LIST OF APPENDICES

Page

Appendix A : Theory Figures 122

Appendix B: Definitions of Fruits and Vegetables (USDA) 123

Appendix C: Fit 49 Survey 124

CHAPTER I:

INTRODUCTION

Research Problem

Chronic diseases are killing Americans. In 2009, approximately 2.5 million people died. Of those deaths, 1,364,588 were caused by heart disease, cancer, stroke, or diabetes (Centers for Disease Control and Prevention, 2011a). Seven out of every ten deaths in the United States are caused by chronic diseases (Centers for Disease Control and Prevention, 2011b). The top three chronic diseases causing those deaths are heart disease, cancer, and stroke (Centers for Disease Control and Prevention, 2011f). Diabetes follows closely behind, ranked seventh in the top causes of death among Americans (Centers for Disease Control and Prevention, 2011f). The number one cause of death among Americans in 2009 was cardiovascular disease, which accounted for approximately 24% of deaths, or 599,413 people (Centers for Disease Control and Prevention, 2011a). Many of the people who have this life-threatening heart disease are of the working-age population (Chung, Melnyk, Blue, Renaud, & Breton, 2009). Cancer, the number two cause of death in America, kills 567,628 people per year. This equates to approximately one in every two men and one in every three women having cancer during in their lifetimes. Stroke causes approximately 128,842 American deaths every year while diabetes accounts for approximately 68,705 American deaths each year (Centers for Disease Control and Prevention, 2011a). An underlying factor of each of these chronic diseases is obesity (Minino & Smith, 2001).

The purpose of this investigation is to examine the effects of participation in a physical activity and nutrition program called the Fit 49 Challenge. The investigation addresses physical activity and nutrition. What effect does participation in an experimental physical activity and nutrition intervention have on the physical activity and nutrition of university employees? In this analysis control variables include age, sex, employee classification, and constructs of the Theory of Planned Behavior such as perceived behavioral control, attitudes, subjective norms, and physical activity intention. More specifically, the results of this investigation address four specific outcomes: What effect does participation in the Fit 49 Challenge have on physical activity intention at post-test? What effect does participation in the Fit 49 Challenge have on the number of days a participant takes 10,000 steps during the five-week Challenge? What effect does participation in the Fit 49 Challenge have on nutrition intention at post-test? What effect does participation in the Fit 49 Challenge have on the number of days a participant consumes five or more fruits and vegetables during the five-week Challenge?

Americans and people across the world have been gaining weight at an increasingly alarming rate. According to recent research by Daddario (2007), "obesity has become America's most serious epidemic" (p. 364). Some researchers even view obesity as an independent risk factor for contracting many chronic diseases (Neville, Merrill, & Kumpfer, 2010). Obesity and lack of physical activity are the two leading causes of morbidity and mortality according to the World Health Organization (Atlantis, Chow, Kirby & Fiatarone Singh, 2006). When a person continues to gain weight, certain health consequences, such as high blood pressure and high cholesterol, accompany that weight gain and further contribute to chronic diseases (Siegal, Prelip, Erausquin, & Kim, 2010) such as diabetes, cancer, cardiovascular disease, and many others (Thompson, 2003).

Healthy People is a science-based initiative aiming to improve the health of America through the use of clearly defined objectives every ten years. Healthy People 2020 objectives address the efforts to reduce chronic diseases in Americans and the underlying cause of many of those chronic diseases—obesity. Most of the objectives are aimed at reducing chronic deaths by 10% by the year 2020. One objective targets the reduction of cancer-related deaths from 178.4 deaths per 100,000 to 160.6 deaths per 100,000. A second chronic disease related objective aims to reduce the diabetes death rate from 73.1 deaths per 100,000 to 65.8 deaths per 100,000. Additionally, efforts are being made to reduce the number of deaths caused by stroke from 42.2 deaths per 100,000 to 33.8 deaths per 100,000—a 20% improvement. Two Healthy People 2020 objectives specifically address the rapid increase of obesity among Americans. The aim of the Healthy People 2020 Nutrition and Weight Status objective nine is to reduce the overall percentage of obese Americans from 34 to

30.6 while increasing the percentage of healthy weight Americans from 30.8 to 33.9 (Centers for Disease Control and Prevention, 2011j).

Two underlying but modifiable behaviors that contribute to obesity are low levels of physical activity and consuming too many calories (Pratt, Jandzio, Tomlinson, Kang, & Smith, 2006). According to Yancey and colleagues (2006), people are presented "with a smorgasbord of aggressively advertised, highly palatable, energy-dense but nutrient-poor foods and in which most obligatory physical activity has been engineered out of our lives" (Yancey, Lewis, Guinyard, Sloane, Nascimento, & Galloway-Gilliam, p. 233). The self-reported average daily caloric consumption of women and men over the age of 19 is 1,785 and 2,640 calories per day, respectively. Although this number does not appear high, reports also indicate that people tend to underestimate their caloric intake when self-reporting. Over the past 40 years, the average self-reported caloric consumption has increased by over 600 calories per person per day. During the same time period, restaurants have also increased their portion sizes. For example, in 1960 the average bagel was three inches in diameter and contained 140 calories. In today's super-sized world, bagels are twice the size with more than twice the calorie content (350 calories). In 1983 a one-cup serving of spaghetti served at a restaurant contained 500 calories. Today's two-cup serving contains 1,025 calories (National Heart, Lung, and Blood Institute, 2003). Furthermore, the more frequently a person eats the large portion sizes served at restaurants, the more likely that person is to gain weight and become overweight or obese. Interestingly, the top five sources of calories for adults over the age of 19 are grain-based desserts, yeast breads, chicken and chicken mixed dishes, soda/energy/sports drinks, and alcoholic beverages (U.S. Department of Agriculture, 2010). Rather than eating nutrient-dense foods that could protect against chronic diseases, many Americans are filling their hunger with highly caloric foods that provide little to no nutrients.

In 2004, the American Heart Association, the American Diabetes Association, and the American Cancer Society created research-based recommendations for lowering the prevalence of heart disease, diabetes, and cancer through four specific avenues: physical activity, diet, smoking prevention and cessation, and health screenings (White and Jacques, 2007). Literature has consistently shown a link between consuming fruits, specifically plums and peaches, and the reduction of one's risk of cancer ("Pitting fruit against cancer," 2011). Several Healthy People 2020 recommendations address the need to increase fruit and vegetable consumption among American adults. Healthy People 2020 objectives recommend that people consume a 0.9 cup serving of fruit for every 1,000 calories consumed and a 1.1 cup serving of vegetables for every 1,000 calories consumed. At the same time, Healthy People 2020 objectives recommend that Americans reduce their consumption of sugar, fat, saturated fat, and sodium (Centers for Disease Control and Prevention, 2011c).

Although Americans consume many foods that are lacking in nutrition, there is also a lack of physical activity that causes many Americans to be obese.

Nutrition and physical activity interventions have proven to be effective for those making efforts to control their weight and increase their fitness levels, (Abood, Black, & Feral, 2003). Research has indicated an inverse relationship between increasing physical activity levels and disease prevention, specifically heart disease, stroke, diabetes, and certain types of cancer (Blanchard, Fisher, Sparling, Nehl, Rhodes, Courneya, 2008; Martin and Kulinna, 2004; Perez, Phillips, Cornell, Mays, & Adams, 2009). Continuously, results have shown an increase in health benefits when inactive people increase their physical activity to moderate levels (Haines, Davis, Rancour, Robinson, Ned-Wilson, & Wagner, 2007).

The Centers for Disease Control and Prevention (CDC) defines a moderate level of physical activity for adults as 150 minutes per week, in the form of 30 daily minutes of moderate-to-vigorous activity for five days a week or 75 minutes per week of vigorous activity plus two weekly strength-training sessions (Centers for Disease Control and Prevention, 2011e). Additionally, people who are trying to lose weight should increase their physical activity to 200-300 minutes per week (Atlantis et al., 2006). In order to combat obesity, people need to increase their physical activity levels. Currently 36.2% of Americans engage in no leisure-time physical activity. The aim of Healthy People 2020 Physical Activity objective number one is to decrease the number of people who participate in no leisure-time physical activity to 32.6% (Centers for Disease Control and Prevention, 2011e).

In order to reduce the ever-increasing number of people who are obese, Americans must make time for the CDC-recommended level of physical activity (Centers for Disease Control and Prevention, 2011e). Many efforts have been made to increase physical activity levels among adults in developed countries, but only a small number of adults participate in adequate levels of physical activity (Dishman, Oldenburg, O'Neal, & Shephard, 1998). Despite all the evidence that reports positive results of appropriate physical activity levels, many adults in industrialized nations continue to participate in insufficient levels of physical activity (Kwan, Bray, & Martin Ginis, 2009).

Historically, Americans have been physically active while on the job, but the shift from an agrarian society to that of the corporate setting has hindered the amount of physical activity in which many Americans participate (Brownson & Boehmer, n.d.). According to Healthy People 2020 objectives, worksite wellness programs are a critical component in combating obesity. The Surgeon General, in his *Call to Action,* cites the worksite as a conducive environment for positive health behavior changes to be made (Siegal et al., 2010). The increase of worksite weight management programs is included as a developmental objective of Healthy People 2020 (Centers for Disease Control and Prevention, 2011j). Chapman claims that the worksite is "one of the most influential settings" where health behaviors can be modified and positive health outcomes are possible (Neville et al., 2010) because the worksite is an advantageous setting for recruiting participants (Abood et al., 2003). It is estimated that Americans who are employed outside the home spend almost half of their waking hours at the worksite (Engbers, Poppel, Chin, Paw, Van Mechelen, 2005; Dishman et al., 1998).

Because over 60% of American adults are employed (Linnan, 2010), the provision of worksite health interventions can potentially reach large numbers of people to incorporate nutritional and physical activity modifications to their lifestyles (Atlantis et al., 2006). Interventions at the worksite can potentially be more effective than interventions in other community settings because of the number of hours that employees spend at the worksite (Dishman et al., 1998). Additionally, the worksite is an effective location for health interventions because of the reduced cost of interventions when compared to clinical settings (Abood et al., 2003). Challenges among coworkers and decision-prompts at the workplace can contribute to healthy behavior choices (Engbers et al., 2005). People who participate in worksite health interventions have a convenient opportunity to instill personal lifestyle changes (Chung, 2009) with the encouragement and accountability that employees experience when participating together in worksite interventions (Abood et al., 2003).

Since the 1920's and through the 1950's, health screenings, trainings, and health-related educational sessions have been offered to employees in an effort to decrease infectious diseases and to help employees with their personal problems. Although employers were providing education, there was no space, time, or change of worksite routine devoted to creating a significantly healthier employee. This communicated a lack of genuine commitment to the employees' health as well as to the establishment of a successful worksite wellness program (Gebhardt & Crump, 1990).

Since the 1960's the number of dollars spent on health care has risen dramatically. For example, the amount of money spent on Americans' health-care has increased from an average of $143 per person (5.1% of the Gross Domestic Product) to $7,018 per person (or just under 16% of the Gross Domestic Product) (Baker, 2008). The major goal of most worksite health promotion programs is to reduce the risk factors that accompany so many chronic diseases, including high blood pressure, high cholesterol, and excessive body weight, (Neville et al., 2010) and therefore reduce the amount of money spent annually on health care and insurance. The cost of health insurance continues to rise year after year (Abood et al., 2003). People who are obese and physically inactive spend more money on health care in the form of medications and doctor visits (Caperchione, Duncan, Mummery, Steele, & Schofield, 2008) and have more sick days from work than those people who are physically active and not obese (Atlantis et al., 2006). In fact, it is estimated that over 39 million days are missed per year in U.S. industries because of diseases related to obesity (Centers for Disease Control and Prevention, 2011d). As much as 35-40% of total health care expenditures made by companies are caused by sedentary and overweight or obese people (Aldana, 2007). The occurrence of obesity contributing to many chronic diseases causes a marked rise in health care costs and lost productivity in the worksite (Perez et al., 2009).

Being obese is costly for all parties involved—the individual, the employer and the government. Approximately $147 billion is spent every year on medical care costs directly related to obesity. This does not include money lost in productivity, restricted activity, and absenteeism (Centers for Disease Control and Prevention, 2011g). An average of $1,429 additional dollars is spent on health care by individuals who are overweight than by those who are of normal weight (Finkelstein, Trogdon, Cohen, & Dietz, 2009). Additionally, overweight people take more sick days and therefore have decreased productivity in the worksite. If reduced health care costs occur, they usually come in the form of reduced visits to the primary care physician, reduced absenteeism, and therefore increased productivity (Haines et al., 2007).

It is estimated that absences related to obesity have more than doubled in a 15 year span—from 7.5 days in 1993 to 17 days in 2008 (Rainone, 2010). Because obesity is considered an occupational hazard (Winick, Rothacker, & Norman, 2002), companies with worksite wellness programs have the opportunity to create safer environments with fewer accidents because of employees' increased fitness levels. Effective worksite interventions have been shown to reduce disease risk and absenteeism, while also increasing work productivity (Chung et al., 2009). A report by the U.S. Department of Health and Human Services has indicated an improvement in health and productivity, and a significant return on investment when employees have access to a worksite wellness program (Haines et al., 2007). Absenteeism and loss of productivity have been linked to those who do not participate in worksite wellness programs (Chung et al., 2009).

In addition to decreased absenteeism, research also indicates that when wellness programs are utilized, employers and employees experience increased morale and productivity. Even for people who already have a chronic disease, absenteeism can be reduced. Rates of absenteeism have been reduced between 20% and 55% during participation in wellness programs that lasted one to five years (Gebhardt & Crump, 1990). Among respondents of the 2005 National Business Group on Health survey, 56% of companies reported increased morale because of their wellness programs. Twenty percent of companies reported more productivity and less absenteeism (Corporate fitness, 2005). Effective worksite interventions have been proven to reduce disease risk and absenteeism, while also increasing work productivity (Chung et al., 2009).

Individuals and companies have typically addressed sickness and disease from a reactionary viewpoint, but many companies are trying to reduce their health care costs by shifting their viewpoint to the prevention of illness (Justice, 2010). For example, a person who smokes, is a diabetic, does not exercise, and fails to take his/her medication can cost the company $15,000 per year while a compliant diabetic will cost the company a third of that cost at $5,000 (Banham, 2010). Because companies are shifting their vision to a prevention mindset in order to save money, wellness program coordinators should target high-risk employees and encourage them to participate so that a significant difference can be made in the lives of those employees. That significant difference may come in the form of a heart attack that never occurs, the mental clarity of the employee, or in the form of a smile when handling an unhappy customer (Justice, 2010). Patrick Casinelli, an insurance broker at Cavignac and Associates, wrote that if management of risk can occur before that risk becomes a claim, then a company can be successful at lowering overall costs (Dump, 2009).

When reduced absenteeism occurs because of participation in effective wellness programs, decreased health care spending often occurs as well (Morton, 2011; Gebhardt & Crump, 1990). For example, Meredith Corporation employs approximately 3,000 employees. The company saw an 18.5% increase in health care costs from 2004-2006. In order to halt the sharp increase in company health care expenditures, Meredith integrated wellness initiatives into their company culture, including health screenings and participation in physical activity. Documentation was kept for those who participated in the initiatives. The result was not just a halt in the increase of health insurance costs. A 2% decrease occurred that equated to approximately $8-10 million in savings. Considering that the company contributed $2 million into the program, they greatly benefited from the inclusion of fitness and wellness into their company culture. The individual employees benefited as well—saving nearly $500 each year in insurance premiums (Morton, 2011).

A Fortune 100 company has also seen decreases in their health care expenditure. They have seen a trend in reduction of health care costs of approximately $500 less per year, per employee. The company's Chief Financial Officer claims that the financial return of investment is just one of the benefits of a wellness program. He claims that the wellness program cultivates more industrious and contented workers. According to their worksite survey, a 5% increase in employee engagement has been recorded and employees are giving their best to accomplish the overall mission of the company (Banham, 2010).

Employees at a biopharmaceutical company have also experienced reductions in annual health care costs. Those who participated in the wellness program and attended at least 10 wellness activities saw reductions of up to $896 compared to reductions of $293 by those who did not participate in the program. In terms of return on investment, there is a 97 cent return for every dollar spent. More important, though, is the increased employee satisfaction and engagement. The company's administration claims that the reputation their company now has for their wellness improvements more than make up for the somewhat low return on investment (Benham, 2010).

Incorporating a company wellness program indicates that the organization believes in and supports its most valuable asset—its employees (Gebhardt & Crump, 1990). It also communicates that the company is committed to helping the employees to better their health. Having a fitness facility is the best way to encourage employees to make time to include exercise in their daily lives.

Having a corporate fitness program is also a positive asset when hiring new employees and keeping current employees (Morton, 2011). Companies that conduct effective worksite wellness interventions may set themselves apart by becoming a worksite of choice, thereby attracting the most qualified employees for their business (Chung et al., 2009).

Among companies that employ 50 or more people, reports indicate that as few as two-thirds (Winick et al., 2002) and as many as nine-tenths of U.S. companies offer worksite health promotion programs to their employees (Byrd, Silliman, & Neyman Morris, 2008). Many state governments have also instituted worksite health promotion programs that promote nutritious eating and physical activity levels, in order to reduce the population of obese employees (Perez et al., 2009).

How to Build a Wellness Program

Many practitioners believe that a worksite fitness program should be a part of the larger picture of wellness. Although it can be a stand-alone program, the overall health of the employees will be benefited if corporate fitness is a piece of the larger wellness puzzle. Programs that focus on exercise, losing weight, smoking cessation, and stress management showed great improvements in employee fitness, body fat, "overall feelings of well-being, and decreases in coronary risk factors" (Gebhardt & Crump, 1990, p. 264). Other companies that have had improved overall fitness and health as a result of exercise classes include the National Aeronautics and Space Administration (NASA), Johnson & Johnson, and Xerox (Gebhardt & Crump, 1990).

Several program-planning components are present among successful worksite wellness initiatives. These components include 1) having program goals and objectives, 2) having high-quality staff members, 3) having an evaluation plan in place, and 4) successfully recruiting employees into the initiative (Gebhardt & Crump, 1990).

In order to have appropriate program goals and objectives for a university wellness program, Gebhardt and Crump (1990) recommend creating a committee derived from several different departments including psychology, exercise science, and risk management. This committee should also establish evaluation methods for the programs and activities that take place. Program goals and objectives should be achievable, measurable, quantifiable, and congruent with the company's goals (Gebhardt & Crump, 1990). In 1983, over 1,000 businesses were surveyed and fewer than 75% reported having wellness goals and objectives, and just a quarter of businesses formally evaluated their programs (*Employee Health Promotion,* 1983). Fifteen years later, results of a 1998 study by the Office of Disease Prevention and Health Promotion revealed that of all worksites that made at least one wellness activity available to its employees, only 17% had formal goals and objectives ("*WELCOA's seven benchmarks: Carefully crafting an operating plan,*" n.d.).

Although incentives might encourage initial participation in the program, it is the quality of the staff that maintains participation in wellness programs (Gebhardt & Crump, 1990). To recruit new employees and maintain participation among established employees, worksite wellness programs must have creative and motivating staff members (Fielding, 1982).

In order for any worksite wellness program to be successful, feedback and evaluation must be provided to the wellness committee (Higgins, 1986). An initial evaluation can provide much needed target information such as demographics, expected participation rates, and expected start-up costs. Ongoing evaluation will provide demographics and health care costs among participants and non-participants so that comparisons can be made between the two groups. Individual fitness testing can be helpful when evaluating the success of participants' behavior change and health status before and after a wellness initiative (Gebhardt & Crump, 1990).

Many companies evaluate and determine success of their wellness programs through rates of absenteeism, productivity, and employee satisfaction. Those companies that have a positive return on investment had participation levels ranging from 15-30% (Cox, Shepherd, & Corey, 1981; Gibbs, Mulvaney, Henes, & Reed, 1985). One of the biggest challenges to the success of a worksite wellness program is the recruiting of those participants who are at a high risk of having chronic diseases (Corporate fitness, 2005). In order to make a significant difference in the health status of employees and in the finances of the company, efforts must be made to target employees who are at a high risk of having chronic diseases and recruit those employees to participate in wellness initiatives (Gebhardt & Crump, 1990). Generally, only 25% of employees participate in worksite wellness programs (Corporate fitness, 2005).

Other components of wellness programs address the encouragement of the other 75% of the population to participate in the wellness initiatives. Worksite wellness initiatives should be fun, simple, and inclusive, and they should provide for accountability and incentives. Because participation in many wellness programs is voluntary, initiatives should be fun (Busbin and Campbell, 1990). One of the major contributing factors to sticking with physical activity is the fun factor (Vansickle, Hancher-Rauch, & Hicks, 2010).

Time is one of the biggest barriers to participating in worksite wellness program (Fletcher, Barrens, & Domina, 2008; Haines et al., 2007). Wellness program initiatives should not be so labor-intensive (participation or record-keeping) that participants are discouraged from taking part (Vansickle et al., 2010). Wellness coordinators should try to create initiatives that do not require excessive amounts of time. Maintaining similar record-keeping methods during all wellness initiatives will contribute to high levels of participation.

Another component that will encourage employees to participate in wellness initiatives is for the program to be inclusive. If a program is designed for only the fit population, it is not as likely to be successful (Vansickle et al., 2010). If reducing absenteeism and increasing employee productivity, satisfaction and engagement really are the goals, having a program geared only for the fit population will exclude the very people who need the wellness program the most. Initiatives can be designed and implemented that will encourage people of all fitness levels to participate. Additionally, each participant should have at least one wellness component that they can improve. Providing different activities is critical when trying to involve as many people as possible (Chapman, Whitehead, & Connors, 2008).

A fourth component that encourages participation in worksite wellness initiatives is for there to be a sense of accountability. An exercise log is one tool that has been used to create accountability during physical activity interventions (Rooney, Smalley, Larson, & Havens, 2003). Pedometers have also been used to provide immediate feedback to participants, indicating their number of steps walked in a given time (Vansickle et al., 2010). Results from a meta-analysis by Kang and colleagues (2009) indicate moderate and positive effects of feedback provided during pedometer-based physical activity interventions on people's physical activity behaviors (Kang, Marshall, Barreira, & Lee, 2009). Providing competitions that promote teamwork through the creation of partnerships and teams has also been shown to provide accountability and can encourage other coworkers to participate (Fletcher et al., 2008). Additionally, when an employee succeeds in a particular wellness initiative, his/her peers generally are aware of the success that encourages participation and improvement in the other employees as well (Wellness watch, 2006).

A final component that is critical for including as many participants as possible is the provision of incentives. Incentives are used to encourage initial participation as well as decrease attrition rates (Demoranville, Schoenbachler, & Przytulski, 1998). Choosing incentives that motivate participants is critical. Some incentives include cash, gift certificates from local restaurants and sporting goods stores and time off from work (Vansickle et al., 2010). The more the wellness coordinator knows his/her participants, the more strategic he/she can be in providing incentives that motivate employees to begin and continue to participate in the wellness initiatives.

Many companies offer a variety of wellness programs. According to a 2008 survey by the National Business Group on Health, many large companies offer annual health surveys, weight management programs, health coaching, and onsite health centers to their employees (Marshall, 2008). Other examples include onsite gym memberships, knowledge-based seminars, fitness classes, smoking cessation classes, and weight management seminars. Other companies offer low-cost or no-cost health screenings, cancer screenings, and immunizations at the worksite (Banham, 2010). Some companies employ nutrition and fitness professionals to provide one-on-one counseling for their employees (Marshall, 2008).

An accounting firm runs an incentive-based wellness program similar to a mileage club. For every activity that employees participate in (screenings, seminars, health risk assessments, attending the fitness center, etc.) they receive points toward the redemption of cash and prizes (Banham, 2010).

Wellness programs are just as beneficial for small companies as they are for large companies. Small businesses can get better participation rates and generally do not have to go to great lengths to provide quality programs. Small businesses should be encouraged to do what they can as well as they can and not to make things overly complicated. A program should be created that can be sustained over the long term (Wellness Watch, 2006).

The purpose of this investigation is to examine the effects of participation in a physical activity and nutrition program called the Fit 49 Challenge. What effect does participation in a physical activity and nutrition experimental intervention have on the physical activity and nutrition of university employees? More specifically, the results of this investigation address four outcomes:

Physical Activity Research Question #1: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, what effect does participation in the Fit 49 Challenge have on physical activity intention at post-test?

Physical Activity Research Question #2: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant takes 10,000 steps during the five-week Challenge?

Fruit and Vegetable Consumption Research Question #3: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and nutrition intention at pre-test, what effect does participation in the Fit 49 Challenge have on nutrition intention at post-test?

Fruit and Vegetable Consumption Research Question #4: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant consumes five or more fruits and vegetables during the five-week Challenge?

Physical Activity Hypothesis #1: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, a person who participates in the Fit 49 Challenge will have higher physical activity intention at post-test than will a person who does not participate in the Fit 49 Challenge.

Physical Activity Hypothesis #2: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, a person who participates in the Fit 49 Challenge will complete more 10,000-step days than will a person who does not participate in the Fit 49 Challenge.

Fruit and Vegetable Consumption Hypothesis #3: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and nutrition intention at pre-test a person who participates in the Fit 49 Challenge will have higher nutrition intention at post-test than will a person who does not participate in the Fit 49 Challenge.

Fruit and Vegetable Consumption Hypothesis #4: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, a person who participates in the Fit 49 Challenge will complete more days of five or more fruits and vegetables consumption than will a person who does not participate in the Fit 49 Challenge.

This experimental intervention took place from the latter part of January to the end of March. Out of 49 possible days for participants to partake in physical activity, 27 days were deemed appropriate. Weather was deemed appropriate if the temperature was 40 degrees or higher and if it rained, it was less than two-tenths of an inch. If the temperature was lower than 40 degrees or it rained two-tenths of an inch or more, the weather was deemed inappropriate for physical activity. Additionally, some types of fruits and vegetables were not easily accessible because of the season in which the Fit 49 Challenge took place.

The following definitions are provided to clarify employee classification and the three different types of group assignment.

Employee classification: Self-defined by each participant as either a faculty or staff member.

Treatment group: Volunteer participants who received the Fit 49 Challenge to walk 10,000 steps per day and consume five or more fruits and vegetables per day, five days per week for five weeks.

Wait-list control group: Volunteer participants who were not challenged to walk 10,000 steps per day and consume five or more fruits and vegetables per day, five days per week for five weeks, but were instructed to continue their normal physical activity and nutrition consumption routines.

Population control group: Participants who were randomly selected from the overall employee base and not challenged to walk 10,000 steps per day and consume five or more fruits and vegetables per day, five days per week for five weeks, but were instructed to continue their normal physical activity and nutrition consumption routines.

CHAPTER II:

LITERATURE REVIEW

The literature seems to indicate an absence of theory in worksite nutrition and physical activity interventions. Of those interventions that are theory-based, few take place in university employee settings. Currently, researchers are attempting to create more interventions that have a theoretical foundation (Abood et al., 2003). Interventions that are theory-based are more effective than are those that lack a theoretical foundation (Maruyama, Kimura, Okumura, Hayashi, & Arao, 2010). Physical activity interventions that incorporate health behavior theories aid researchers in understanding health behaviors (Dishman and Buckworth, 2002) and therefore will allow practitioners to conduct more effective interventions in the future (Tavares, Plotnikoff, & Loucaides, 2009).

Researchers have identified the Theory of Planned Behavior as the most promising theory for effective behavior change related to the prevention of weight gain (Daddario, 2007). The Theory of Planned Behavior (TPB) is a modification of the Theory of Reasoned Action (TRA). The TRA model includes the constructs of attitude, subjective norms, and behavioral intention (Figure 1). The success of the TRA in explaining behavior is dependent on the degree of control the participant has during the time behavior change takes place. This insufficiency of explanation led to the addition of perceived behavioral control by Ajzen and Driver and became the TPB (Glanz, Rimer, & Viswanath, 2008).

Over the years, the TPB has been used for interventions in a variety of health behaviors including fruit and vegetable consumption and physical activity (Kwan et al., 2009). Kwan (2009) identifies the TPB "as one of the best-validated models for understanding why people exercise" and its ability to predict one's physical activity habits (p. 46). The TPB has consistently explained approximately 43% of the variation in intentions and 33% of the variation in behavior. It is imperative that the constructs of TPB actually predict behavior change so that practitioners can tailor interventions for a variety of populations (Blanchard et al., 2008) and actually create behavior change. Furthermore, it is also important that researchers are able to study the process of adopting and maintaining the intended behavior change (Caperchione et al., 2008) and determining the role each construct plays in the process of behavior change.

As shown in Figure 2, the four constructs of the Theory of Planned Behavior are attitude, intention, subjective norms, and perceived behavioral control (Blanchard et al., 2008). Each of the constructs of the TPB is an internal variable, although the modification of the behavior itself has an external outcome (Francis, Eccles, Johnston, Walker, Grimshaw, Foy, Kaner, Smith, & Bonetti, 2004). For example, a participant's intention (internal variable) modifies the behavior of a participant's frequency of physical activity (external outcome).

The attitude one has concerning the potentially modified behavior is a component included in both the Theory of Reasoned Action and the Theory of Planned Behavior. Attitudes are defined as beliefs and evaluations of results that occur if a behavior is modified (Glanz et al., 2008). In other words, it is a weighing of the positive and negative potential conclusions of the adopted behavioral change and the potential outcomes if the change is made (Francis et al., 2004). An example of an assessment question regarding affective attitude would be: "For me, taking 10,000 steps per day (at least five days per week) would a) be extremely satisfying, b) be somewhat satisfying, c) neutral, d) be somewhat unsatisfying, or e) be extremely unsatisfying." An additional question that also measures a person's attitude toward adopting more physical activity would be: "For me, taking 10,000 steps per day (at least five days per week) would a) be great for my health, b) be good for my health, c) have no impact on my health, d) be bad for my health, or e) be very bad for my health." A third assessment item that has been modified for use in the Theory of Planned Behavior survey in the Fit 49 Challenge and addresses the effort required on the part of the participant would be: "For me, taking 10,000 steps per day (at least five days per week) would a) be an excellent use of effort, b) be a good use of effort, c) be neither a good nor a bad use of effort, d) be a poor use of effort, or e) be a complete waste of effort."

A second construct included in the Theory of Planned Behavior is subjective norms. These are defined as normative beliefs combined with motivation to comply in making behavioral changes (Glanz et al., 2008). According to the National Institutes of Health, subjective norms are influenced by the views of the proposed behavioral change held by key people in the life of the person who is making the behavioral change or the extent to which important people in a person's life encourage or discourage the proposed behavioral change. Generally people want to gain the approval of the key people in their life, and this desire for approval can influence their behavioral change positively and negatively (Rimer, and Glanz, 2005). Subjective norms are also influenced by the value of the intended change as positive or negative; this judgment is made by the person altering his/her behavior (Francis et al., 2004). People are more likely to participate in a given behavior if friends and family members view that behavior positively and if they believe that people around them think they should participate in that behavior (Kwan et al., 2009). An example of an assessment item that has been modified for use in the Theory of Planned Behavior survey in the Fit 49 Challenge regarding subjective norms would be: "People who are important to me think my taking of 10,000 steps per day (at least five days per week) is a) something I should do regularly, b) something I should do occasionally, c) have no opinion, d) something I should do rarely, or e) something I should never do." A similar question also assessing one's subjective norms is "People who are important to me think my taking of 10,000 steps per day (at least five days per week) is a) very important, b) somewhat important, c) neither important nor unimportant, d) somewhat unimportant, or e) very unimportant."

Perceived behavioral control is defined as the belief in one's ability and perceived degree of control to overcome barriers in order to achieve the desired behavioral outcome (Kwan et al., 2009). The belief in one's ability to overcome barriers may include situational and internal factors (Francis et al., 2004). The presence or absence of one's perceived control will determine the success that a person has when making behavioral changes, specifically when incorporating physical activity in one's life or increasing current physical activity levels (Rimer & Glanz, 2005). An example of an assessment item that has been modified for use in the Theory of Planned Behavior survey in the Fit 49 Challenge regarding perceived behavioral control would be: "For me, taking 10,000 steps per day (at least five days per week) is a) totally in my control, b) somewhat in my control, c) have no opinion, d) rarely in my control, or e) never in my control." A similar item that also assesses perceived behavioral control is "For me, taking 10,000 steps per day (at least five days per week) is a) extremely easy, b) somewhat easy, c) neither easy nor difficult, d) somewhat difficult, or e) extremely difficult."

The most important component of TRA and TPB is behavioral intention, which is determined by a person's attitudes, subjective norms, and perceived behavioral control (Glanz et al., 2008). Kwan and colleagues define intention as one's motivation to perform a specific behavior (2009). An example of an assessment item measuring intention is "For me, taking 10,000 steps per day (at least five days per week) is a) a high priority, b) something I intend to do, c) no opinion, d) something I do not intend to do, or e) something I will absolutely not do." A similar assessment item asks "On how many days of the next week do you intend to take 10,000 steps?" Each of the example assessment items were modified based upon the guidelines of Francis and colleagues (2004) in their manual for creating questionnaires based on the Theory of Planned Behavior (Francis et al., 2004).

Worksite Literature Review

A recent meta-analysis written by Scott and colleagues identifies the Theory of Planned Behavior as better than the Theory of Reasoned Actions when predicting physical activity intentions and actions (2007). Although both the Theory of Planned Behavior and the Theory of Reasoned Action have been used to address many health behaviors, few studies actually attempt to predict specific physical activity behaviors, such as taking 10,000 steps per day. Additionally, the outcome measures of most physical activity studies fail to provide accurate information because people tend to overestimate their physical activity levels and generally a single item is measured. The use of a single item as an outcome measure often limits the use of the Theory of Planned Behavior when predicting behavior modifications. When self-reported estimates are used, the Physical Activity Recall (PAR) interview is often the best outcome measurement tool. In the PAR, a person works backwards for a seven day memory of all physical activity, prompted at times by an interviewer. The PAR sometimes reports less accurately for low intensity activity. This causes researchers to question its usage in a walking program (Scott, Eves, French, & Hoppe, 2007).

In one study, four self-reported physical activity measures were compared to one objective measure, a pedometer. Researchers hypothesized that interview prompted outcome measures would be significantly closer to the pedometer measure than the physical activity recall questionnaires. Pedometers were sealed shut so that participants could not see counts and therefore could not deviate from their regular routines. Participants wore pedometers for one week and kept a diary of all their physical activity. Intention to walk regularly was measured by two items: plan and intend. These options were available on a seven point Likert scale anchored by "definitely do" on one end of the continuum and "definitely do not do" on the other end of the continuum. Two items were provided for perceived behavioral control: "confident" and "sure" of completing the specified physical activity. Interviews proved to be more highly correlated with pedometer step counts than were physical activity questionnaires and diaries of physical activity. The Theory of Planned Behavior constructs explained 21.7% of variation for intention to walk and perceived behavioral control resulted as the only unique contributor. When past behavior was added, 50% of variation was explained (Scott et al., 2007).

The methods of a second study were similar to that of the previously mentioned study, except for the duration. For two weeks, 200 Air Force craftsmen followed their regular routine. Because their military-related duties were so consistent, their past and future physical activity behaviors were used as predictors for the two-week time period. Instead of completing two similar questionnaires, the Air Force craftsmen answered a single-item questionnaire and participated in one Physical Activity Recall interview with additional questions asking participants to identify any active transport, walking or biking, that they had failed to include. Though the step counts and self-reported walking had no association, the use of past behavior added a significant increase in explained variance. In models only using traditional TPB constructs, intention and perceived behavioral control are significant predictors. Because so much of walking is not necessarily for exercise, people tend to underreport how much they walk. Additionally, people tend to report what they plan and the Theory of Planned Behavior is used for predicting planned behavior. Throughout both studies, intention was most strongly predicted by attitude, but perceived behavioral control also made a significant contribution. Subjective norms did little to explain the variation (Scott et al., 2007).

The purpose of one study by Abood and colleagues was to increase participants' knowledge of nutrition and to decrease both their cardiovascular disease and their cancer risk factors through nutritious food consumption, using the Health Belief Model (2003). Participants were self-selected staff employees at a southern university who were given release time by their deans to participate in the nutritional intervention. Control participants were randomly chosen from the overall university employee population. All participants took a knowledge-based pre-test to determine baseline knowledge of nutrition and cardiovascular and cancer risks (Abood et al., 2003).

Educational sessions for those in the treatment group lasted eight weeks and consisted of nutritional counseling for one hour each week. The nutrition presentations were tailored for the treatment population based on their prior knowledge, dietary behaviors, and Health Belief Model constructs. All information presented in the nutritional counseling sessions was based on the recommendations made by the United States Department of Agriculture and the United States Department of Health and Human Services' National Cholesterol Program Guidelines. Information was presented using paper-based and computer materials as well as question and answer discussion periods. Participants in the control group completed only the pre-test and post-test nutrition and disease risk assessment (Abood et al., 2003).

Following the nutritional counseling, participants' perceived benefits of incorporating positive dietary behaviors into their lives increased significantly. Based upon the increase of perceived benefits, it could be expected that the participants' perceived barriers would decrease significantly, but this was not the case. Though the perceived barriers of the treatment participants did not decrease significantly, their positive dietary behaviors did increase significantly. Treatment participants increased their knowledge of nutrition, knowledge of cardiovascular and cancer risk based on nutrition and fiber intake more than those participants in the control group. They decreased their consumption of overall calories, fat, saturated fat, and cholesterol more than those participants in the control group (Abood et al., 2003).

Similarly, Touger-Decker and colleagues created a weight management intervention for employees that addressed nutrition, physical activity, and chronic disease risk in order to decrease participants' risk factors associated with chronic disease (2008). During the 12-week intervention, participants attended weekly educational presentations and were weighed. Biometric data was taken from all participants at baseline and at weeks 6 and 12. The topics that were chosen to be discussed at the weekly presentations were chosen by the participants and addressed portion control, restaurant eating, and stress eating. Additionally, participants met individually with a dietician three different times to discuss weight management specific to their situation and needs. They were also instructed to use employer-provided pedometers to log their daily steps and to report those step counts weekly. Participants were given the opportunity to earn incentives when they achieved specific benchmarks (Touger-Decker, O'Sullivan-Maillet, & Byham-Gray, 2008).

As a result of participation, individuals consumed more fruits and vegetables, fewer candy bars, and more moderate portion sizes. Following the intervention, significant reductions were found in all outcomes, including weight, waist circumference, hip circumference, Body Mass Index (BMI), percent body fat, cholesterol, and glucose. Those who were overweight and obese lost weight, and the number of group sessions was not found to be associated with an individual's weight loss. Of those participants who intended to lose weight, 12.1% changed BMI classification, from obese at pre-test measurement to overweight at post-test measurement. Participants who lost more weight had better outcomes. By reducing body weight, waist circumference, total cholesterol, and systolic and diastolic blood pressure, one reduces many of the risk factors that accompany cardiovascular disease, diabetes, and cancer. Participants perceived the program as an employee benefit (Touger-Decker et al., 2008). Limitations included not having a control group and having a small sample size (122 completed the program). Additionally, participants were volunteers and 89.7% of them were females. Although the intervention was short, the significant results of the intervention indicate that a 12-week worksite-based weight management program is feasible and productive (Touger-Decker et al., 2008).

A 20-week intervention at the Marshfield Clinic in western Wisconsin aimed at increasing participants' physical activity levels, decreasing the number of people who were overweight and obese, and helping all participants in sustaining a healthy body weight. Participants were recruited through email and announcements in the weekly employee newsletter. Before being able to participate in the intervention, participants completed a pre-program survey that was modeled after the American Cancer Society Active for Life program and the Healthy People 2010 objectives. All information received from the participants was self-reported including blood pressure, BMI, motivation for participation, and current physical activity levels. Participants could use the National Heart, Lung, and Blood Institute BMI calculator to assist in calculating BMI or the Stages of

Change Theory physical activity identification tool to help them more accurately measure their BMI and physical activity levels. Another pre-test measure was cardiovascular endurance, in which participants were allowed to self-measure using the Rockport Fitness Walking Test (Chyou, Scheur, and Linneman, 2006). Following all pre-test measurements, participants were then able to choose between a specified walking program and an alternate exercise goal program. Although all employees were invited to participate, only 32 males responded compared to 724 women; therefore, the analysis for this program only applies to the female population. Findings of the Marshfield Clinic study are similar to those of many studies addressing physical activity. Participants significantly improved their activity levels and significantly decreased their BMI following the twenty-week intervention (Chyou et al., 2006).

In a study conducted by Pratt and colleagues, too many high calorie, inexpensive food items were too readily available to employees. Additionally, lower energy outputs were required for their job-related duties. Several chronic diseases were probable for many of the employees including type 2 diabetes, heart disease, sleep apnea, orthopedic problems, and certain types of cancer because of their low activity levels and over consumption of food. The risk of these chronic diseases greatly increased the probability of higher health care costs for themselves as well as their employers (Pratt et al., 2006).

It was determined that in order to reach a majority of the employees, a virtual program was needed. The program was called 5-10-25 and consisted of participants challenged to walk 10,000 steps per day during a four-year period. Smaller-scale team competitions were conducted for employees three times per year. Additionally, they were sent motivational articles to encourage their physical activity. A nutrition component was included to increase participants' fruit and vegetable consumption to five or more servings per day. The third component consisted of efforts to keep participants' Body Mass Index (BMI) levels at 25 and below. Monthly logs were used to keep records of their steps, fruit and vegetable consumption, and BMI levels. Rewards were given for those who kept their BMI below 25 (Pratt et al., 2006).

The program was greatly marketed and had a 45% participation rate over a period of four years. Over 2,498 participants took part in the 5-10-25 program during that time. Results indicated a beneficial relationship between exercise frequency, fitness levels, and job performance. Results also indicated a statistically significant increase in exercise and fruit and vegetable consumption. A small but statistically significant negative correlation was shown between fruit and vegetable consumption and weight, indicating that participants lost weight when they consumed more fruits and vegetables. A similar correlation was found between exercise and weight. It was also shown that a higher rate of engagement was found when specific support material was provided (Pratt et al., 2006).

One limitation in Pratt's study was the inclusion of participants who were interested in increasing their overall health and the exclusion of control participants. There was no randomization in determining which participants received the treatment. A final limitation was the use of self-reported BMI, steps taken, and fruits and vegetables consumed (Pratt et al., 2006).

Evidence of past research has shown that people who are obese and participate in low physical activity levels are absent from the worksite more often than are those who are not obese and those who participate in high levels of physical activity. Researchers hypothesized that casino employees' participation in 150 minutes of aerobic physical activity (including weight lifting) and dietary education would lead to improvements in participants' waist circumference, Body Mass Index (BMI), weight, and VO2 max over the course of a 24-week program. Participants were stratified, and then randomized into treatment group or wait-list control group (Atlantis et al., 2006).

During the intervention, treatment group participants were encouraged to reduce their consumption of energy-dense non-nutrients, but the controls were given no education or advice concerning their nutrition. They were neither encouraged to increase their fruits, vegetables, and physical activity, nor were they discouraged from reducing their consumption of energy-dense non-nutrients. Reward points and prizes were given as incentives for reaching specified program milestones. Results indicated that when participants spent more time in aerobic physical activity, they had greater reductions in waist circumference than those who spent less time in aerobic physical activity.

Results also indicated greatly improved fitness levels and are similar to those of other studies (Atlantis et al., 2006).

High attrition rates and non-blind randomization were just two of the limitations of this study. Only 6.4% of the entire casino employee base expressed interest in participation and therefore may be a difficult population to treat. Additionally, post-measurement outcome measurements were not specific enough to distinguish statistically significant changes in dietary or physical activity levels (Atlantis et al., 2006).

Haines and colleagues conducted a pilot study that required university-employed participants to log their walking behavior with a pedometer. Each participant had an individual program based on their initial physical activity level. Participants were directed to increase their initial physical activity by 10% each week until they reached 10,000 steps. Throughout the 12-week intervention, the 125 participants were provided access to 10 virtual seminars. Topics presented included nutrition, physical activity, and other wellness-related topics and tips. Two weeks prior to the end of the program, an email was sent to remind participants of their post-test biometric measurements. At the end of the program participants completed the biometric testing, completed a post-test survey, and turned in their logs of their daily steps. After four reminder phone calls and emails, 60 participants were deemed dropouts because they failed to complete the post-test biometric measurements. The other 60 participants were deemed graduates of the program because they completed all aspects of the program (Haines et al., 2007).

Over the course of participation, the mean number of steps increased by 27% and the number of participants who completed the program with a normal BMI increased by 4.8%. Although not considered statistically significant, the number of participants who had hypertension, high cholesterol, or high blood glucose decreased. Unintended but positive results of participation included weight loss, diet improvements, and overall health awareness. The high number of drop-outs and the high number of women who participated in the walking program is not uncommon for these types of studies (Haines et al., 2007).

The internet was used during a worksite wellness program at a German automobile plant. The program was only available to those employees who were overweight or obese, participated in low levels of physical activity, and had two or more metabolic risk factors. Metabolic risk factors were indicated by information on a health survey conducted by the company. Participants were randomized into control and treatment groups for a 12-week program that consisted of education sessions and either a structured (treatment) or a non-structured (control) exercise plan. Both plans were delivered through the internet and participants were blinded to group assignment (Pressler, Knebel, Esch, Kolbl, Esefeld, Scherr, & Leimeister, 2010).

All participants recorded their resting heart rate once per week and were given heart rate monitors with a manual to use during their exercise sessions.

The treatment group was instructed to participate in four exercise sessions per week, including one weight-training session and three cardiovascular sessions that increased from 30 to 70 minutes per session. Participants in the treatment group were also provided with a weekly goal (Pressler et al., 2010).

Following randomization of the treatment and control groups, initial significant differences were not found in the groups. Results of participation in the program pointed to significant improvements in weight-adjusted performance at the anaerobic lactate threshold, peak oxygen uptake, reduction of heart rate during exercise, waist circumference, Body Mass Index, body fat, glucose, and diastolic blood pressure for the treatment group. For the control group, improvements were made in peak ergometer performance, waist circumference, Body Mass Index, body fat, glucose, and diastolic blood pressure. The conclusion was made that internet-delivered exercise plans can lead to significant improvements in reducing metabolic risks among the overweight and obese population, but few significant differences were found between the control group and the treatment group. This may be a result of high attrition rates and low participation. Results were found to be similar to those of previous studies (Pressler et al., 2010).

With over 6 million school employees in the United States, the school is an appropriate environment to address behavior change. Wellness program participation also reduces absenteeism and employee turnover. This helps schools run more efficiently. Additionally, faculty/staff wellness is one of the eight components included in the Coordinated School Health program. Researchers assumed that teachers who participate in a wellness program are more likely to incorporate health into their lesson plans than other teachers who do not participate in a wellness program. Social Cognitive Theory (SCT) was used as a theoretical foundation. SCT attempts to address behavior change through the constructs of the person, the environment, and interaction of the person and the environment. Self efficacy is an important construct that is often used with the SCT. In relation to environmental factors, perceived barriers and perceived social norms are important constructs (Siegel et al., 2010).

The purpose of the wellness program was to focus on creating an environment that would build camaraderie and foster support for fellow employees. It was hypothesized that employees at the treatment school would lose more weight than employees at the control school and that teachers at the treatment school would be more likely to change diet and physical activity behaviors than employees at the control school. The intervention allowed schools to create their own wellness committees and initiate their chosen wellness activities for three years. Pre- and post-anthropometric measures were taken as outcome measures. These measures included Body Mass Index (BMI), waist-to-hip ratio, minutes of physical activity, and fruit and vegetable consumption (Siegel et al., 2010).

The intervention resulted in significant changes in BMI, but not waist-hip, minutes of physical activity, or fruit and vegetable consumption. The results revealed that employees at the treatment school did lose more weight than employees at the control school, but that teachers at the treatment school were not more likely to change their diet and physical activity behaviors than employees at the control school. A possible limitation to this study was that many participants viewed participation in the program as a burden. Poor communication between committee members and principals detailing the wellness activities also was a limitation to full participation (Siegel et al., 2010).

Cardiovascular disease is one of the most frequent causes of death in the United States and Canada. It is also one of the costliest chronic diseases. Most people who have cardiovascular disease are of working age. Participation in a worksite wellness program can promote lifestyle changes and reduce cardiovascular disease risks. If lifestyle changes do occur and cardiovascular disease risks are reduced, potential results include increased productivity and decreased absenteeism. Colleagues worked to create a program called "Tune Up Your Heart." The purpose of the study was to evaluate the effects of participation in the program directly related to health and economic outcomes (Chung et al., 2009).

Screenings were conducted and employees were categorized into three different groups: low, moderate, and high risk for cardiovascular disease. Only those people identified as having an above average risk for cardiovascular disease were invited to participate in the "Tune Up Your Heart" program. The program included education and an individual meeting with a nurse to set goals to decrease risks associated with cardiovascular disease. Participants also had to attend progress meetings and a medical review meeting (Chung et al., 2009).

Behavioral outcomes included observed changes in cardiovascular risk factors and modification of behaviors related to those risk factors. Economic outcomes included the reduction of group life insurance costs, absenteeism, short-term and long-term disability, and drug claims costs. In the end, a 12.7% relative risk reduction was found in participants including decreased systolic and diastolic blood pressure, decreased triglycerides, decreased Body Mass Index, and decreased weight. The number of participants who smoked decreased by 14% after being involved with the "Tune Up Your Heart" program. An increase occurred in physical activity levels and consumption of healthy nutrition. Participants even moved into different risk classes. Over $793 was saved per participant, mostly from drug costs (73%). Projected savings of the entire employee base after one year was $18,000 and up to $330,000 after ten years. These projections were made based on participants' change in risk classification that occurred during the program (Chung et al., 2009).

Because interventions in the worksite are less expensive than those carried out in clinical settings, and because a person's dietary choices contribute to four of the top ten causes of death, researchers at a mid-sized regional university created a three-month program. In this program, participants logged their daily food intake and daily exercise. Participants in the program were encouraged to consume five or more fruits and vegetables per day and were allowed to choose one of four exercise plans that required them to exercise 30 minutes per day, six days per week. Participants also had to attend a minimum of four educational sessions on the topics of stress, diet, and exercise throughout the intervention. They were given meal plans, recipes, and individualized exercise plans (White et al., 2007).

Significant differences were found in pre- and post-measures of cholesterol, low-density lipoproteins (LDL), high-density lipoproteins (HDL), triglycerides, and weight. The mean for total cholesterol drop was 23 points—from 202 to 179. At the beginning of the program 36.7% of participants had a cholesterol level less than 200. By the end of the program, 72% of participants had a cholesterol level less than 200. Evidence revealed no significant decrease in blood pressure or blood glucose, but only a few participants with high blood pressure participated. Participants believed the program to be valuable and they encouraged researchers to continue it (White et al., 2007).

In summary, the purpose of this investigation is to examine the effects of participation in a physical activity and nutrition challenge program called the Fit 49 Challenge. The investigation focuses on four specific outcomes: physical activity intention at post-test, number of days participants take 10,000 steps, nutrition intention, and number of days participants consume five or more fruits and vegetables.

CHAPTER III:

METHODS

The purpose of this chapter is to explain the methods used to analyze the effects of participation in a physical activity and nutrition program called the Fit 49 Challenge on physical activity levels and consumption of fruits and vegetables. What effect does participation in a physical activity and nutrition experimental intervention have on the physical activity and nutrition of university employees? More specifically, the results of this investigation address four specific outcomes:

Physical Activity Research Question #1: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, what effect does participation in the Fit 49 Challenge have on physical activity intention at post-test?

Physical Activity Research Question #2: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant takes 10,000 steps during the five-week Challenge?

Fruit and Vegetable Consumption Research Question #3: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and nutrition intention at pre-test, what effect does participation in the Fit 49 Challenge have on nutrition intention at post-test?

Fruit and Vegetable Consumption Research Question #4: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant consumes five or more fruits and vegetables during the five-week Challenge?

What is FIT 49?

To encourage university faculty and staff members, whose jobs are mostly sedentary, to increase their physical activity and consumption of fruits and vegetables, a five-week experiment was created called the Fit 49 Challenge. The Fit 49 Challenge consisted of a two-pronged challenge: 1) to walk 10,000 steps per day, five days per week over the course of a specified five-week period and 2) to consume a combination of five or more fruits and vegetables per day, five days per week for that same five weeks (January 29-March 3). A pre-test week began one week before the Fit 49 Challenge (January 22-28) and a post-test was given one week following the Challenge (March 4-10). The Fit 49 Challenge was given this name because it lasted for 49 days, including the pre- and post-test days.

The Fit 49 Challenge was loosely based on several interventions previously conducted by other researchers at universities and hospitals, specifically a program called 5-10-25 by Pratt and colleagues (2006). The purpose of Pratt's program was to challenge participants to walk 10,000 steps per day and consume five or more fruits and vegetables per day over the course of a four-year period. A major difference from other interventions is that the Fit 49 intervention is based on a specific period of time. A second major difference is the distinction between the targeted population for the Fit 49 Challenge and those targeted in past studies. The target audience of the 5-10-25 program was employees at multiple worksites in a singular, global workforce. The target audience of the Fit 49 Challenge was university faculty and staff, who all work on the same campus and whose work-related duties are mostly sedentary.

According to results of a study by Church, Thomas, Tudor-Locke, Katzmarzyk, and Earnest (2011), service occupations (including the education profession) are classified as sedentary and require light-intensity workloads. People who work in those industries typically complete their tasks while sitting or participating in light physical activity the majority of their day. Other research also indicates that many university employees spend much time sitting, an activity associated with being overweight and obese. The time an employee spends sitting during the day averages approximately five to seven hours per day, among those who are employed in Australian, English, and Spanish university settings. Furthermore, university employees are an appropriate population with which to work because of the tightly-knit community in which they are a part. Many universities are the largest employers of their city and employ people from a variety of diverse backgrounds who assume many different job-related duties (Gilson, Brown, Faulkner, McKenna, Murphy, Pringle, Proper, Puig-Ribera, & Stathi, 2009).

The challenge of 10,000 steps per day was chosen because of research results by Tudor-Locke and Bassett (2004). They conducted a study to determine the translation of the recommended number of minutes of physical activity to an equivalent number of steps that people should take throughout the day. The purpose of their study was to dispel a myth that had originated in Japan in the 1960's. Although the myth may not have been founded on scientific principles, it was correct in recommending 10,000 steps as a guideline for living an active life (Tudor-Locke & Bassett, 2004).

When establishing recommendations for steps per day, the purpose of those recommendations (screening, intervention, or program evaluation) must be taken into consideration (Tudor-Locke, Hatano, Pangrazi, & Kang, 2008). In years past, cut-off points and recommendations for different populations have been based on norms for particular age groups. Because past recommendations have been norm-based, factors such as geography, climate, and season may inadvertently affect these norms. Criterion-referenced recommendations have been successful in other programs (FITNESSGRAM) when establishing health-enhancing behaviors. In follow-up studies, Tudor-Locke and colleagues (2008) recommended using specific categories for a hierarchical order of classes for step recommendations (Tudor-Locke et al., 2008). The following recommendations for healthy adults resulted from their previous study: fewer than 5,000 steps equate to a sedentary lifestyle; 5,000-7,499 steps equate to a low-active lifestyle; 7,500-9,999 equate to a somewhat active lifestyle; $\geq$ 10,000 equate to an active lifestyle; and 12,500 steps or more equate to a highly active lifestyle. Different recommendations exist for older adults, adults with chronic diseases and disabilities, children, and other special populations (Tudor-Locke & Bassett, 2004).

The challenge of five or more fruits and vegetables per day was determined based on the recommendation by the United States Department of Agriculture (USDA). The USDA science-based recommendations call for 5-13 servings (or 2 ½- 6 ½ cups) of fruits and vegetables to be consumed per day. A decreased risk of stroke and other cardiovascular related diseases is associated with the consumption of the aforementioned amount. Furthermore, increased fruit and vegetable consumption has been associated with decreased risk for certain types of cancer and type two diabetes. Increasing fruits and vegetables into a person's diet has been shown to be a helpful component in weight maintenance and weight loss. Similar research studies have also used the USDA-recommended challenge of five or more fruits and vegetables per day (Altman, 2008).

The United States Department of Agriculture defines a serving of fruit as one half cup of dried fruit, one cup of 100% fruit juice, or one cup of fruit that is fresh, canned, or frozen. In general, one cup of vegetables or vegetable juice, or two cups of raw leafy greens, can be considered as one serving of vegetables. A serving of vegetables includes 100% vegetable juice, or one cup of raw, cooked, fresh, frozen, canned, or dried/dehydrated vegetables.

Study Purpose

This collection of data served several purposes related to physical activity and nutrition consumption. The overall purpose of this study was to perform an intervention for faculty and staff members of a local university in order to increase the physical activity and fruit and vegetable consumption of those participants. The first purpose related to physical activity was to determine the effect of participation in the Fit 49 Challenge on intention to take 10,000 steps per day measured at post-test. Age, sex, employee classification, intention to walk 10,000 steps per day at pre-test, perceived behavioral control, attitudes, and subjective norms were control variables. The second purpose related to physical activity was to determine the effect of participation in the Fit 49 Challenge on the number of days the participant took 10,000 steps. Age, sex, employee classification, intention to walk 10,000 steps per day at pre-test, intention to walk 10,000 steps per day at post-test, number of days participants consumed five or more fruits and vegetables, perceived behavioral control, attitudes, and subjective norms were control variables.

The first purpose related to fruit and vegetable consumption was to determine the effect of participation in the Fit 49 Challenge on intention to consume five or more fruits and vegetables per day measured at post-test. Age, sex, employee classification, intention to consume five or more fruits and vegetables per day at pre-test, number of days 10,000 steps were walked, perceived behavioral control, attitudes, and subjective norms were control variables. The second purpose related to fruit and vegetable consumption was to determine the effect of participation in the Fit 49 Challenge on the number of days participants consumed five or more fruits and vegetables. Age, sex, employee classification, intention to consume five or more fruits and vegetables per day at pre-test, intention to consume five or more fruits and vegetables per day at post-test, perceived behavioral control, attitudes towards fruit and vegetable consumption, and subjective norms about fruit and vegetable consumption were control variables. Furthermore, an indirect, but hopeful outcome of increasing the physical activity levels and fruit and vegetable consumption of the participants was to reduce the number of obese employees at the university. This outcome was not measured for this study.

The objectives of this study were 1) to use questions derived from a Theory of Planned Behavior-based questionnaire to measure each participant's intention to walk 10,000 steps per day, five days per week and 2) to estimate the effect of intention on successful completion of the FIT 49 Challenge by walking 10,000 steps per day, five days per week for the five-week intervention. Furthermore, the questions derived from the Theory of Planned Behavior-based questionnaire were also used 1) to measure each participant's intention to consume five or more fruits and vegetables per day, five days per week and 2) to estimate the effect of intention on successful completion of the FIT 49 Challenge by consuming five or more fruits and vegetables per day, five days per week for the five-week intervention.

Hypotheses

Physical Activity Hypothesis #1: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, a person who participates in the Fit 49 Challenge will have higher physical activity intention at post-test than will a person who does not participate in the Fit 49 Challenge.

Physical Activity Hypothesis #2: When controlling for age, sex, number of fruits and vegetables consumed, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, a person who participates in the Fit 49 Challenge will complete more 10,000-step days than will a person who does not participate in the Fit 49 Challenge.

Fruit and Vegetable Consumption Hypothesis #3: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and nutrition intention at pre-test a person who participates in the Fit 49 Challenge will have higher nutrition intention at post-test than will a person who does not participate in the Fit 49 Challenge.

Fruit and Vegetable Consumption Hypothesis #4: When controlling for age, sex, number of days 10,000 steps are taken, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, a person who participates in the Fit 49 Challenge will complete more days of five or more fruits and vegetables consumption than will a person who does not participate in the Fit 49 Challenge.

Description of the Sample

Faculty and staff members of a university in the Southeast were recruited as volunteer participants for the treatment group and a wait-list control group. These volunteer participants were randomized into two groups: treatment and wait-list control. The wait-list control group was allowed to participate in the Fit 49 Challenge at a later date. A second control group, the population control, was randomly selected from the target population, which was the overall employee base. A random number generator was used to randomly assign the participants to their groups. The random number generator uses a statistical algorithm to produce the random group assignment.

Two control groups were required because the convenience sample control group included participants who were motivated and desired to participate. Additionally, those participants who made up the convenience sample were rewarded with wellness points. This may have contributed to their motivation to complete the Fit 49 Challenge.

It was determined in a power analysis with an alpha set at .05 and power set at 80%, using G* Power software, that 269 participants were needed in order to provide sufficient evidence that those who participated in the Fit 49 Challenge did indeed walk significantly more 10,000 step days and had significantly more days of five or more fruit and vegetable consumption than did those not participating in the Fit 49 Challenge (G*Power). Because only 175 people participated, the analysis may not have sufficient power to detect an effect if one exists.

Instrumentation and materials for data collection

In recent years, computer and internet-based interventions have been effectively used in employee health interventions (Maruyama et al., 2010) to record data and create accountability to self in a cost-effective manner (Perez et al., 2009). All information concerning the Fit 49 Challenge was provided through university email.

Permission was received by the investigator's university Institutional Review Board (IRB) to conduct the study. IRB approval was also received by the participating university, in which the participants were employed, to conduct the study.

Following the IRB approval, faculty and staff were given the opportunity to complete their consent forms and questionnaires for approximately two weeks before the Fit 49 Challenge began. Sex, age, employee classification, height, and weight were self-reported before the Fit 49 Challenge began. Participants were required to complete consent forms and a Theory of Planned Behavior based questionnaire to determine their intention to walk 10,000 steps per day and a second Theory of Planned Behavior based questionnaire to determine their intention to consume five or more fruits and vegetables per day. The

Theory of Planned Behavior questions were also used to determine attitudes, subjective norms, perceived behavioral control, and intention to take 10,000 steps per day and attitudes, subjective norms, perceived behavioral control, and intention to consume five or more fruits and vegetables per day during the five week Fit 49 Challenge.

Following the completion of the questionnaires and the randomization of two of the three groups, all participants were informed of the USDA-defined serving size for fruits and vegetables and all the rules and regulations for the Fit 49 Challenge through email. All participants were instructed to wear their pedometers at least five days per week. Those in the treatment group were challenged to walk 10,000 steps per day and eat five or more fruits and vegetables per day five days of the week. Participants in the two control groups also wore their pedometers five days of the week, but were instructed to continue in their regular physical activity and job-related duties and to record the steps they took. There was no difference in the instructions given to the two control groups. The volunteer wait-list control group was later allowed to participate as the treatment group following the completion of the 49 day Challenge.

All participants wore their pedometers and recorded their steps one week prior to the start of the Fit 49 Challenge. This week of recording was used as a pre-test score to determine if the Fit 49 Challenge caused a significant increase in the participants' number of steps. The challenge portion of the Fit 49 program lasted five weeks (January 29 through March 3) and ended with a final week to be used as a post-test. Prior to the post-test week (March 4-10), participants completed the Theory of Planned Behavior questionnaires again as a post-test score for intention to walk 10,000 steps per day and intention to consume five or more fruits and vegetables per day.

Instruments

The 10,000 step challenge was chosen over the recommendation of 30 minutes of moderate physical activity, designated by the American College of Sports Medicine, because internal validity can be increased when using an objective instrument. Additionally, results from a meta-analysis by Kang and colleagues indicate moderate and positive effects of pedometer-based physical activity interventions on people's physical activity behaviors (Kang et al., 2009).

The pedometer is a small step-counting device generally clipped to a person's waistband, thereby making it non-invasive. The pedometer records the number of steps a person takes daily and most models must be reset every day. Pedometers can be used with small and large studies and for people young and old. The pedometer is inexpensive and does not require significant amounts of time or effort to measure and record a person's steps. Modern pedometers have proven to be valid and reliable instruments for step counting (Holbrook, Barreira, & Kang, 2009).

Many studies have been performed to determine which pedometer brands and models are reliable and which are not. Several of the models researchers used in studies are quite reliable, but the expense of these models generally does not allow for widespread consumer use. The most commonly used models in research are the Yamax, Omron, and Sportline (Le Masurier, Lee, & Tudor-Locke, 2004).

Researchers at Arizona State University East performed a study comparing the percent error between the following three brands of pedometers: Yamax, Omron, and Sportline. Percent error mean is always reported in studies, but not the direction of that error. Both directions, positive and negative, are averaged making the mean error of percent appear to be much smaller than it truly is for most pedometers. The goal of their study was to determine if these models underestimate or overestimate the number of steps taken during an established treadmill protocol and during a day of free living conditions. As discovered in previous studies, the reliability of the pedometers varied according to the speed of the walking. Manufacturers of the Yamax pedometer reported a 0.35 gram threshold. This would explain the lower reliability at slower speeds because the force would not be high enough for the pedometer to register a step. No thresholds were reported for the Omron or Sportline, although having a higher threshold than the Yamax could explain the difference in reliability (Le Masurier et al., 2004).

The Sportline pedometer consistently underestimated the number of steps taken during the treadmill trials while the Yamax and Omron revealed no significant differences in the number of steps counted and the actual number of steps taken. While the Yamax and Omron pedometers had high overall reliability, their reliability was reduced at slower speeds. The results indicated that the Yamax had the highest reliability during free-living conditions followed by the Omron and the Sportline. (Le Masurier et al., 2004).

Recently Omron introduced the HJ-303 pedometer. It has been advertised as "Omron's most advanced pedometer [which] can be used anywhere at any angle—in your pocket, bag or on your hip" (*Omron Global,* 2011, para. 1). The Omron HJ-303 is advertised as "an ideal motivational tool for fitness enthusiasts on the go and those interested in improving and maintaining health" by its manufacturer (*Omron Global,* 2011, para. 1). The HJ-303 has many functions. It measures steps, minutes of participation in moderate steps, and distance. It also calculates calories burned and stores seven days of information in its memory. A positive feature of the HJ-303 is that it resets automatically at midnight so that it is ready to be used every morning and is almost impossible for participants to reset accidentally (*Omron Global,* 2011, para. 1).

In the Fit 49 Challenge, an Omron HJ-303 pedometer was used to measure the number of steps that a participant took each day. A preliminary study conducted by the principal investigator and research from Steeves and colleagues (2011) revealed validity and reliability of the Omron HJ-303 pedometer. The procedures of the preliminary study are similar to those of Holbrook, Barreira, and Kang (2009) in their validation of the Omron HJ-151 and HJ-7201TC pedometers.

Twenty-six participants (six males and twenty females), with a mean age of 45, walked an approximately one mile trip wearing five pedometers so that the validity and reliability of the Omron HJ-303 could be determined. These participants were faculty and staff members at a university in the southeastern United States. The information of one participant was excluded from the results because of a malfunction of the hand-counter and the information of two participants was excluded because they did not wear the pedometers in their pockets. Step counts for a total of 23 participants were used. Height, weight, and BMI were also measured. The mean height and weight of the participants was 66.59 inches and 168.43 pounds respectively while the mean BMI was 26.60.

Participants were shown the designated pathway and then prompted to walk the course at a self-selected moderate pace. The one-half mile course included indoor and outdoor walking as well as stair ascent and descent. For each participant, the left hip (LH), right hip (RH), and mid-back (MB) pedometer positions were used. For twenty-four of the participants, the additional pedometer positions of left pocket (LP) and right pocket (RP) of pants or a jacket were used. The information of the two participants who did not wear one in their pocket was not used for the analysis. The HJ-303 pedometer models are not easily reset manually; therefore, measurements of pre-trial step counts were recorded before the participant began walking the designated pathway. While the participant walked the designated pathway, the investigator followed each participant with a hand counter in order to determine actual steps. This was used as a criterion measure (Schneider, 2003). Following the one-half mile completion of the designated pathway, post-trial pedometer steps were recorded. Later Microsoft Excel was used to subtract pre-trial steps from post-trial steps and compared to the criterion measure recorded by the investigator.

Data screening and analyses were performed using SPSS (version 15.0) and Microsoft Excel for Windows. Descriptive statistics, including mean and standard deviation (SD), were calculated for demographic information using Excel. For validity evidence of the HJ-303 pedometer, absolute percent error (APE) was calculated between actual steps and pedometer-determined steps (APE = [pedometer steps – actual steps / actual steps] x 100) and was used as an outcome measure. An APE value of less than 3% has been deemed as acceptable (Crouter, Schneider, Karabulut, & Bassett, 2005; Hatano, 1997). A repeated-measures ANOVA was performed across the five pedometer positions (right hip, left hip, mid-back, left pocket, and right pocket) to determine inner device reliability at the different locations.

The APE values across pedometer positions for the Omron HJ-303 pedometer model ranged from 1.02% to 2.07% with an overall APE value of -1.73 + 1.09 across the five pedometer positions. The least amount of error for the HJ-303 was shown at the left hip position during the self-paced moderate speed of walking (1.02% ± 1.20). The position where the most error was found was in the left pocket position (2.07% ± 2.45). Repeated-measures ANOVA revealed no statistically significant differences in the APE values among the five different HJ-303 pedometer positions of right hip, left hip, mid-back, left pocket, and right pocket ($p = .091$).

Because walking has been used in so many programs in an effort to increase physical activity and therefore decrease obesity prevalence, it is important to confirm that a valid instrument exists to measure walking steps and physical activity. After many steps were walked with the investigator following participants and counting the participants' individual steps, results of this data analysis indicate that the Omron HJ-303 is a valid measurement tool for step counting, when used to measure physical activity.

Results from Steeves and colleagues also indicate that the Omron HJ-303 is a valid and reliable step counter (2011). Sixty participants assisted in efforts to determine the validity and reliability of the Omron HJ-303, Yamax Traq and the Sportline SW 200. The Omron and Sportline models are similar in their features. They both allow gender, height, and weight to be entered into the pedometer. In addition to step counting, they also display distance walked (or run), calories burned, and the pace at which one walks (or runs). The Omron has the added feature of a 7-day memory. The Yamax is the most widely used model in research studies. It does allow for one to clear their steps and begin again, but has no additional features (Steeves, Tyo, Connolly, Gregory, Stark, & Bassett, 2011).

The validity of the three models was tested through walking on a treadmill, running on a treadmill, and participation in lifestyle activities, such as ballroom dancing, exercise on an elliptical machine, ascending the stairs and descending the stairs. A hand tally counter followed the participants to determine the actual number of steps taken by the participant during both the walking and running phases. The Omron pedometer was the most valid for walking while the Sportline overestimated steps and the Yamax underestimated steps taken. During lifestyle activities, the Omron and Yamax underestimated step counts, but the Sportline overestimated step counts (Steeves et al., 2011).

For the reliability test, each participant walked five trials of 100 steps on a track. They each wore five pedometers in three different positions (waist, mid-back, and pants pocket). A hand tally counter was also used as a criterion for the 100-step trials. All models of the pedometers indicated reliability during testing. Though testing results revealed that the Sportline was reliable, it consistently overestimated steps and was therefore not a valid step counter for walking, running, or participating in other lifestyle activities. All in all, the Omron HJ-303 was deemed the most valid pedometer of those that were tested. It measured walking steps, running steps, and steps taken during lifestyle activities across normal weight and overweight, Body Mass Index levels (Steeves et al., 2011).

An Excel log was sent (via email) to each participant before the Fit 49 Challenge began to use as a daily log for recording their daily steps and daily fruit and vegetable consumption. Additionally, participants reported their daily step and produce (fruit and vegetable) counts each week via Survey Monkey.

Data collection procedures

Emails were sent weekly by the principal investigator to remind the participants to report their weekly recordings. An email was sent to each of the three groups: the treatment group, the wait-list control group, and the population control group. The email to participants in the treatment group included an article related to physical activity or nutrition, a healthy recipe, and the link to report their information. Emails to the participants in the wait-list and population control groups included the link to report their information only. Survey Monkey was used to aid in the data entry process for the responses from the questionnaires and weekly reports in order to reduce error from hand-entered data. Survey Monkey allows for custom reports to be created and responses to be filtered & cross tabulated by custom criteria. Survey Monkey also allows for export of participants' responses directly to SPSS for analysis.

Analysis Procedures

An ANCOVA design is used to analyze the data collected in the Fit 49 Challenge. As noted in the Theory of Planned Behavior and from previous research, all independent variables that are known to have an effect on the dependent variable are included in the preliminary model. The use of these variables is needed even though randomization was used to determine group assignment. Initially, the analysis begins with the model that contains all main effects and all interactions. Then the main effects model is run that contains only the main effects. The overall fit of the model is compared to the overall fit of the interaction model. If the interaction model does not significantly improve the explanation of the variation in the dependent variable, then all interactions are dropped and the main effects model is used. One by one, the interaction terms are removed by eliminating the highest-order interaction terms that are not significant. Then the parsimonious model is developed. When the model contains only main effects and significant interaction terms, in successive steps insignificant main effects are deleted until the model only contains significant main effects and significant interactions. When significant interaction terms occur, the analysis involves finding a way to divide the sample into three groups (according to group assignment) so that the interaction variables are eliminated. The best (parsimonious) model includes only the significant interaction terms, the independent variables that are included in the significant interaction terms (whether or not the independent variables are significant), and significant main effects that are not part of interaction terms.

By using the aforementioned methods, the purpose of this investigation is to increase the physical activity levels and the fruit and vegetable consumption of university employees through the use of a worksite wellness intervention. What effect does participation in a physical activity and nutrition experimental intervention have on the physical activity and nutrition of university employees?

CHAPTER IV:

RESULTS

The purpose of this investigation is to increase physical activity levels and fruit and vegetable consumption of university employees through the use of a worksite wellness intervention. Additionally, it is the purpose of this investigation to determine four specific outcomes of participation in the Fit 49 Challenge.

Physical Activity Research Question #1: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, what effect does participation in the Fit 49 Challenge have on physical activity intention at post-test?

Physical Activity Research Question #2: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant takes 10,000 steps during the five-week Challenge?

Fruit and Vegetable Consumption Research Question #3: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and nutrition intention at pre-test, what effect does participation in the Fit 49 Challenge have on nutrition intention at post-test?

Fruit and Vegetable Consumption Research Question #4: When controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, what effect does participation in the Fit 49 Challenge have on the number of days a participant consumes five or more fruits and vegetables during the five-week Challenge?

Development of the Indexes

Physical Activity

To establish adequate internal consistency for the Theory of Planned Behavior questionnaire regarding 10,000 steps of physical activity, a Cronbach's alpha for each subscale is reported. For the physical activity pre-test, 26 items were used to measure the constructs of intention, subjective norms, attitudes, and perceived behavioral control. Each of the items, except for the intention items, was anchored by five answer options. Several of the questions were the same, but different answer options were provided. These options generally ranged from "great for my health" to "very bad for my health." See Appendix C for specific questions and answer options.

Two items were initially used to measure physical activity behavioral intention for the pre-test and post-test. The Cronbach's alpha level was 0.473. One item was chosen to measure physical activity intention. Eight choices, from no days to seven days, were provided for the item used to measure physical activity behavioral intention. The item read "On how many days during the week of January 22-28 do you intend to take 10,000 steps?" Both pre-test and post-test scores for physical activity intention were used in the analysis.

With an alpha level of 0.730, six items were used to measure attitudes towards physical activity. Responses to these six items were summed to create an index for attitudes toward physical activity. Only the pre-test scores for physical activity attitudes were used in the analysis.

Three items were reduced to two, with an initial alpha level of 0.543, to measure subjective norms toward physical activity. The Cronbach's alpha level for the two items chosen to measure subjective norms was 0.786. Only the pre-test scores for physical activity norms were used in the analysis.

Lastly, with an initial Cronbach's alpha level of 0.342, two items were reduced to one to measure perceived behavioral control regarding physical activity. The item read "For me, taking 10,000 steps (at least five days per week) is totally in my control, somewhat in my control, no opinion, rarely in my control, never in my control." Only the pre-test perceived behavioral control items were used for the analysis.

Fruit and Vegetable Consumption

To establish adequate internal consistency for the Theory of Planned Behavior questionnaire regarding the consumption of fruits and vegetables, a Cronbach's alpha for each subscale is reported. For the fruit and vegetable consumption pre-test, 26 items were used to measure the constructs of intention, subjective norms, attitudes, and perceived behavioral control.

Two items were initially used to measure intention to consume fruits and vegetables for the pre-test and the post-test. The Cronbach's alpha level was 0.498. One item was chosen to measure intention to consume fruits and vegetables. Eight choices, from no days to seven days, were provided for the item used to measure behavioral intention. The item read "On how many days during the week of January 22-28 do you intend to consume five or more fruits and vegetables?" Both pre-test and post-test scores for nutrition intention were used in the analysis.

With an alpha level of 0.718, six items were used to measure attitudes towards fruit and vegetable consumption. Responses to these six items were summed to create an index for attitudes toward fruit and vegetable consumption. Only the pre-test scores for nutrition attitudes were used in the analysis.

Three items were reduced to two, with an initial alpha level of 0.713, to measure subjective norms toward fruit and vegetable consumption. The Cronbach's alpha level for the two items chosen to measure subjective norms was 0.809. Only the pre-test scores for nutrition norms were used in the analysis.

Lastly, because of a Cronbach's alpha level of 0.331, the use of two items was reduced to one to measure perceived behavioral control. The item read "For me, eating five or more fruits and vegetables (at least five days per week) is totally in my control, somewhat in my control, no opinion, rarely in my control, never in my control." Only the post-test scores for nutrition perceived behavioral control were used in the analysis. The same construct indices were used for the post-test and resulted in similar Cronbach's alpha levels. See Appendix C for specific assessment items.

Participants

Selection of Participants

Faculty and staff members, $N = 97$, of a university in the Southeast were recruited as volunteer participants for the treatment group and wait-list control group. These volunteer participants were randomized into two groups: treatment ($n = 50$) and wait-list ($n = 47$). The wait-list control group was allowed to participate in the Fit 49 Challenge at a later date. A second control group ($n = 78$) was randomly selected from the target population, which was the overall employee base. Two control groups were required because the convenience sample wait-list control group included participants who were motivated and desired to participate. Additionally, those participants who made up the convenience sample were rewarded with wellness points upon completion of the Fit 49 Challenge. This may have added to their motivation to complete the Fit 49 Challenge.

Attrition

At the beginning of the Fit 49 Challenge, 196 participants volunteered to be in one of the three groups. One hundred seventy-five participants (89.29%) completed both surveys, wore the pedometer during the entire Fit 49 Challenge, and reported all weeks of steps taken and fruits and vegetables consumed.

Description of the Participants

The sample size of this data analysis equals 175 participants, men composing 34.29% of the sample (n = 60) as shown in Table 1. Overall, 44% of the sample was composed of faculty members (n = 77). The mean BMI for all participants equals 27.08 (SD = 5.75). The mean age for all participants equals 44.81 (SD = 13.24).

The sample size of the treatment group equals 50 participants, men comprising 34% (n = 17) of the sample. Overall, 58% (n = 29) of the participants in the treatment group were faculty members. The mean BMI for treatment participants equals 28.02 (SD = 5.65). The mean age for treatment participants equals 47.42 (SD = 13.51).

The sample size of the wait-list control group equals 47 participants, men comprising 31.9% (n = 15) of the sample. Overall, 40.4% (n = 19) of the participants in the wait-list control group were faculty members. The mean BMI for wait-list participants equals 27.24 (SD = 6.32). The mean age for wait-list participants equals 46.32 (SD = 11.44).

The sample size of the population control group equals 78 participants, men comprising 35.9% ($n = 28$) of the sample. Overall, 37% ($n = 29$) of the participants in the population control group were faculty members. The mean BMI for control participants equals 26.37 ($SD = 5.42$). The mean age for control participants equals 42.22 ($SD = 13.75$).

Among all participants, the mean number of days 10,000 steps were taken equals 9.18 ($SD = 9.43$). The mean for physical activity intention at the pre-test equals 3.41 ($SD = 1.02$) and equals 2.82 ($SD = 1.24$) at the post-test. The mean for physical activity attitudes at the pre-test equals 25.24 ($SD = 2.73$). The mean for physical activity norms at the pre-test equals 3.42 ($SD = 1.47$). The mean for physical activity perceived behavioral control at the pre-test equals 1.59 ($SD = 0.65$).

For all participants, the mean for number of days five or more fruits and vegetables were consumed equals 16.14 ($SD = 8.225$). The mean for fruit and vegetable consumption intention at the pre-test equals 2.75 ($SD = 0.52$) and equals 2.46 ($SD = 0.741$) at the post-test. The mean for fruit and vegetable consumption attitudes at the pre-test equals 25.48 ($SD = 2.36$). The mean for fruit and vegetable consumption norms at the pre-test equals 3.23 ($SD = 1.32$). The mean for fruit and vegetable consumption perceived behavioral control at the pre-test equals 1.28 ($SD = 0.46$).

Among all participants, the mean for physical activity intention decreased from 3.40 ($SD = 1.02$) at pre-test to 2.82 ($SD = 1.24$) at the post-test. Physical activity attitudes increased from a mean of 25.24 (*SD* = 2.73) at pre-test to 25.26 (*SD* = 2.69) at the post-test. Physical activity norms increased from a mean of 3.42 (*SD* = 1.47) at pre-test to 3.63 (*SD* = 1.42) at the post-test. Physical activity perceived behavioral control increased from a mean of 1.59 (*SD* = 0.65) at pre-test to 1.78 (*SD* = 0.78) at the post-test.

Among all participants, the mean for nutrition intention decreased from 2.74 (*SD* = 0.52) at pre-test to 2.46 (*SD* = 0.74) at the post-test. Nutrition attitudes decreased from a mean of 25.48 (*SD* = 2.36) at pre-test to 24.97 (*SD* = 2.44) at the post-test. Nutrition norms increased from a mean of 3.23 (*SD* = 1.32) at pre-test to 3.37 (*SD* = 1.31) at the post-test. Nutrition perceived behavioral control increased from a mean of 1.28 (*SD* = 0.46) at pre-test to 1.52 (*SD* = 0.72) at the post-test.

Among treatment participants, the mean for physical activity intention decreased from 3.58 (*SD* = 0.95) at pre-test to 3.12 (*SD* = 1.19) at the post-test. Among wait-list participants, the mean for physical activity intention decreased from 3.83 (*SD* = 0.43) at pre-test to 2.91 (*SD* = 1.23) at the post-test. Among control participants, the mean for physical activity intention decreased from 3.04 (*SD* = 1.19) at pre-test to 2.58 (*SD* = 1.25) at the post-test.

Among treatment participants, the mean for physical activity perceived behavioral control increased from 1.46 (*SD* = 0.50) at pre-test to 1.76 (*SD* = 0.77) at the post-test. Among wait-list participants, the mean for physical activity perceived behavioral control increased from 1.62 (*SD* = 0.71) at pre-test to 1.91

(*SD* = 0.86) at the post-test. Among control participants, the mean for physical activity perceived behavioral control increased from 1.67 (*SD* = 0.70) at pre-test to 1.71 (*SD* = 0.74) at the post-test.

Among treatment participants, the mean for nutrition intention decreased from 2.86 (*SD* = 0.35) at pre-test to 2.68 (*SD* = 0.65) at the post-test. Among wait-list participants, the mean for nutrition intention decreased from 2.89 (*SD* = 0.31) at pre-test to 2.43 (*SD* = 0.71) at the post-test. Among control participants, the mean for nutrition intention decreased from 2.60 (*SD* = 0.65) at pre-test to 2.33 (*SD* = 0.78) at the post-test.

Among treatment participants, the mean for nutrition perceived behavioral control increased from 1.18 (*SD* = 0.39) at pre-test to 1.52 (*SD* = 0.81) at the post-test. Among wait-list participants, the mean for nutrition perceived behavioral control increased from 1.34 (*SD* = 0.48) at pre-test to 1.62 (*SD* = 0.74) at the post-test. Among control participants, the mean for nutrition perceived behavioral control increased from 1.31 (*SD* = 0.49) at pre-test to 1.47 (*SD* = 0.64) at the post-test. See Table 2.

Intention to Treat

The analysis was conducted based on group assignment and not on how the participants may have participated in the study, under the convention of intention to treat (Rubin, & Van der Laan, 2008). The participants in the various groups were instructed not to discuss their group assignment, but participants may have interacted with one another because of working or social encounters. This potential cross-contamination may weaken the results of this study.

Physical Activity Intention

A primary purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more physical activity intention at post-test than would those who did not participate in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, a person who participated in the Fit 49 Challenge would have higher physical activity intention at post-test than would a person who did not participate in the Fit 49 Challenge.

To test the effect of participation in the Fit 49 Challenge on intention to take 10,000 steps per day, an ANCOVA design was used. The first independent variable, group assignment, was categorical and the dependent variable of post-test intention was continuous. There were three levels of group assignment: treatment group, wait-list control group, and population control group. Pre- and post-test scores for intention were measured for each participant.

The initial model for physical activity intention at post-test contained all hypothesized main effects (age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and group assignment) and the interaction of group assignment with each of the main effects. The interaction model explained significantly more variation (36.3%) in post-test intention than did the model using only main effects (17.9%).

In a step-wise fashion, the most insignificant interactions were dropped until only the interaction of group assignment and pre-test physical activity intention remained. Then insignificant main effects that were not part of the interaction were dropped until a parsimonious model was achieved.

Overall, the fit of the parsimonious interaction model for physical activity intention at post-test was significant. Physical activity intention at pre-test, physical activity attitudes at pre-test, group assignment, sex, and the interaction of group assignment and physical activity intention at pre-test explained 26.0% of the variation for physical activity intention at post-test, $F = (7, 167) = 8.389$, $MSE = 1.194$, $p < .001$.

In order to check the assumptions for ANCOVA, the results from the Levene's test for homogeneity of variances and the K-S test for normality of residuals were checked. The results of the Levene's test was not significant (F $(5, 169) = 0.952$, $p = 0.449$). This implies that the variance is equal across all groups. The results of the K-S test were significant ($p = 0.015$), indicating that the model's residuals were normally not distributed. ANCOVA is robust to this violation (Garson, 2012).

It is noteworthy that physical activity intention was not the same for all three groups at the time of the pre-test, indicating a randomization problem because the population control group was not the same as the randomized treatment and wait-list control groups. Because of the significant interaction, main effects models for two groups of physical activity intention at pre-test were run.

Control variables included physical activity attitudes at pre-test and sex. When controlling for all variables, there was an effect of group assignment on physical activity intention at post-test among those with low physical activity intention at pre-test, $F = (2, 46) = 8.882$, $MSE = 10.038$, $p = .001$. There was no effect of group assignment on physical activity intention at post-test among those with high physical activity intention at pre-test, $F = (2, 119) = 0.238$, $MSE = 0.322$, $p = 0.788$.

As shown in Table 3, participants with lower pre-test physical activity intention planned to exercise one to three days per week. Their post-test physical activity intention was highest in the treatment group (*EMM* = 3.72). This result was significantly higher than the wait-list control group (*EMM* = 2.10, $p = .001$) and the population control group (*EMM* = 1.87, $p = 0.004$). There was no difference in the means for the two control groups. Participants with higher pre-test physical activity intention planned to exercise four or more days per week. The estimated marginal means for post-test physical activity intention for the three groups ranged form 3.03 to 3.21 and were not significantly different.

The first analysis, shown in Table 4, pertained to the treatment group. Hypothesized variables that were not significant were deleted from the analysis. Control variables included physical activity attitudes at pre-test, sex, and physical activity intention at pre-test. When controlling for all other variables, physical activity intention at pre-test is negatively related to physical activity intention at post-test (*B* = -0.365, *t* = -2.07, *p* = 0.044). This negative and significant relationship is the reason that the interaction term of group assignment and physical activity at pre-test was significant, when compared to the positive relationships presented below for the wait-list control group and the population control group. Physical activity attitude at pre-test is not related to physical activity intention at post-test (*B* = 0.132, *t* = 1.80, *p* = 0.078). Men did not have statistically significant lower levels of physical intention at the post-test (*B* = 0.107, *t* = 0.307, *p* = 0.760) than did women. This model explained 13.0% of the variation in post-test physical activity intention.

The second analysis, as shown in Table 5, pertained to the wait-list control group. Control variables included physical activity attitudes at pre-test, sex, and physical activity intention at pre-test. Physical activity intention at pre-test is positively related to physical activity intention at post-test (*B* = 1.07, *t* = 2.818, *p* = 0.007). Physical activity attitude at pre-test is positively related to physical activity intention at post-test (*B* = 0.112, *t* = 2.119, *p* = 0. 040). Men did not have significantly greater physical activity intention at post-test (*B* = 0.609, *t* = 1.749, *p* = 0.087) than did women. This model explained 24.0% of the variation in post-test physical activity intention.

The third analysis, as shown in Table 6, pertained to the population control group. Control variables included physical activity attitudes at pre-test, sex, and physical activity intention at pre-test. Physical activity intention at pre-test is positively related to physical activity intention at post-test (B = 0.511, t = 4.699, p < .001). Physical activity attitude at pre-test is positively related to physical activity intention at post-test (B = 0.109, t = 2.112, p = 0.038). Men did have significantly greater physical activity intention at post-test (B = 0.582, t = 2.00, p = 0.049) than did women. This model explained 30.4% of the variation in post-test physical activity intention.

A change did occur in physical activity intention from pre-test to post-test for each of the three groups. The change in the treatment group was negative and the change in the wait-list and population control groups was positive. The effect of participation in the Fit 49 Challenge on physical activity intention at post-test is dependent upon physical activity intention at pre-test, attitudes at pre-test, sex, and group assignment. Among participants with lower intention, those in the treatment group did have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups. Among participants with higher intention, those in the treatment group did not have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups.

10,000 Step Days

A second purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more 10,000 step days than would those who did not participate in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, steps taken at pre-test, physical activity intention at pre-test, and physical activity intention at post-test, a person who participates in the Fit 49 Challenge will complete more 10,000 step days than will a person who does not participate in the Fit 49 Challenge.

To test the effect of participation in the Fit 49 Challenge on the number of days 10,000 steps were taken, an ANCOVA design was used. The independent variable of group assignment was categorical and the dependent variable of number of days the participant took 10,000 steps was continuous. There were three levels of group assignment: treatment group, wait-list control group, and population control group.

The initial model for number of 10,000 step days contained all hypothesized main effects (age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, steps taken at pre-test, physical activity intention at pre-test, physical activity intention at post-test, and group assignment) and the interaction of group assignment with each of the main effects. The interaction model explained significantly more variation (68.2%) for the number of days 10,000 steps were taken than did the model using only main effects (64.8%).

In a step-wise fashion, the most insignificant interactions were dropped until only the interaction of group assignment and physical activity intention at post-test remained significant. Then insignificant main effects that were not part of the interaction were dropped until a parsimonious model was achieved.

Overall, the fit of the parsimonious model for number of days participants took 10,000 was significant. Group assignment, the number of days a participant walked 10,000 steps at pre-test, physical activity at intention at post-test, and the interaction of group assignment and physical activity intention at post-test explained 65.2% of the variation for the number of days 10,000 steps were taken, $F = (6, 168) = 52.450$, $MSE = 32.033$, $p < .001$.

In order to check the assumptions for ANCOVA, the results from the Levene's test for homogeneity of variances and the K-S test for normality of residuals were checked. The results of the Levene's test was significant (F (2, 172) = 25.425, $p < 0.001$). This implies that the variance was not equal across all groups. Garson (2012) recommends that the value of this test be accepted because the ratio of the two largest variances is below any critical ratio (4.0). The results of the K-S test were not significant ($p = 0.119$), indicating that the model's residuals were normally distributed.

The control variable was the number of days a participant walked 10,000 steps at pre-test. As shown in Table 7, there was an effect of group assignment on the number of days a participant took 10,000 steps among those who intended to walk one day of 10,000 steps per week, $F = (2, 36) = 4.892$, $MSE = 78.813$, $p < 0.012$. There was an effect of group assignment on the number of days a participant took 10,000 steps among those who intended to walk two days of 10,000 steps per week, *F* = (2, 29) = 4.403, *MSE* = 89.538, *p* = 0.021. There was not an effect of group assignment on the number of days a participant took 10,000 steps among those who intended to walk three days of 10,000 steps per week, *F* = (2, 16) = 1.888, *MSE* = 74.747, *p* = 0.184. There was an effect of group assignment on the number of days a participant took 10,000 steps among those who intended to walk four days of 10,000 steps per week, *F* = (2, 78) = 26.996, *MSE* = 1057.802, *p* < .001.

For the participants who intended to walk one day of 10,000 steps, the number of days they took 10,000 steps in the treatment group is higher (*EMM* = 7.816) than both the wait-list control group (*EMM* = 2.264, *p* = .026) and the population control group (*EMM* = 2.493, *p* = .015). The control groups are not different. For the participants who intended to walk two days of 10,000 steps, the number of days they took 10,000 steps in the treatment group is higher (*EMM* = 7.507) than the population control group (*EMM* = 1.944, *p* = .021), but not the wait-list control group (*EMM* = 2.421, *p* = .142). The control groups are not different. The estimated marginal means ranged from 6.808 to 14.069 and there are no differences by treatment groups among those participants who intended to walk three days of 10,000 steps. For the participants who intended to walk four days of 10,000 steps, the number of days they took 10,000 steps in the treatment group is higher (*EMM* = 20.636) than both the wait-list control group (*EMM* = 8.451, *p* < .001) and the population control group (*EMM* = 12.225, *p* < .001). The control groups are not different.

Additional analyses were run for the interaction effects. As shown in Table 8, the first analysis pertained to the treatment group. Control variables included the number of days a participant walked 10,000 steps at pre-test, and physical activity intention at post-test. When controlling for all other variables, physical activity intention at post-test is positively related to the number of days a participant took 10,000 steps (B = 3.0352, t = 2.958, p = 0.005). The number of days a participant walked 10,000 steps at pre-test is positively related to the number of days a participant took 10,000 steps (B = 2.258, t = 0.716, p = 0.003). This model explained 34.3% of the variation in the number of days 10,000 steps were taken.

The second analysis pertained to the wait-list control group. Control variables included the number of days a participant walked 10,000 steps at pre-test, and physical activity intention at post-test. When controlling for all other variables, physical activity intention at post-test is not positively related to the number of days a participant took 10,000 steps (B = 0.771, t = 1.356, p = 0.182). The number of days a participant walked 10,000 steps at pre-test is positively related to the number of days a participant took 10,000 steps (B = 2.914, t = 6.118, $p < .001$). This model explained 51.8% of the variation in the number of days 10,000 steps were taken.

The third analysis pertained to the population control group. Control variables included the number of days a participant walked 10,000 steps at pre-test, and physical activity intention at post-test. When controlling for all other variables, physical activity intention at post-test is positively related to the number of days a participant took 10,000 steps (B = 1.499, t = 3.317, p = .001). The number of days a participant walked 10,000 steps at pre-test is positively related to the number of days a participant took 10,000 steps (B = 3.313, t = 10.623, p < .001). This model explained 78.9% of the variation in the number of days 10,000 steps were taken.

The effect of participation in the Fit 49 Challenge on the number of days participants took 10,000 steps depends on group assignment, the number of days a participant walked 10,000 steps at pre-test, and physical activity intention at post-test. Among those who intended to walk one, two, or four days of 10,000 steps per week, there was an effect of group assignment on the number of days a participant took 10,000 steps. Among those who intended to walk three days of 10,000 steps per week, there was not an effect of group assignment on the number of days a participant took 10,000 steps.

Nutrition Intention

A third purpose of this investigation was to determine if participants who received a challenge to consume five or more fruits and vegetables per day, five days per week for five weeks would have higher nutrition consumption intention at the end of the Fit 49 Challenge than would those who did not have the Challenge. It was hypothesized that when controlling for age, sex, employee classification, intention to consume five or more fruits and vegetables at pre-test, perceived behavioral control, attitudes, and subjective norms, a person who participates in the Fit 49 Challenge will have higher nutrition consumption intention at post-test than will a person who does not participate in the Fit 49 Challenge.

To test the effect of participation in the Fit 49 Challenge on intention to consume five or more fruits and vegetables per day, an ANCOVA design was used. The first independent variable of group assignment was categorical and the dependent variable of intention was continuous. There were three levels of group assignment: treatment group, wait-list control group, and population control group. Pre- and post-test scores for intention were measured for each participant.

The initial model for nutrition intention at post-test contained all hypothesized main effects (age, sex, employee classification, group assignment, nutrition consumption intention, perceived behavioral control, attitudes, and norms at pre-test) and the interaction of group assignment with each of the main effects. The interaction model explained significantly more variation (31.6%) in post-test intention than did the model using only main effects (23.3%).

After deleting insignificant interactions and main effects, the fit of the parsimonious model for nutrition intention at post-test was significant. Nutrition intention at pre-test, attitudes, and the interaction of group assignment and nutrition norms at pre-test explained 22.4% of the variation for physical activity intention at post-test, $F = (7, 167) = 6.88$, $MSE = 0.444$, $p < .001$.

In order to check the assumptions for ANCOVA, the results from the Levene's test for homogeneity of variances and the K-S test for normality of residuals were checked. The results of the Levene's test was not significant (F (2, 172) = 2.105, p = 0.125). This implies that the variance is equal across all groups. The results of the K-S test were significant (p = .001), indicating that the model's residuals were not normally distributed. When looking at the histogram, it appears that the residuals are approximately normally distributed. ANCOVA is known to be robust to this slight violation.

As shown in Table 9, participants with lower pre-test nutrition intention planned to consume five or more fruits and vegetables one to two days per week. Their post-test nutrition intention was highest in the treatment group (*EMM* = 2.46). This result was not higher than the wait-list control group (*EMM* = 1.50, p = 0.129) and the population control group (*EMM* = 1.95, p = 0.416). There was no difference in the means for the two control groups. Participants with higher nutrition intention planned to consume five or more fruits and vegetables three or more days per week. The estimated marginal means for post-test nutrition intention for the three groups ranged from 2.51 to 2.69 and were not significantly different.

Control variables included sex, nutrition intention at pre-test, and nutrition norms at pre-test. When controlling for all other variables, there was not an effect of group assignment on nutrition intention at post-test among those with lower nutrition intention at pre-test, F = (2, 31) = 2.288, *MSE* = 1.307, p = 0.118.

There was not an effect of group assignment on nutrition intention at post-test among those with higher nutrition intention at pre-test, $F = (2, 134) = 0.995$, $MSE = 0.437$, $p = 0.372$.

The analysis in Table 10 pertains to the treatment group. Variables specified from theory included pre-test nutrition attitudes, norms, and intention. When controlling for all other variables, nutrition intention at pre-test is not significantly related to nutrition intention at post-test ($B = 0.168$, $t = 0.652$, $p = 0.518$). Attitudes at pre-test are not significantly related to nutrition intention at post-test ($B = 0.041$, $t = 0.940$, $p = 0.352$). Norms at pre-test are positively related to nutrition intention at post-test ($B = .237$, $t = 2.421$, $p = 0.019$). Overall, 12.3% of the variation in nutrition intention at post-test was explained by this model.

The second analysis, as shown in Table 11, pertained to the wait-list control group. Variables specified from theory included pre-test nutrition attitudes, norms, and intention. When controlling for all other variables, nutrition intention at pre-test is positively related to nutrition intention at post-test ($B = 0.898$, $t = 3.005$, $p = 0.004$). Attitudes at pre-test are not related to nutrition intention at post-test ($B = 0.063$, $t = 1.636$, $p = 0.109$). Norms at pre-test are not related to nutrition intention at post-test ($B = -0.093$, $t = -1.328$, $p = 0.191$). Overall, 34.8% of the variation in nutrition intention at post-test was explained by this model.

The third analysis, as shown in Table 12, pertained to the population control group. Variables specified from theory included pre-test nutrition attitudes, norms, and intention. When controlling for all other variables, nutrition intention at pre-test is positively related to nutrition intention at post-test ($B = 0.403$, $t = 2.971$, $p = 0.004$). Attitudes at pre-test are not related to nutrition intention at post-test ($B = 0.023$, $t = 0.640$, $p = 0.524$). Norms at pre-test are not related to nutrition intention at post-test ($B = -0.086$, $t = -1.467$, $p = 0.147$). Overall, 18.2% of the variation in nutrition intention at post-test was explained by this model.

The effect of participation in the Fit 49 Challenge on nutrition intention at post-test is dependent on group assignment, nutrition intention, attitudes, and norms at pre-test. Among those participants with lower nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants who were in the wait-list and population control groups. Among those participants with higher nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants who were in the wait-list and population control groups.

Days of Fruit and Vegetable Consumption

A fourth purpose of this investigation was to determine if participants who took part in the Fit 49 Challenge would have more days of consuming five or more fruits and vegetables than would those who did not take part in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, number of days five or more fruits and vegetables were consumed at pre-test, nutrition intention at pre-test, and nutrition intention at post-test, a person who participated in the Fit 49 Challenge would complete more days of five or more fruit and vegetable consumption than would a person who did not participate in the Fit 49 Challenge.

To test the effect of participation in the Fit 49 Challenge on the number of days five or more fruits and vegetables were consumed, an ANCOVA design was used. The first independent variable, group assignment, was categorical and the dependent variable of number of days participant consumed five or more fruits and vegetables was continuous. There were three levels of group assignment: treatment group, wait-list control group, and population control group.

The initial model for the number of days a participant consumed five or more fruits and vegetables contained all hypothesized main effects (age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, number of days five or more fruits and vegetables were consumed at pre-test, nutrition intention at pre-test, and nutrition intention at post-test) and the interaction of group assignment with each of the main effects. The interaction model explained significantly more variation (74.8%) in post-test intention than did the model using only main effects (67.0%).

Overall, the fit of the parsimonious main effects model for the number of days participants consumed five or more fruits and vegetables was significant.

Group assignment, the number of days participants consumed five or more fruits and vegetables per day at pre-test, and nutrition intention at post-test, explained 69.6% of the variation for the number of days a participant consumed five or more fruits and vegetables, $F = (6, 168) = 64.066$, $MSE = 21.310$, $p < .001$.

In order to check the assumptions for ANCOVA, the results from the Levene's test for homogeneity of variances and the K-S test for normality of residuals were checked. The results of the Levene's test was not significant (F (2, 172) = 1.437, $p = 0.240$). This implies that the variance was equal across all groups. The results of the K-S test were not significant ($p = 0.024$), indicating that the model's residuals were not normally distributed. ANCOVA is robust to this violation (Garson, 2012).

Control variables included the number of days a participant consumed five or more fruits and vegetables per day at pre-test and nutrition intention at post-test. As shown in Table 13, when controlling for all other variables, there was an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables among those who intended to consume five or more fruits and vegetables one day per week, $F = (2, 26) = 3.707$, $MSE = 27.218$, $p = 0.041$. There was not an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables among those who intended to consume five or more fruits and vegetables two days per week, $F = (2, 39) = 3.129$, $MSE = 110.511$, $p = 0.055$. There was an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables among those who intended to consume five or more fruits and vegetables two days per week, $F = (2, 102) = 8.844$, $MSE = 204.923$, $p < .001$.

Among those who intended to consume five or more fruits and vegetables one day per week, the number of days participants consumed five or more fruits and vegetables in the treatment group is not higher than the wait-list control group or the population control group. The estimated marginal means ranged from 3.497 to 7.674. The control groups are not different. Among those who intended to consume five or more fruits and vegetables two days per week, the number of days they consumed five or more fruits and vegetables in the treatment group is not higher than the population control group or the wait-list control group. The control groups are not different. The estimated marginal means ranged from 11.343 to 18.003. Among those who intended to consume five or more fruits and vegetables three days per week, the number of days they consumed five or more fruits and vegetables in the treatment group (EMM = 23.072) is higher than the population control group (EMM = 18.528, $p < .001$) and the wait-list control group (EMM = 19.713, $p = 0.022$). The control groups are not different.

Additional analyses were run for the interaction effects. As shown in Table 14, the first analysis pertained to the treatment group. Variables included the number of days a participant consumed five or more fruits and vegetables at pre-test, and nutrition intention at post-test. When controlling for all other variables, nutrition intention at post-test is positively related to the number of days a participant consumed five or more fruits and vegetables ($B = 6.093$, $t = 5.026$, $p < .001$). The number of days a participant consumed five or more fruits and vegetables at pre-test is not related to the number of days a participant consumed five or more fruits and vegetables ($B = 0.377$, $t = 0.952$, $p = 0.346$). This model explained 41.2% of the variation in the number of days five or more fruits and vegetables were consumed.

The second analysis pertained to the wait-list control group. Control variables included group assignment, the number of days a participant consumed five or more fruits and vegetables at pre-test, and nutrition intention at post-test. When controlling for all other variables, nutrition intention at post-test is positively related to the number of days a participant consumed five or more fruits and vegetables ($B = 5.478$, $t = 5.074$, $p < .001$). The number of days a participant consumed five or more fruits and vegetables at pre-test is positively related to the number of days a participant consumed five or more fruits and vegetables ($B = 2.009$, $t = 4.789$, $p < .001$). This model explained 65.4% of the variation in the number of days five or more fruits and vegetables were consumed.

The third analysis pertained to the population control group. Control variables included group assignment, the number of days a participant consumed five or more fruits and vegetables at pre-test, and nutrition intention at post-test. When controlling for all other variables, nutrition intention at post-test is positively related to the number of days a participant consumed five or more fruits and vegetables ($B = 3.447$, $t = 4.497$, $p < .001$). The number of days a participant consumed five or more fruits and vegetables at pre-test is positively related to the number of days a participant consumed five or more fruits and vegetables (B = 2.665, t = 9.062, $p < .001$). This model explained 78.1% of the variation in the number of days five or more fruits and vegetables were consumed.

The effect of participation in the Fit 49 Challenge on the number of days participants consumed five or more fruits and vegetables is dependent on the number of days participants consumed five or more fruits and vegetables per day at pre-test and nutrition intention at post-test. Among those who intended to consume five or more fruits and vegetables one or three days per week, there was an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables. Among those who intended to consume five or more fruits and vegetables two days per week, there was not an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables.

Summary of Results

Physical Activity Intention

A primary purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more physical activity intention at post-test than would those who did not participate in the Fit 49 Challenge. When controlling for physical activity attitudes at pre-test and sex, there was an effect on physical activity intention at post-test among those with lower physical activity intention at pre-test but not among those with higher physical activity intention at pre-test.

A change did occur in physical activity intention from pre-test to post-test for each of the three groups. The change in the treatment group was negative and the change in the wait-list and population control groups was positive. The effect of participation in the Fit 49 Challenge on physical activity intention at post-test is dependent upon physical activity intention at pre-test, attitudes at pre-test, sex, and group assignment. Among participants with lower intention, those in the treatment group did have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups. Among participants with higher intention, those in the treatment group did not have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups.

10,000 Step Days

A second purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more 10,000 step days than would those who did not participate in the Fit 49 Challenge. Overall the number of days a participant walked 10,000 steps at pre-test, group assignment, and physical activity intention at post-test helped explain the variation for the number of days that 10,000 steps were taken.

Among those who intended to walk one, two, or four days of 10,000 steps per week, there was an effect of group assignment on the number of days a participant took 10,000 steps. The treatment group had more days of 10,000 steps than the control groups. Among those who intended to walk three days of 10,000 steps per week, there was not an effect of group assignment on the number of days a participant took 10,000 steps.

Nutrition Intention

A third purpose of this investigation was to determine if participants who received a challenge to consume five or more fruits and vegetables per day, five days per week for weeks would have higher nutrition consumption intention at the end of the Fit 49 Challenge than would those who did not have the Challenge. Overall, nutrition intention at pre-test, attitudes, and the interaction of group assignment and nutrition norms at pre-test helped explain the variation for nutrition intention at post-test. When controlling for nutrition intention at pre-test and nutrition norms, sex had an effect on nutrition intention at post-test among those with lower nutrition intention at pre-test. When controlling for nutrition intention at pre-test and nutrition norms at pre-test, sex did not have an effect on nutrition intention at post-test among those with higher nutrition intention at pre-test.

The effect of participation in the Fit 49 Challenge on nutrition intention at post-test is dependent on group assignment, nutrition intention at pre-test, attitudes, and norms. Among those participants with lower nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants who were in the wait-list and population control groups. Among those participants with higher nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants who were in the wait-list and population control groups.

Days of Fruit and Vegetable Consumption

A fourth purpose of this investigation was to determine if participants who took part in the Fit 49 Challenge would have more days of consuming five or more fruits and vegetables than would those who did not take part in the Fit 49 Challenge. Overall, the number of days participants consumed five or more fruits and vegetables at pre-test and nutrition consumption intention at post-test significantly explained the variation for the number of days a participant consumed five or more fruits and vegetables during the Fit 49 Challenge. Among those who intended to consume five or more fruits and vegetables one or three days per week, there was an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables. Among those who intended to consume five or more fruits and vegetables two days per week, there was not an effect of group assignment on the number of days a participant consumed five or more fruits and vegetables.

The purpose of this investigation is to increase physical activity levels and fruit and vegetable consumption of university employees through the use of a worksite wellness intervention and to examine the effects of participation in a physical activity and nutrition program called the Fit 49 Challenge.

CHAPTER V:

DISCUSSION

One hundred seventy-five faculty and staff members of a university in the Southeast participated in the Fit 49 Challenge. Ninety-seven participants were randomized into two groups: treatment and wait-list. A second control group was randomly selected from the overall employee base. All participants were asked to complete a pre- and post-test Theory of Planned Behavior Survey, wear a pedometer for seven weeks, and record their steps and consumption of fruits and vegetables for seven weeks.

Physical Activity Intention

A primary purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more physical activity intention at post-test than would those who did not participate in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, and physical activity intention at pre-test, a person who participated in the Fit 49 Challenge would have higher physical activity intention at post-test than would a person who did not participate in the Fit 49 Challenge. The effect of participation in the Fit 49 Challenge on physical activity intention at post-test is dependent on physical activity intention at pre-test, attitudes, sex, and group assignment. Among participants with lower intention, those in the treatment group did have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups, when controlling for physical activity attitudes and sex. Among participants with higher intention, those in the treatment group did not have higher physical activity intention at post-test than did those participants who were in the wait-list and population control groups, when controlling for physical activity attitudes at pre-test and sex.

10,000 Step Days

A second purpose of this investigation was to determine if participants who participated in the Fit 49 Challenge would have more days of 10,000 steps than would those who did not participate in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, physical activity intention at pre-test, and physical activity intention at post-test, a person who participates in the Fit 49 Challenge would complete more days of 10,000 steps than would a person who did not participate in the Fit 49 Challenge.

The effect of participation in the Fit 49 Challenge on the number of days participants took 10,000 steps is dependent on group assignment, the number of days participants took 10,000 steps at pre-test, and physical activity intention at post-test. Participants who were in the treatment group of the Fit 49 Challenge did take more days of 10,000 steps than did those who were in the wait-list and population control groups if they had intended to walk one, two, or four days of 10,000 steps per week.

Nutrition Intention

A third purpose of this investigation was to determine if participants who received a challenge to consume five or more fruits and vegetables per day, five days per week for five weeks would have higher nutrition consumption intention at the end of the Fit 49 Challenge than would those who did not participate in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, intention to consume five or more fruits and vegetables at pre-test, perceived behavioral control, attitudes, and subjective norms, a person who participated in the Fit 49 Challenge would have higher nutrition consumption intention at post-test than would a person who did not participate in the Fit 49 Challenge.

The effect of participation in the Fit 49 Challenge on nutrition intention at post-test is dependent on group assignment, nutrition intention, attitudes, and norms. Among those participants with lower nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants who were in the wait-list and population control groups. Among those participants with higher nutrition intention at pre-test, those in the treatment group did not have higher nutrition intention at post-test than did those participants in the wait-list and population control groups.

Days of Fruit and Vegetable Consumption

A fourth purpose of this investigation was to determine if participants who took part in the Fit 49 Challenge would have more days of consuming five or more fruits and vegetables than would those who did not take part in the Fit 49 Challenge. It was hypothesized that when controlling for age, sex, employee classification, perceived behavioral control, attitudes, subjective norms, nutrition intention at pre-test, and nutrition intention at post-test, a person who participated in the Fit 49 Challenge would complete more days of five or more fruits and vegetables consumption than would a person who did not participate in the Fit 49 Challenge.

The effect of participation in the Fit 49 Challenge on the number of days participants consumed five or more fruits and vegetables is dependent on the number of days participants consumed five or more fruits and vegetables at pre-test and nutrition intention at post-test. When controlling for the number of days a participant consumed five or more fruits and vegetables, group assignment did have an effect on the number of days a participant consumed five or more fruits and vegetables among those who intended to consume five or more fruits and vegetables one or three days per week, but not among those who intended to consume five or more fruits and vegetables two days per week.

Outcomes

Though the results of the Fit 49 Challenge may not be the same as those presented in other studies, it was created as a theory-based intervention so that its results would allow practitioners to conduct more effective interventions in the future (Tavares et al., 2009).

Several interesting occurrences took place during the Fit 49 Challenge. An increase in physical activity intention occurred at post-test among those participants with low physical activity intention at pre-test. A decrease in physical activity intention occurred at post-test among those participants with high physical activity intention at pre-test. Sex had an effect on nutrition intention at post-test among those with low nutrition intention at pre-test, but did not have an effect on nutrition intention at post-test among those with high nutrition intention at pre-test. An increase in physical activity perceived behavioral control and nutrition perceived behavioral occurred from pre-test to post-test. Though participants felt an increase in behavioral control of their physical activity and nutrition habits, those with higher intention at pre-test intended to walk fewer 10,000 step days and consume fewer days of fruit and vegetable consumption at post-test. Though an increase in perceived behavioral control occurred, it did not have significant effects on physical activity intention at post-test nor nutrition intention at post-test. Norms had a significant effect on nutrition intention at post-test only for the treatment group.

One possible reason for the decline of physical activity intention from pre-test to post-test among those with high pre-test physical activity intention is fatigue. Once the participants in the treatment group had completed their five week Fit 49 Challenge, it is possible that they no longer desired to make the effort to walk 10,000 steps per day or consume five or more fruits and vegetables, five days per week. Additionally, prior to the Fit 49 Challenge, it is possible that the participants knew that their challenge would be to walk 10,000 steps per day, five days per week because of a fall intervention called "Walktober." Many of the participants who took part in "Walktober" had high intentions to complete a challenge during the spring semester. It is encouraging that participation in a program similar to the Fit 49 Challenge can increase physical activity intention among those with initially low physical activity intention.

Oftentimes, studies fail to attempt the prediction of specific physical activity behaviors, such as taking 10,000 steps per day. This study did attempt to predict specific physical activity behaviors and nutrition behaviors, but information may be misleading because only one item per intention construct was able to be used in the analysis. The use of a single item as an outcome measure often limits the use of the Theory of Planned Behavior when predicting behavior modifications (Scott et al., 2007).

In other studies using the Theory of Planned Behavior, the use of past behavior has added a significant increase in explained variance. In models using TPB constructs, intention and perceived behavioral control have been found to be significant predictors. Because so much of walking is not necessarily for exercise, people tend to underreport how much they walk. Additionally, people tend to report what they plan and the Theory of Planned Behavior is used for predicting planned behavior. In both of Scott's (2007) studies, intention was most strongly predicted by attitude and perceived behavioral control. Subjective norms did little to explain the variance. In the Fit 49 Challenge, the attitudes of treatment participants may not have changed significantly if they did not read the weekly articles emphasizing the benefits which accompany increased physical activity and fruit and vegetable consumption. As was found in Scott's studies, subjective norms did not provide much prediction of behavior intention.

Attitudes, norms, nor perceived behavioral control seemed to have significant effects on the number of days participants consumed five or more fruits and vegetables or the number of days participants walked 10,000 steps.

Theoretical constructs that appear to be useful in improving physical activity intention are pre-test intention and attitudes. Theoretical constructs that do not appear to be useful in improving physical activity intention are subjective norms and perceived behavioral control. For nutrition intention, useful theoretical constructs are intention at pre-test and subjective norms. Theoretical constructs that are not useful for predicting nutrition intention include attitudes and perceived behavioral control.

Theoretical constructs that appear to be useful in improving physical activity behavior are intention only. Theoretical constructs that do not appear to be useful in improving physical activity behavior are attitudes, subjective norms, and perceived behavioral control. For predicting nutrition behavior, useful theoretical constructs are pre-test intention and subjective norms. Theoretical constructs that do not appear to be useful in improving nutrition behavior include attitudes and perceived behavioral control.

One of the unmeasured results of the Fit 49 Challenge was the interest of the participants. They were very interested in the results of their participation, specifically their physical activity habits. Participants also reacted to the Fit 49 Challenge by describing to the investigator the benefits they received from the pedometer-based feedback. They enjoyed participation so much so that approximately 30 participants purchased their pedometers at the end of the Fit 49 Challenge.

Limitations

There are a few limitations in this study that are common in many studies similar to this one. One potential limitation is the self-reported steps taken by the individuals. Although a pedometer was used, it was left to the participant to be honest in reporting these numbers.

A second potential limitation was that additional motivation was provided to the treatment group through wellness points upon completion of the Fit 49 Challenge. Wellness points add up throughout the academic year and lead to savings on health insurance. Although, they were randomized into treatment and wait-list participants, all of the participants were volunteers in those groups.

A third potential limitation is the length of the intervention. Five weeks may be too short of a time period to create significant lifestyle changes in physical activity and fruit and vegetable consumption.

Body Mass Index (BMI) is a commonly used outcome measure used to determine one's body composition. BMI was calculated for each participant, but was not used in the analysis because participation in the Fit 49 Challenge did not address body composition or body fat percentage. The purpose of this analysis was to determine the affects of participation in the Fit 49 Challenge and not the change that may have taken place in participants' body composition. The use of calculating BMI in this analysis provides more information on the participating population.

Although there are always limitations in studies, there are also positive elements to each study as well. One positive element of this study was the use of a validated and reliable instrument to measure physical activity. The HJ-303 pedometer is easy to use and created very little additional effort on the part of the participant. A second positive element of this study is the use of a randomized population control group to compare to the treatment group. This allowed the investigator to determine significant differences between the treatment, wait-list, and population control groups.

Future Recommendations

If the Fit 49 Challenge were to be conducted again, certain changes should be made to improve the efficiency of data collection. Instead of providing a reporting website link and allowing participants to report their steps and nutrition consumption at their convenience, it is strongly recommended that a weekly deadline be established. If the deadline passes and participants failed to report their data, he or she would have to contact the investigator directly to report their steps. Approximately 21 participants dropped out of the Fit 49

Challenge between the beginning and end of the five-week period. If the participants had been required to meet a weekly deadline, the attrition rate might have been decreased.

Another change that would have benefited the investigation would be the requirement of seven days of data instead of only five days. The challenge would still have been to consume five or more fruits and vegetables per day for five days per week and to walk 10,000 steps five days per week, but the participants would be required to wear the pedometer for seven days and report the data for each day. This requirement of seven days would have allowed the trip meter on the pedometer to be checked. This would have increased the internal validity of the investigation. During the actual investigation, people may have worn the pedometer for seven days, but reported only five days of data. This made it difficult to use the tripometer data for all participants.

The results of the Fit 49 Challenge contribute to literature through the use of determining future behavior by using intention and attitude constructs to determine future behavior. Investigators conducting the Fit 49 Challenge only attempted to measure behavioral intention and determine its role in behavior change. Researchers could use the foundation of this study to modify a participant's intention to be physically active or to consume more nutritious foods by attempting to improve the participant's attitudes and perceived behavioral control. If these two constructs were improved, a participant's intention is more likely to improve and therefore their behaviors are more likely to improve as well.

More can be added to the body of literature if investigators of future studies attempt to improve the constructs which lead to changes in behavioral intention.

WORKS CITED

Abood, D., Black, D., & Feral, D. (2003). Nutrition education worksite intervention for university staff: application of the health belief model. *Journal of Nutrition Education and Behavior, 35*(5), 260-267.

ACSM position stand on physical activity and weight loss. (2009, January 29). Retrieved from http://www.acsm.org/am/template.cfm?section=home_page template=/cm/contentdisplay.cfm&contentid=12153

Aldana, S. (2007). The Costs of Unhealthy Behaviors. WELCOA's Absolute Advantage Magazine, *6*(4), 22-29.

Altman, J. U.S. Department of Agriculture, Food and Nutrition Service, (2008). *Increasing fruit and vegetable consumption through the USDA nutrition assistance program: A progress report*. Retrieved from website: http://www.fns.usda.gov/ora/menu/Published/NutritionEducation/Files/fruit_veggie_report.pdf

American College Health Association (2009). American College Health Association-National College Health Assessment II: Reference Group Executive Summary Fall 2009. Linthicum, MD: *American College Health Association*. Retrieved from http://www.achancha.org/docs/ACHA-NCHA_Reference_Group_ExecutiveSummary_Fall2009.pdf

Atlantis, E., Chow, C., Kirby, A., & Fiatarone Singh, M. (2006). Worksite intervention effects on physical health: a randomized controlled trial. *Health Promotion International, 21*(3), 191-200. doi:10.1093/heapro/dal012.

Baker, S. (2008, August 28). *U.S. national health spending, 2006.* Retrieved from http://hspm.sph.sc.edu/courses/econ/classes/nhe06/

Banham, R. (2010). The financial virtue of wellness: Corporate fitness and health programs seem to be paying off in bottom-line value as well as in Improved productivity. *Treasury & Risk*, May 2010, p. *36*.

Blanchard, C., Fisher, J., Sparling, P., Nehl, E., Rhodes, R., Courneya, K. (2008). Understanding Physical Activity Behavior in African American and Caucasian College Students: An Application of the Theory of Planned Behavior. *Journal of American College Health, 56*(4), 341-346.

Brownson, R., & Boehmer, T. Institute of Medicine, Physical Activity, Health, Transportation, and Land Use. (n.d.). Retrieved from http://onlinepubs.trb.org/onlinepubs/archive/downloads/sr282papers/sr282Brownson.pdf

Busbin, J. & Campbell, D. (1990). Employee wellness programs: A strategy for increasing participation. *Journal of Health Care Marketing, 10(4)*, 22-30.

Byrd, K., Silliman, K., & Neyman Morris, M. (2008). Impact of a three-year worksite wellness program on employee blood lipid levels. *Californian Journal of Health Promotion*, *6*(1), 49-56.

Caperchione, C., Duncan, M., Mummery, K., Steele, R., & Schofield, G. (2008). Mediating relationship between body mass index and the direct measures of the Theory of Planned Behaviour on physical activity intention. *Psychology, Health & Medicine, 13*(2), 168-179. doi:10.1080/13548500701426737.

Centers for Disease Control and Prevention. (2011a). *Deaths and Mortality.* Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/nchs/fastats/deaths.htm.

Centers for Disease Control and Prevention. (2011b). *Chronic Diseases and HealthPromotion.* Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/chronicdisease/overview/index.htm.

Centers for Disease Control and Prevention. (2011c). *Healthy people 2020 objectives: Nutrition and Weight Status.* Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=29

Centers for Disease Control and Prevention. (2011d). *CDC's lean works! A Workplace obesity prevention program.* Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/leanworks/

Centers for Disease Control and Prevention. *How much physical activity do adults need?* (2011e). Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html

Centers for Disease Control and Prevention. *Leading causes of death* (2011f). Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/nchs/fastats/lcod.htm

Centers for Disease Control and Prevention. *Overweight and obesity: Economic consequences* (2011g). Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/obesity/causes/economics.html

Centers for Disease Control and Prevention. *Healthy people 2020 objectives: Physical Activity* (2011j). Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=33

Chapman, L., Whitehead, D., & Connors, M. (2008). The changing role of incentives in health promotion and wellness. *American Journal of Health Promotion, 23*(1), 1-11.

Chung, M., Melnyk, P., Blue, D., Renaud, D., & Breton, M.C. (2009). Worksite health promotion: The value of the tune up your heart program. *Population Health Management, 12*, 297-304.

Church, T., Thomas, D., Tudor-Locke, C., Katzmarzyk, P., Earnest, C. (2011). Trends over 5 Decades in U.S. Occupation-Related Physical Activity and Their Associations with Obesity. *PLOS ONE 6*(5): e19657. doi:10.1371/journal.pone.0019657.

Chyou, P., Scheur, D., and Linneman, J. (2006). Assessment of female participation in an employee 20-week walking incentive program at Marshfield Clinic, a large multispecialty group practice. *Clinical Medicine & Research*, *4*(4), 256-265.

Corporate fitness programs create healthier employees. (2005). *Claims*, *53*(1), 12.

Cox, M., Shephard, R., & Corey, P. (1981). Influence of an employee fitness Programme upon fitness, productivity, and absenteeism. *Ergonomics, 24,* 795-806.

Crouter, S., Schneider, P., Karabulut, M. & Bassett, D. (2005). Validity of 10 electronic pedometers for measuring steps, distance, and energy cost. *Medicine and Science in Sports and Exercise, 35*(8), 1455-60.

Daddario, D. (2007). A review of the use of the health belief model for weight management. *MEDSURG Nursing, 16*(6), 363-366.

DeMoranville, C. , Schoenbachler, D. , & Przytulski, J. (1998). Wellness at work. *Marketing Health Services, 25(2),*15-23.

Dishman, R., Oldenburg, B., O'Neal, H., & Shephard, R. (1998). Worksite physical activity interventions. *American Journal of Preventative Medicine, 15*(4), 344-361.

Dump, C. (2009 Feb. 23) Insurance firms track effectiveness of wellness programs: Taking preventive action drives down risks and claims. *San Diego Business Journal, 30*(8), 22.

Employee health promotion: A guide for starting programs at the workplace. (1983). Seattle, WA: Health Works Northwest.

Engbers L., Van Poppel M., Chin A., Paw M., Van Mechelen W. (2005). Worksite health promotion programs with environmental changes: A systematic review. *American Journal of Preventative Medicine, 29*(1), 61–70.

Fielding, J. (1982). Effectiveness of employee health improvement programs. *Journal of Occupational Medicine, 24,* 907-916.

Finkelstein, E., Trogdon, J., Cohen, J., Dietz, W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. *Health Affairs (Project Hope), 28*(5), 822-831.

Fletcher, G., Barrens, T., & Domina, L. (2008). Barriers and enabling factors for work-site physical activity programs: A qualitative examination. *Journal of Physical Activity and Health, 5,* 418-429.

Francis, J., Eccles, M., Johnston, M., Walker, A., Grimshaw, J., Foy, R., Kaner, E., Smith, L. & Bonetti, D. (2004). Constructing questionnaires based on the theory of planned behavior: A manual for health services researchers (0-9540161-5-7). United Kingdom: Quality of Life Management of Living Resources. Retrieved from http://www.rebeqi.org/ViewFile.aspx?itemID=212

Garson, G. (2012, January 26). *Univariate GLM, ANOVA, and ANCOVA.* Retrieved from http://faculty.chass.ncsu.edu/garson/PA765/anova.htm

Gebhardt, D., & Crump, C. (1990). Employee fitness and wellness programs in the workplace. *American Psychologist, 45*(2), 262-272.

Gibbs, J., Mulvaney, D., Hencs, C., & Reed, R. (1985). Work-site health promotion. *Journal of Occupational Medicine, 27(11),* 826-830.

Gilson, N., Brown, W., Faulkner, G., McKenna, J., Murphy, M., Pringle, A., Proper, K., Puig-Ribera, A., & Stathi, A. (2009). The International Universities Walking Project: Development of a Framework for Workplace Intervention Using the Delphi Technique. *Journal of Physical Activity and Health, 6*(4), 520-528.

Glanz, K., Rimer, B., and Viswanath, K. (2008). *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed). San Francisco: Jossey-Bass.

G*Power (Version 2) [Computer software]. Retrieved from http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/

Haines, D. , Davis, L., Rancour, P., Robinson, M., Ned-Wilson, T., & Wagner, S. (2007). A pilot intervention to promote walking and wellness and to improve the health of college faculty and staff. *Journal of American College Health*, *55*(4), 219-225.

Hatano, Y. (1997). Prevalence and use of pedometer. *Research Journal of Walking*, *1*(45), 54.

Higgins, W. (1986). Evaluating wellness programs. *Health Values,10*(6), 44-51.

Holbrook, E., Barreira, T., & Kang, M. (2009). Validity and Reliability of Omron Pedometers for Prescribed and Self-Paced Walking. *Medicine & Science in Sports & Exercise, 41*(3), 669-674.

Justice, G. (2010). Corporate fitness as a profit center for clubs. *Club Industry*, Retrieved from http://thefitnessbootcampclub.com/bootcamp-marketing/corporatefitness-as-a-profit-center-for-clubs .

Kang, M., Marshall, S., Barreira, T., & Lee, J. (2009). Effect of Pedometer-Based Physical Activity Interventions: A Meta-Analysis. *Research Quarterly for Exercise and Sport, 80*(3), 648–655.

Kwan, M., Bray, S., & Martin Ginis, K. (2009). Predicting Physical Activity of First-Year University Students: An Application of the Theory of Planned Behavior. *Journal ofAmerican College Health, 58*(1), 45-55.

Le Masurier, G., Lee, S., & Tudor-Locke, C. (2004). Motion Sensor Accuracy under controlled and free-living conditions. *Medicine & Science in Sports & Exercise,* 905-910.

Lezin, N. (n.d.). Theories & approaches: theory of reasoned action. Retrieved from http://www.etr.org/recapp/index.cfm?fuseaction=pages.TheoriesDetail&PageID=517

Linnan, L. (2010). The business case for employee health: What we know and what we need to do. *North Carolina Medical Journal, 71*(1), 69-74.

Marshall, L. (2008) Health clubs pumped up by wellness trend. *ColoradoBiz, 35*(9), 52.

Martin, J., & Kulinna, P. (2004). Self-efficacy theory and the theory of planned behavior: Teaching physically active physical education classes. *Research Quarterly for Exercise and Sport, 75*(3), 288-297.

Maruyama, C., Kimura, M., Okumura, H., Hayashi, K., & Arao, T. (2010). Effect of a worksite based intervention program on metabolic parameters in middle-aged male white collar workers: A randomized controlled trial. *Journal of Preventative Medicine*, *51*, 11-17.

Minino A. & Smith L. (2001). National Center for Health Statistics, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. "Death Preliminary Data for 2000." *National Vital Statistics Report, 49*(12).

Morton, J. (2011). Working up a sweat. *Buildings, 4*(11*)*, 40-42.

National Heart, Lung, and Blood Institute, (2003). *Portion distortion interactive quiz*. Retrieved from website: http://hp2010.nhlbihin.net/portion/portion.cgi?action=question&number=1

Neville, B., Merrill, R., & Kumpfer, K. (2010). Longitudinal outcomes of a comprehensive, incentivized worksite wellness program. *Evaluation & the HealthProfessions, 34*(1), 103-123.

Omron Global. (n.d.). Retrieved from http://omron.com/

Perez, A., Phillips, M., Cornell, C., Mays, G., & Adams, B. (2009). Promoting dietary change among state health employees in Arkansas through a worksite wellness program: The healthy employee lifestyle program (HELP). *Preventing Chronic Disease: Public Health Research, Practice, and Policy, 6*(4), 1-8.

Pitting fruit against cancer (2011). *EatingWell*, (4),14. Retrieved from http://www.eatingwell.com/nutrition_health/nutrition_news_information/promising_news_about_link_between_cancer_and_fruit

Pratt, D., Jandzio, M., Tomlinson, D., Kang, X., & Smith, E. (2006). The 5-10-25 challenge: An observational study of a web-based wellness intervention for a global workforce. *Disease Management, 9*(5), 284-290.

Pressler, A., Knebel, U., Esch, S., Kölbl, D., Esefeld, K., Scherr, J., & Leimeister, J. (2010). An internet-delivered exercise intervention for workplace health promotion in overweight sedentary employees: A randomized trial. *Journal of Preventive Medicine, 51*(3/4), 234-239. doi:10.1016/j.ypmed.2010.07.008

Rainone, C. (Producer). (2010, September 21). Obesity's sick days [Audio Podcast]. CUNY Radio. Retrieved from http://www1.cuny.edu/mu/podcasts/2010/09/21/obesity%E2%80%99s-sick-days/

Rimer, B., & Glanz, K. (2005). U.S. Department of Health and Human Services, National Institutes of Health. (2005). Theory at a glance: A guide for health promotion practice (2nd ed.). Retrieved from http://www.cancer.gov/theory.pdf.

Rooney, B., Smalley, K., Larson, J., & Havens, S. (2003). Is knowing enough? Increasing physical activity by wearing a pedometer. *Wisconsin Medical Journal, 102*(4), 31-36.

Rubin, D. & Van der Laan, M., (2008). Covariate Adjustment for the Intention-to-Treat Parameter with Empirical Efficiency Maximization. *U.C. Berkeley Division of Biostatistics Working Paper Series.* Working Paper 229. Retrieved from http://biostats.bepress.com/ucbbiostat/paper229

Schneider, P., Crouder, S., Lukajic, O., & Bassett D. (2003). Accuracy and reliability of 10 pedometers for measuring steps over a 400-meter walk. *Medicine & Science in Sports& Exercise, 35*(10), 1779-84.

Scott, E., Eves, F., French, D., & Hoppe, R. (2007). The theory of planned Behavior predicts self-reports of walking, but does not predict step count. British Journal of Health Psychology, *12*, 601-620.

Serxner , S. (1990). Organizational contraction and participation in worksite weight control programs: A pilot study. *American Journal of Health Promotion, 5*(1), 44-51.

Siegal, J., Prelip, M., Erausquin, J., & Kim, S. (2010). A worksite obesity intervention: Results from a group-randomized trial. *American Journal of Public Health, 100*(2), 327-333.

Steeves, J., Tyo, B., Connolly, C., Gregory, D., Stark, N., & Bassett, D. (2011). Validity and reliability of the Omron HJ-303 tri-axial accelerometer-based pedometer. *Journal of Physical Activity and Health, 2011*(8), 1014 -1020.

Tavares, L., Plotnikoff, R., & Loucaides, C. (2009). Social-cognitive theories for predicting physical activity behaviours of employed women with and without young children. *Psychology, Health & Medicine, 14*(2), 129-142.

Thompson, P. (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease. *Arteriosclerosis, Thrombosis, and Vascular Biology*, *23*(8), 1319-1321.

Touger-Decker, R., O'Sullivan-Maillet, J., & Byham-Gray, L. (2008). Wellness in the workplace: a 12-week wellness program in an academic health sciences university. *Topics in Clinical Nutrition*, *23*(3), 244-251.

Tudor-Locke, C., & Bassett Jr., D. (2004). How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Medicine, 34*(1), 1-8.

Tudor-Locke, C., Hatano, Y., Pangrazi, R., & Kang, M. (2008). Revisiting how many steps are enough? *Medicine and Science in Sports & Exercise, 40*(7S), S537-S543.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.

Vansickle, J., Hancher-Rauch, H., & Hicks, L. (2010). Designing a university-wide fitness program to promote campus health and department image. *Journal of Physical Education, Health, Recreation, and Dance, 81*(1), 27-32.

WELCOA's seven benchmarks: Carefully crafting an operating plan (n .d.). Retrieved from http://www.welcoa.org/wellworkplace/index.php?cat=2&page=11

Wellness watch: Small businesses can benefit from wellness initiatives. (2006). *Employee Benefit News*, ITEM06305010.

White, K., & Jacques, P. (2007). Combined diet and exercise intervention in the workplace: Effects on cardiovascular disease risk factors. *AAOHN Journal*, *55*(3), 109-114.

Winick, C., Rothacker, D., & Norman, R. (2002). Four worksite weight loss programs with high-stress occupations using a meal replacement product. *Occupational Medicine, 52*(1), 25-30.

Yancey, A., Lewis, L., Guinyard, J., Sloane, D., Nascimento, L., Galloway-Gilliam, L., & McCarthy, W. (2006). Putting promotion into practice: The African-Americans building a legacy of health organizational wellness program. *Health Promotion Practice, 7*(3), 233-246.

APPENDICES

APPENDIX A

Figure 1: Theory of Reasoned Action

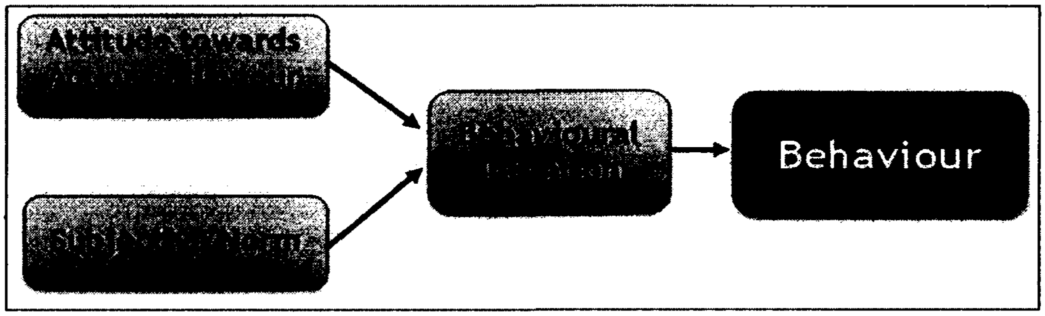
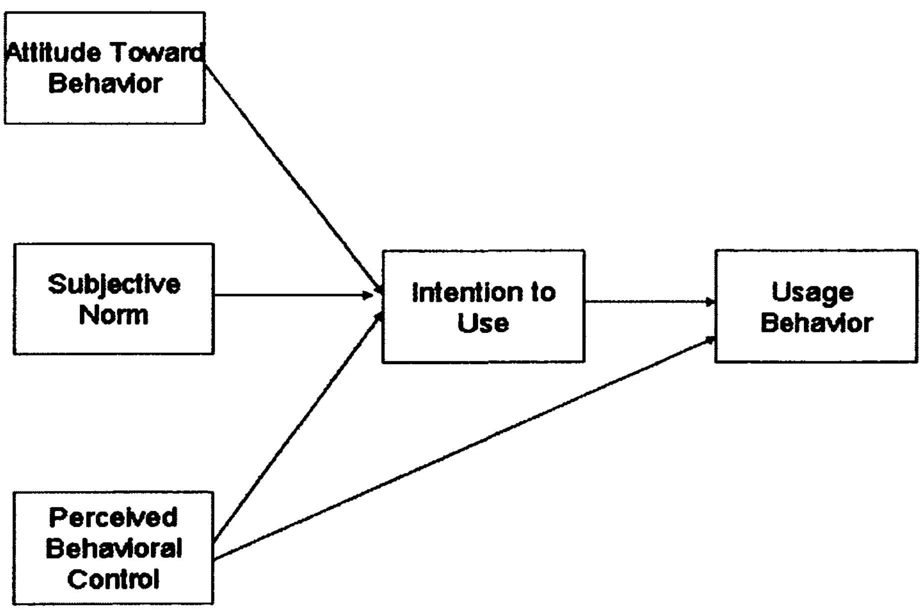


Figure 2: Theory of Planned Behavior



APPENDIX B

Servings sizes for Fruits and Vegetables:

Fruit: any fruit or 100% fruit juice counts as part of the Fruit Group. Fruits may be fresh, canned, frozen, or dried, and may be whole, cut-up, or pureed.

Serving of fruit: In general, 1 cup of fruit or 100% fruit juice, or ½ cup of dried fruit can be considered as 1 cup from the Fruit Group. The following specific amounts count as 1 cup of fruit (in some cases equivalents for ½ cup are also shown) towards your daily recommended intake. Need more examples? Click HERE.

Vegetable: Any vegetable or 100% vegetable juice counts as a member of the Vegetable Group. Vegetables may be raw or cooked; fresh, frozen, canned, or dried/dehydrated; and may be whole, cut-up, or mashed.

Serving of vegetables: In general, 1 cup of raw or cooked vegetables or vegetable juice, or 2 cups of raw leafy greens can be considered as 1 cup from the Vegetable Group. The chart lists specific amounts that count as 1 cup of vegetables (in some cases equivalents for ½ cup are also shown) towards your recommended intake. Need more examples? Click HERE.

All information taken from the United States Department of Agriculture.

APPENDIX C

FIT 49 Survey

1. For me, taking 10,000 steps per day (at least 5 days per week) would:
    a. Be great for my health
    b. Be good for my health
    c. Have no impact on my health
    d. Be bad for my health
    e. Be very bad for my health
2. For me, taking 10,000 steps per day (at least 5 days per week) would:
    a. Be an excellent use of effort
    b. Be a good use of effort
    c. Be neither good nor bad
    d. Be a poor use of effort
    e. Be a complete waste of effort
3. For me, taking 10,000 steps per day (at least 5 days per week) would:
    a. Be extremely satisfying
    b. Be somewhat satisfying
    c. Be neutral
    d. Be somewhat unsatisfying
    e. Be extremely unsatisfying
4. For me, taking 10,000 steps per day (at least 5 days per week) would:
    a. Greatly reduce my stress
    b. Somewhat reduce my stress
    c. Have no impact on my stress
    d. Somewhat increase my stress
    e. Greatly increase my stress
5. For me, NOT taking 10,000 steps per day (at least 5 days per week) would:
    a. Make me feel very unsatisfied
    b. Make me feel somewhat unsatisfied
    c. Not affect me
    d. Make me feel somewhat satisfied
    e. Make me feel very satisfied

6. For me, NOT taking 10,000 steps per day (at least 5 days per week) would mean:
    a. I'm very unhealthy
    b. I'm somewhat unhealthy
    c. I'm unaffected
    d. I'm somewhat healthy
    e. I'm very healthy
7. People who are important to me think my taking of 10,000 steps per day (at least 5 days per week) is:
    a. Very important
    b. Somewhat important
    c. Neither important nor unimportant
    d. Somewhat unimportant
    e. Very unimportant
8. People who are important to me think my taking of 10,000 steps per day (at least 5 days per week) is:
    a. Something I should do regularly
    b. Something I should do occasionally
    c. I have no opinion
    d. Something I should do rarely
    e. Something is should never do
9. People who are important to me think taking 10,000 steps per day (at least 5 days per week) is:**
    a. Something THEY do regularly
    b. Something THEY do occasionally
    c. No opinion
    d. Something THEY do rarely
    e. Something THEY never do
10. For me, taking 10,000 steps per day (at least 5 days per week) is:**
    a. Extremely easy
    b. Somewhat easy
    c. Neither easy nor difficult
    d. Somewhat difficult
    e. Extremely difficult

11. For me, taking 10,000 steps per day (at least 5 days per week) is:
    a. Totally in my control
    b. Somewhat in my control
    c. No opinion
    d. Rarely in my control
    e. Never in my control
12. For me, taking 10,000 steps per day (at least 5 days per week) is:**
    a. A high priority
    b. Something I intend to do
    c. No opinion
    d. Something I do not intend to do
    e. Something I will absolutely not do
13. On how many days during the week of March 4-10 do you intend to take 10,000 steps?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6
    h. 7
14. For me, eating 5 or more fruits/vegetables (at least 5 days per week) would:
    a. Be great for my health
    b. Be good for my health
    c. Have no impact on my health
    d. Be bad for my health
    e. Be very bad for my health
15. For me, eating 5 or more fruits/vegetables (at least 5 days per week) would:
    a. Be an excellent use of effort
    b. Be a good use of effort
    c. Be neither good nor bad
    d. Be a poor use of effort
    e. Be a complete waste of effort

16. For me, eating 5 or more fruits/vegetables (at least 5 days per week) would:
    a. Be extremely satisfying
    b. Be somewhat satisfying
    c. Be neutral
    d. Be somewhat unsatisfying
    e. Be extremely unsatisfying
17. For me, eating 5 or more fruits/vegetables (at least 5 days per week) would:
    a. Greatly reduce my stress
    b. Somewhat reduce my stress
    c. Have no impact on my stress
    d. Somewhat increase my stress
    e. Greatly increase my stress
18. For me, NOT eating 5 or more fruits/vegetables (at least 5 days per week) would: Make me feel very unsatisfied
    a. Make me feel somewhat unsatisfied
    b. Not affect me
    c. Make me feel somewhat satisfied
    d. Make me feel very satisfied
19. For me, NOT eating 5 or more fruits/vegetables (at least 5 days per week) would:
    a. I'm very unhealthy
    b. I'm somewhat unhealthy
    c. I'm unaffected
    d. I'm somewhat healthy
    e. I'm very healthy
20. People who are important to me think my eating of 5 or more fruits/vegetables (at least 5 days per week) is:
    a. Very important
    b. Somewhat important
    c. Neither important nor unimportant
    d. Somewhat unimportant
    e. Very unimportant

21. People who are important to me think my eating of 5 or more fruits/vegetables (at least 5 days per week) is:
    a. Something I should do regularly
    b. Something I should do occasionally
    c. I have no opinion
    d. Something I should do rarely
    e. Something is should never do
22. People who are important to me think eating 5 or more fruits/vegetables (at least 5 days per week) is:**
    a. Something THEY do regularly
    b. Something THEY do occasionally
    c. No opinion
    d. Something THEY do rarely
    e. Something THEY never do
23. For me, eating 5 or more fruits/vegetables (at least 5 days per week) is:
    a. Extremely easy
    b. Somewhat easy
    c. Neither easy nor difficult
    d. Somewhat difficult
    e. Extremely difficult
24. For me, eating 5 or more fruits/vegetables (at least 5 days per week) is:**
    a. Totally in my control
    b. Somewhat in my control
    c. No opinion
    d. Rarely in my control
    e. Never in my control
25. For me, eating 5 or more fruits/vegetables (at least 5 days per week) is:**
    a. A high priority
    b. Something I intend to do
    c. No opinion
    d. Something I do not intend to do
    e. Something I will absolutely not do

26. On how many days during the week of March 4-10 do you intend to eat five or more fruits and vegetables?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4
    f. 5
    g. 6
    h. 7

Thanks so much for taking your time to respond to the above survey!

**Items were not used in the analyses, due to inappropriate Cronbach alpha levels.

Table 1

Participant Characteristics, FIT 49 Challenge (N = 175)

Characteristic	*M*	*SD*
BMI	27.08	5.75
Age	44.81	13.24
	n	%
Gender		
Men	60	34.29
Women	115	65.71
Classification		
Faculty	77	44.00
Staff	98	56.00
Group		
Treatment	50	28.57
Wait-List Control	47	26.86
Population Control	78	44.57

Table 2

Pre- and Post- Scores for TPB Survey, FIT 49 Challenge (N = 175)

Characteristic	Pre-Test 1		Post-Test 1		Pre-Test 2		Post-Test 2		Pre-Test 3		Post-Test 3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Days ≥10,000 Steps Were Taken	1.38	1.71	2.78	2.22	1.13	1.47	1.66	1.82	1.36	1.82	1.41	1.64
Days ≥ 5 Fruits and Vegetables Were Consumed	2.20	2.00	4.08	1.46	2.45	1.84	3.66	1.75	2.50	2.04	3.09	1.69
Physical Activity Intention	3.58	0.95	3.12	1.19	3.83	0.43	2.91	1.23	3.04	1.19	2.58	1.25
Physical Activity Attitude	25.70	2.26	25.32	2.41	25.28	3.10	25.28	2.94	24.92	2.76	25.22	2.74
Physical Activity Norms	3.18	1.22	3.44	1.18	3.29	1.63	3.60	1.51	3.64	1.50	3.78	1.51
Physical Activity Perceived Behavioral Control	1.46	0.50	1.76	.77	1.62	0.71	1.91	.86	1.67	0.70	1.71	.74
Nutrition Intention	2.86	0.35	2.68	.65	2.89	0.31	2.43	.71	2.60	0.65	2.33	.78
Nutrition Attitude	25.70	2.08	25.14	2.54	25.74	2.49	25.00	2.47	25.18	2.43	24.83	2.38
Nutrition Norms	2.90	0.93	3.24	1.22	3.13	1.38	3.29	1.34	3.51	1.44	3.49	1.35
Nutrition Perceived Behavioral Control	1.18	0.39	1.52	.81	1.34	0.48	1.62	.74	1.31	0.49	1.47	.64

Note: 1 = Treatment Group, 2 = Wait-List Control Group, 3 = Population Control Group
Note: 1 (n = 50), 2 (n = 47), 3 (n = 78)

Table 3

Post-test Physical Activity Intention, FIT 49 Challenge (N = 175)

Characteristic	*M*	*S.E.*	*95% CI* Lower	Upper
1-3 Days Intention at Pre-test				
Treatment Group	3.723	.359	3.001	4.445
Wait-List Control Group	1.870	.420	1.024	2.715
Population Control	2.103	.185	1.730	2.477
4+ Days Intention at Pre-test				
Treatment Group	3.035	.188	2.660	3.407
Wait-List Control Group	3.210	.190	2.834	3.585
Population Control	3.085	.184	2.720	3.450

Note: Means are Estimated Marginal Means,
adjusted for Pretest Physical Activity Attitudes and Sex

Table 4

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Treatment Group (N = 50)

Variable	*B*	*SE B*	*p*
Treatment Group 1			
Constant	1.000	1.928	.607
Physical Activity Intention at Pre-test	-.365	.176	.044
Physical Activity Attitude at Pre-test	.132	.073	.078
Sex			
Men	.107	.348	.760
Women	reference		

Note: Partial $Eta^2 = .130$ ($p < .001$)

Table 5

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Wait-List Control Group (N = 47)

Variable	*B*	*SE B*	*p*
Wait-List Control Group			
Constant	-4.217	2.089	.050
Physical Activity Intention at Pre-test	1.070	.380	.007
Physical Activity Attitude at Pre-test	.112	.053	.040
Sex			
Men	.609	.348	.087
Women	reference		

Note: Partial $Eta^2 = .240$ ($p = .008$)

Table 6

Summary of Regression Analysis for Variables Predicting Physical Activity Intention Post for Control Group (N = 18)

Variable	*B*	*SE B*	*p*
Control Group			
Constant	-1.899	1.315	.153
Physical Activity Intention at Pre-test	.511	.109	< .001
Physical Activity Attitude at Pre-test	.109	.052	.038
Sex			
Men	.582	.291	.049
Women	reference		

Note: Partial $Eta^2 = .304$ ($p < .001$)

Table 7

10,000 Step Days, FIT 49 Challenge (N = 175)

Characteristic	*M*	*S.E.*	*95% CI* Lower	*95% CI* Upper
1 Day Intention at Post-test				
Treatment Group	7.816	1.507	4.760	10.871
Wait-List Control Group	2.264	1.264	-.300	4.827
Population Control Group	2.493	.859	.750	4.236
2 Days Intention at Post-test				
Treatment Group	7.507	1.600	4.234	10.780
Wait-List Control Group	2.421	1.814	-1.290	6.131
Population Control Group	1.944	1.078	-.261	4.149
3 Days Intention at Post-test				
Treatment Group	14.069	3.146	7.399	20.739
Wait-List Control Group	9.921	2.379	4.879	14.964
Population Control Group	6.808	2.097	2.362	11.255
4 Days Intention at Post-test				
Treatment Group	20.636	1.147	18.353	22.920
Wait-List Control Group	8.451	1.329	5.806	11.096
Population Control Group	12.225	1.200	9.835	14.615

Note: Means are Estimated Marginal Means, adjusted for
Number of Days 10,000 Steps Taken at Pre-Test and Physical Activity Intention at Post-test

Table 8

Summary of Regression Analysis for Variables Predicting 10,000 Step Days (N = 175)

Variable	*B*	*SE B*	*p*
Treatment Group 1			
Constant	3.362	1.004	.321
Number of Days 10,000 Steps Taken at Pre-Test	2.258	3.152	.003
Physical Activity Intention at Post-test	3.052	2.958	.005
Wait-List Control Group 2			
Constant	.041	.024	.981
Number of Days 10,000 Steps Taken at Pre-Test	2.914	6.118	< .001
Physical Activity Intention at Post-test	.771	1.356	.182
Population Control Group 3			
Constant	-1.376	-1.312	.194
Number of Days 10,000 Steps Taken at Pre-Test	3.313	10.623	< .001
Physical Activity Intention at Post-test	1.499	3.317	.001

Note: 1: Partial $Eta^2 = .343$ ($p < .001$), 2: Partial $Eta^2 = .581$ ($p < .001$), 3: Partial $Eta^2 = .789$ ($p < .001$)

Table 9

Post-test Nutrition Intention, FIT 49 Challenge (N = 175)

Characteristic	*M*	*S.E.*	*95% CI* Upper	Lower
1-2 Day Intention at Pre-test				
Treatment Group	2.455	.293	1.858	3.052
Wait-List Control Group	1.497	.340	.803	2.191
Population Control Group	1.949	.155	1.632	2.265
3 Days Intention at Pre-test				
Treatment Group	2.693	.105	2.485	2.901
Wait-List Control Group	2.546	.105	2.337	2.754
Population Control Group	2.506	.095	2.319	2.693

Note: Means are Estimated Marginal Means adjusted for Pre-test Nutrition Norms and Sex

Table 10

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Treatment Group (N = 50)

Variable	*B*	*SE B*	*p*
Treatment Group			
Constant	.453	1.458	.757
Nutrition Intention at Pre-test	.168	.258	.518
Nutrition Attitude at Pre-test	.041	.044	.352
Nutrition Norms at Pre-test	.237	.098	.019

Note: Partial Eta^2 = .123 (p = .107)

Table 11

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Wait-List Control Group (N = 47)

Variable	*B*	*SE B*	*p*
Wait-List Control Group			
Constant	-1.513	1.293	.248
Nutrition Intention at Pre-test	.898	.299	.004
Nutrition Attitude at Pre-test	.063	.039	.109
Nutrition Norms at Pre-test	-.093	.070	.191

Note: Partial $Eta^2 = .348$ ($p < .001$)

Table 12

Summary of Regression Analysis for Variables Predicting Nutrition Intention at Post-test for Control Group (N = 78)

Variable	*B*	*SE B*	*p*
Control Group			
Constant	1.004	.925	.281
Nutrition Intention at Pre-test	.403	.136	.004
Nutrition Attitude at Pre-test	.023	.036	.524
Nutrition Norms at Pre-test	-.086	.059	.147

Note: Partial Eta^2 = .182 (p = .002)

Table 13

Days of Nutrition Consumption, FIT 49 Challenge (N = 175)

Characteristic	*M*	*S.E.*	*95% CI* Upper	Lower
1 Day Intention at Post-test				
Treatment Group	7.674	1.231	5.121	10.226
Wait-List Control Group	3.497	1.139	1.135	5.859
Population Control Group	4.31	.722	2.812	5.808
2 Days Intention at Post-test				
Treatment Group	18.003	2.452	13.043	22.963
Wait-List Control Group	11.343	1.537	8.234	14.452
Population Control Group	11.402	1.267	8.838	13.965
3 Days Intention at Post-test				
Treatment Group	23.072	.782	21.521	24.624
Wait-List Control Group	19.713	.944	17.840	21.586
Population Control Group	18.528	.764	17.012	20.043

Note: Means are Estimated Marginal Means Adjusted for Post-test Nutrition Intention and Number of Days Participants Consumed Five or More Fruits and Vegetables at Pre-test

Table 14

Summary of Regression Analysis for Variables Predicting Days of Nutrition Consumption (N = 175)

Variable	*B*	*SE B*	*p*
Treatment Group 1			
Constant	3.043	3.160	.340
Number of Days Five or More Fruits and Vegetables Were Consumed at Pre-test	.377	.396	.346
Nutrition Intention at Post-test	6.093	1.212	< .001
Wait-List Control Group 2			
Constant	-3.053	2.483	.225
Number of Days Five or More Fruits and Vegetables Were Consumed at Pre-test	2.009	.419	< .001
Nutrition Intention at Post-test	5.478	1.080	< .001
Population Control Group 3			
Constant	-.563	1.497	.708
Number of Days Five or More Fruits and Vegetables Were Consumed at Pre-test	2.665	.294	< .001
Nutrition Intention at Post-test	3.447	.766	< .001

Note: 1: Partial $Eta^2 = .412$ ($p < .001$), 2: Partial $Eta^2 = .654$ ($p < .001$), 3: Partial $Eta^2 = .781$ ($p < .001$)

MIDDLE TENNESSEE STATE UNIVERSITY

January 4, 2012

Anna Rose Anderson
Department of Health and Human Performance
ara2r@mtmail.mtsu.edu , weatherb@mtsu.edu

Protocol Title: "The effect of participation in a worksite wellness challenge on physical activity and nutrition consumption"
Protocol Number: **12-152**

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above. The MTSU IRB or its representative has determined that the study poses minimal risk to participants and qualifies for an expedited review under the 45 CFR 46.110 Category 4 and 7.

Approval is granted for one (1) year from the date of this letter for 280 participants, pending our office receives a copy of your approval letter from Lipscomb's IRB.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to provide a certificate of training to the Office of Compliance. **If you add researchers to an approved project, please forward an updated list of researchers and their certificates of training to the Office of Compliance (c/o Emily Born, Box 134) before they begin to work on the project.** Any change to the protocol must be submitted to the IRB before implementing this change.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918.

You will need to submit an end-of-project form to the Office of Compliance upon completion of your research located on the IRB website. Complete research means that you have finished collecting and analyzing data. **Should you not finish your research within the one (1) year period, you must submit a Progress Report and request a continuation prior to the expiration date.** Please allow time for review and requested revisions. Your study expires **January 4, 2013.**

Also, all research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion. Should you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,

Emily Born

Emily Born
Research Compliance Officer
Middle Tennessee State University