PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS
OF A 12-WEEK FACULTY/STAFF
EXERCISE PROGRAM IN A UNIVERSITY SETTING

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By
Duane B. Corbett

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A dissertation written by

Duane B. Corbett

B.S. Exercise Science – Indiana University of Pennsylvania, 2008

M.S. Exercise Science – Indiana University of Pennsylvania, 2009

Ph.D. Exercise Physiology – Kent State University, 2014

Approved by

__________________________, Director, Doctoral Dissertation Committee
Ellen Glickman

__________________________, Member, Doctoral Dissertation Committee
Derek Kingsley

__________________________, Member, Doctoral Dissertation Committee
Dianne Kerr

Accepted by

__________________________, Director, School of Health Sciences
Lynne Rowan

__________________________, Dean, College of Education, Health, and Human Services
Daniel F. Mahony
Cardiovascular disease (CVD) is the number-one cause of death worldwide. Research strongly supports a relationship between physical activity and an associated reduced risk of premature death from CVD. **Purpose:** To determine the effects of a 12-week exercise program on the physiological and psychological health of employees in a major university. **Methods:** To better examine the effects of physical activity on the selected health variables, participants were divided into two groups (compliers, non-compliers) based on their average daily step count (≥10,000 steps/d) across the duration of the study. A total of 50 university employees (33 compliers, 17 non-compliers; mean age = 47.6±10.2 yr) participated in the exercise sessions (60 min, 3d wk⁻¹, 12 wk). Outcome measures include obesity, hypertension, dyslipidemia, prediabetes, depression, anxiety, and stress. **Results:** Physical activity patterns were significantly different between groups at all time points (p ≤ 0.05). Body mass index (BMI) demonstrated a significant decrease (p ≤ 0.05) from baseline to 12-weeks while impaired fasting glucose (IFG) increased (p ≤ 0.05). Psychological health variables demonstrated a significant effect of time (p ≤ 0.05) for depression, anxiety, and stress. There were no observed differences in sleep. **Conclusions:** Based on these results, this program was effective in improving participant psychological health regardless of physical activity level. Further,
while this program did demonstrate significant improvements in BMI and psychological health, an exercise program that is of longer duration is needed to demonstrate lifestyle changes and differences in the blood profile.
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CHAPTER I
INTRODUCTION

Sedentary behavior is one of the leading preventable causes of death in the United States (Mokdad, Giles & Bowman, 2004) with a clear inverse linear dose-response relationship between volume of physical activity and all-cause mortality (Lee & Skerrett, 2001). Regular physical activity has been shown to reduce risk of chronic diseases, the leading causes of death and disability in the United States (Kung, Hoyert & Xu, 2008) and accounting for 75% of our nation’s health care expenditure (Centers for Disease Control and Prevention. (2013). These diseases include cardiovascular disease (Thompson, Buchner & Pina, 2003), type 2 diabetes mellitus (Knowler, Barrett-Connor & Fowler, 2002), osteoporosis (Vuori, 2001), depression (Brosse, Sheets & Lett, 2002; Pollock, 2001), obesity (Wing & Hill, 2001), breast cancer (Breslow, Ballard-Barbash & Munoz, 2001), and colon cancer (Slattery & Potter, 2002). The regular participation in physical activity is also known for the benefit of reducing falls in older adults (Brosse, Sheets & Lett, 2002), the leading cause of injury or death among this population (Hornbrook, Stevens & Wingfield, 1994).

With this wealth of information on the benefits of physical activity, participation in regular physical activity would seem a primary concern for maintaining and improving the quality of life of every individual. Current guidelines developed by the American College of Sports Medicine (ACSM) and American Heart Association (AHA) to promote and maintain health in older adults recommend moderate-intensity aerobic physical activity for a minimum of 30 minutes a day on 5 days a week, or vigorous-intensity
aerobic activity for a minimum of 20 minutes daily only 3 days a week (Pate, Pratt & Blair, 1995). Despite the documented health benefits, still only 32% of adults participate in regular leisure-time physical activity (Barnes & Schoenborn, 2003).

Quantitative syntheses of available literature on the efficacy of interventions for increasing physical activity have shown a moderately large effect (Dishman & Buckworth, 1996). Separate meta-analyses of worksite physical activity interventions have shown modest changes in body weight (Anderson, Quinn & Glanz, 2009; Benedict & Arterburn, 2008). It is of particular importance to investigate the worksite intervention-delivery modality, as this setting has a potentially broader scope (Marcus, Williams & Dubbert, 2006; Gemson, Comimso & Fuente, 2008). Furthermore, the cost effective nature of these programs may appeal to employers as they have been proven to increase productivity (Mavis, 1994; Fielding, 1984; Aldana & Pronk, 2001; Stein, Shakour & Zuidema, 2000; Baicker Cutler & Song, 2010; Finkelstein, Linnan & Tate, 2009) and reduce employee medical costs (Finkelstein, Linnan & Tate, 2009).

Previous research has demonstrated that short duration worksite fitness programs can have positive effects on cardiovascular risk factors. One 15-week study requiring 1.25 hours of aerobic exercise each work day showed significant improvements in blood cholesterol, body weight, and maximum oxygen uptake (Bjurstrom & Alexion, 1978). Another 14-week study consisting of aerobic exercise on at least 3 days a week found significant and positive changes in, blood cholesterol, systolic blood pressure, and maximum oxygen uptake (Pauly, Palmer & Wright, 1982).
Long term studies have shown that worksite fitness gains can be maintained. One such study consisting of interval-circuit training showed significant improvements in body weight, body fat, systolic blood pressure, diastolic blood pressure, and maximal oxygen uptake at both 6 and 12 months of participation (Yarvote, McDonagh & Goldman, 1974). A significant improvement was also seen in blood cholesterol at 6 months but not at 12 months. A relatively larger worksite exercise intervention study over two-year period showed significant improvements in body weight, body fat, and systolic blood pressure. The more interesting finding of this study was that these changes increased as maximum oxygen consumption increased (Blair, Piserchia & Wilbur, 1986).

Even minimal worksite physical activity has shown promising effects. One previous study that examined a 12-week college faculty and staff walking program found improvements in body mass index, blood glucose, and total cholesterol (Haines, Davis & Rancour, 2007).

Our study will examine both the physiological and psychological effects of a 12-week worksite physical activity program for faculty and staff members at a major university. The 3-day a week program will consist of one hour of both aerobic and anaerobic exercise targeting the previously outlined guidelines of the American College of Sports Medicine and the American Heart Association. Our study will specifically look at the changes in cardiovascular disease risk factors along with measures of fitness and evaluate movement of steps via an accelerometer (i.e. MOVband).

One of the unique parts of our design is the incorporation of the MOVband, a modern, easy to use, and relatively inexpensive accelerometer. The use of an
accelerometer throughout the study will allow for the complete tracking of participant physical activity. This is beneficial to the study as it enables us to quantify physical activity. The quantification of physical activity allows for correlational analysis with all dependent variables.

**Statement of the Problem**

Despite previous research detailing the importance of exercise, the majority of adults are still sedentary. While research suggests that worksite exercise programs can be successful, it is unclear how successful a worksite exercise program would be in a university setting. Furthermore, we will utilize the MOVband plus the exercise program to provide reinforcement to engage the individuals to exercise and provide constant feedback to exercise. We believe that those individuals that engage in the exercise with this MOVband will use it frequently for positive reinforcement and gauge their activity levels better.

**Purpose of the Study**

The purpose of the present study was to examine the changes in participant physiological cardiovascular disease risk factors, psychological health, sleep quality, and physical activity patterns following a voluntary 12-week faculty / staff exercise program at a major university.
CHAPTER II

REVIEW OF LITERATURE

Sedentary Lifestyle

It is estimated that sedentary living is responsible for one-third of deaths in the United States due to coronary heart disease, colon cancer, and diabetes. These three diseases alone, all of which have firmly established causal relationships with physical inactivity, account for more than one-million annual deaths nationwide (Powell & Blair, 1994). Furthermore, it is estimated that physical inactivity is responsible for 6% of all global cases of coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer, and 10% of colon cancer. Overall, physical inactivity is responsible for 9% of premature deaths, or more than 5.3 million of the 57 million global deaths of 2008. If just a 10-25% increase in physical activity were assumed, it would translate to 533,000-1.3 million deaths avoided each year. It is also estimated that a complete global conversion of the physically inactive to active would result in a 0.68 year extension of life expectancy (Lee, Shiroma & Lobelo, 2012).

Physically Active Lifestyle

The knowledge of exercise being beneficial to our health is no novel idea. In fact, our understanding of the relationship between health and exercise dates back to 2600 BC when Chinese physicians believed disease was caused by physical inactivity (Lee, Shiroma & Lobelo, 2012). Later in the 5th century BC Hippocrates reiterated this understanding when he stated, “Eating alone will not keep a man well; he must also take exercise. For food and exercise… work together to produce health (Jones, 1952).” Today
this relationship has evolved into the idea that exercise is a medicine that needs to be prescribed, as there is seemingly no end to the benefits of regular physical activity (Sallis, 2009).

One of the major selling-points in the need for exercise is the clear scientific evidence proving the effect of regular physical activity on both the primary and secondary prevention of premature death, specifically from chronic diseases, the leading cause of death and disability in the United States (Kung, Hoyert & Xu, 2005). Previous research has shown a clear inverse linear dose-response relationship between volume of physical activity and all-cause mortality rates in men and women, and in younger and older persons (Lee & Skerrett, 2001). Therefore, as increasing physical activity will reduce the risk of premature death, decreasing physical activity will increase the risk (Erikssen, 2001; Erikssen, Liestol & Bjornholt, 1998; Blair, Kohl & Barlow, 1995; Bijnen, Feskens & Caspersen, 1999). Previous work has shown that individuals who were the most physically active at baseline and either maintained or improved their physical activity status over time were at the lowest risk of premature death (Erikssen, Liestol & Bjornholt, 1998). When previously sedentary individuals underwent relatively moderate improvements in physical activity over a period of 5 years there was a reported 44% reduction in risk of premature death (Blair, Kohl & Barlow, 1995). Even minimal adherence to the current physical activity guidelines translates to a 20-30% reduction in risk of premature death (Lee & Skerrett, 2001). Other ironically supportive evidence suggests that people who are fit yet have known risk factors for cardiovascular disease may be at a lower risk of premature death than sedentary individuals with no known risk
factors for cardiovascular disease (Blair, Kampert & Kohl, 1996; Wessel, Arant & Olson, 2004; Katzmarzyk, Church & Blair, 2004). While we know these statistics account for all causes of death, there is particular interest in the evidence supporting the relationship between physical activity and the associated reduced risk of premature death from chronic diseases including cardiovascular disease (Thompson, Buchner & Pina, 2003), the number-one cause of death in both men and women worldwide (World Health Organization, 2013).

Due to the fact that cardiovascular disease is the number-one cause of death in both men and women worldwide, much research has been done to draw conclusion that an inverse, dose-response relationship exists between cardiovascular disease incidence and mortality rates and levels of physical activity (Kohl, 2001). While participation in regular physical activity can reduce the risk of premature death from cardiovascular disease, it may also unfortunately lead to sudden death if an individual already suffers from it. For this reason, the American College of Sports Medicine has established cardiovascular disease risk factors and stratification as part of their guidelines for exercise testing and prescription (Thompson, Gordon & Pescatello, 2010). This risk stratification process is how health and fitness professionals screen individuals to identify their risk of a cardiovascular event during exercise. The stratification process is limited to three levels of relative risk: 1) low risk: being asymptomatic and having less than or equal to one known risk factor, 2) moderate risk: being asymptomatic and having two or more risk factors, and 3) high risk: being symptomatic or having a known cardiac, pulmonary, or metabolic disease. Generally, a medical exam is implicated for individuals
who are either moderate or high risk based on the intensity of exercise to be performed. Identifiable risk factors may be further divided into modifiable and non-modifiable (Cannon, 2007). The modifiable risk factors account for the majority of cardiovascular disease risk factors and allow individuals the ability to change them. Many of these modifiable risk factors can be positively changed through exercise intervention, including sedentary lifestyle, obesity, hypertension, dyslipidemia, and prediabetes (Goldberg, 1989). With the established thresholds that define these risk factors, we have the ability to measure risk factors and thus measure change in the associated risk for cardiovascular disease. Moreover, through the prescription of exercise we have the ability to reduce the number of known cardiovascular risk factors an individual has and allow them to live a longer, healthier, and happier life.

**Prescribed Exercise**

Currently, the ACSM recommends an overall participation of at least 150 minutes of moderate-intensity exercise each week for most adults (Garber, Blissmer & Deschene, 2011). Basic recommendations for cardiorespiratory exercise for adults can be met through 30-60 minutes of moderate-intensity exercise on 5 days a week, or 20-60 minutes of vigorous-intensity exercise on 3 days a week. The physiological adaptations that result from aerobic exercise are usually accompanied with improvements in glucose tolerance, insulin sensitivity, lipoprotein lipid profiles, and reductions in blood pressure (Goldberg, 1988; Goldberg & Hagberg, 1989).

Resistance exercise is also prescribed to train each major muscle group two or three days each week using a variety of exercises and equipment (Garber, Blissmer &
Deschenes, 2011). Training for each muscle group should consist of two to four sets of each exercise with repetitions ranging from 8-12 for improved strength and power, 10-15 for improved strength in middle-aged adults and older persons starting exercise, and 15-20 repetitions for improved muscular endurance. It is recommended to wait at least 48 hours between resistance training sessions. Dynamic forms of resistive exercise such as circuit training may offer more benefit over traditional forms (Fleck & Dean, 1987; Goldberg, Elliot & Kuehl, 1986; Hagberg, Ehsani & Goldring, 1984; Harris & Holly, 1987; Hurley & Kokkinos, 1987; Hurley, Hagberg & Goldberg, 1988; Koivisto, Yki-Jarvinen & DeFronzo, 1986; Stone, Wilson & Blessing, 1983). The light to moderate resistance, high repetition, and short rest interval nature of this type of resistance exercise is more dependent on oxygen as a fuel source and promotes the utilization of glucose and fat by muscles resulting in improved insulin sensitivity, lipoprotein lipids, blood pressure, and HDL cholesterol.

Prescription of exercise for adults also includes flexibility and neuromotor exercises involving motor skills (balance, coordination, gait, agility and proprioceptive training) on two or three days per week (Garber, Blissmer & Deschenes, 2011). Flexibility exercise is recommended for improving joint range of motion which would translate to enhanced postural stability and balance, particularly when combined with resistance exercise (Costa, Graves & Whitehurst 2009; Bird, Hill & Ball, 2011). The incorporation of neuromotor training into prescribed exercise, sometimes referred to as functional fitness training, is especially important for elderly individuals for improving balance, agility, muscle strength and reducing the risk of falls (Bird, Hill & Ball, 2011;
To achieve the desired effects of exercise on health and cardiorespiratory fitness estimated volumes and intensities of exercise have been established for several methods of measurement. The use of kilocalories (kcal) per week allows for a servo-mechanistic prescription subjective to varying volume and intensity. Previous epidemiological studies show energy expenditure of approximately 1000 kcal per week of moderate-intensity physical activity, or about 150 min per week, is associated with reduced rates of cardiovascular disease and premature death (Lee, Rexrode & Cook, 2001; Manson, Greenland & LaCroix, 2002; Sesso Paffenbarger & Lee, 2000; Tanasescu, Leitzmann & Rimm, 2002). This translates to 3-5.9 METs (for individuals weighing ~68-91 kg) and 10 MET-hours per week, which can be achieved through a minimum of 20 minutes per day of vigorous intensity (≥6 METs) physical activity performed on at least 3 days per week or for a total of about 75 minutes per week. This exercise volume of 1000 kcal expended per week serves as the basis for the ACSM and AHA recommended guidelines (Haskell, Lee & Pate, 2007; Nelson, Rejeski & Blair, 2007; Thompson, Gordon & Pescatello, 2010). Several studies have observed significant reductions in risk of cardiovascular disease and premature death at exercise volumes starting at about one-half of the recommended volume (~500 kcal per week) (Manson, Greenland & LaCroix, 2002; Sesso, Paffenbarger & Lee, 2000; Tanasescu, Leitzmann & Rimm, 2002; Lee & Skerrett, 2001). Perhaps of greater ease of use and interpretation to the general
population, measurement of physical activity through steps per day has also been used to establish guidelines for physical activity. A goal of 10,000 steps per day is most often recommended, however fewer steps per day may satisfy the required energy expenditure guidelines, as the intensity of steps is often ambiguously prescribed and subjectively interpreted (Tudor-Locke, Bassett & Rutherford, 2008). A recent study on pedometer-measured physical activity in U.S. adults showed individuals who reported to be exercising strenuously 3 days per week, likely meeting the current recommendations, accumulated an average of 5486 steps per day (Bassett, Wyatt & Thompson, 2010). Those who reported 4 days per week of strenuous exercise accumulated an average of 6200 steps per day, while those who reported 6-7 days of strenuous exercise accumulated an average of 7891 steps per day. Another study showed 7000 steps per day sufficient in meeting the current recommendations for physical activity (Jordan, Jurca & Locke, 2005).

**Activity Monitoring**

Adherence to the guidelines of exercise prescription is dependent upon measurement of several variables: frequency, intensity, and duration. Measuring frequency and duration may be as simple as counting the number of days per week and the number of minutes per session. Exercise intensity however, may become more complicated, as there are several commonly used methods of measurement. The preferred method of measuring intensity is heart rate. This is commonly done through use of a prescribed target heart rate zone for exercise intensity which is designed as a percentage of maximal heart rate (Karvonen, Kentala & Mustala, 1957; Karvonen, 1975).
Monitoring of heart rate however, either often interrupts activity for manual palpation, or requires expensive technology that may not be afforded in some settings. Therefore, perceived exertion, a commonly used, inexpensive and minimally interruptive alternative to monitoring exercise intensity may be preferred. The self-reported perceptual monitoring of exercise can be done via scales of perceived effort, such as the Borg and OMNI RPE scales (Borg, 1974; Noble, Borg & Jacobs, 1983; Robertson, Goss & Rutkowski, 2003; Robetson, Goss & Dube, 2004; Utter, Robertson & Green, 2004; Dunbar, Robertson & Baun, 1991). These validated methods of measurement only support modulation or refinement of prescribed exercise intensity, as there is insufficient research supporting these methods as a primary means of monitoring exercise prescription. However, the RPE and modality-specific OMNI scales are extensively used and do demonstrate strong validity compared to primary means of measuring cardiorespiratory exercise intensity (Colbert, Hootman & Macera, 2000; Irving, Rutkowski & Brock, 2006). As previously mentioned, pedometer use is another way of monitoring physical activity. The objective nature of these tools make them a more reliable source than self-reported measures of perceived exertion, and the relative low cost make makes them an affordable alternative to heart rate monitors (Tudor-Locke, Williams & Reis, 2002). The simpleness of pedometers being able to generalize an activity count threshold to the prescribed guidelines for exercise makes them desirable to both individuals who exercise and researchers. However, pedometers lack the variable of intensity for measurement. With a pedometer, one step count is measured the same for walking as it is for running. This is where accelerometers find their niche.
Accelerometers are essentially pedometers with the ability to measure the intensity of each movement (Westerterp, 1999). Comparison of relative data from an accelerometer can be done by either translating each movement into a distance, based on intensity, or by accumulating the energy expended from each movement. Unfortunately, accelerometers are relatively expensive compared to pedometers and thus a less attractive option for researchers. However, advances in technology and the demand for commercially-available accelerometers designed to be used in schools, businesses and communities has led to the recent development of modernized and highly affordable accelerometers.

**Benefits of Activity Monitors**

Accelerometers have long been beneficial research tools, but only recently have they become affordable (Bassett & John, 2010). This opens a new door to researchers looking to objectively track and analyze the movement of large groups of individuals. And although accelerometers do provide intensity based objective data such as distance traveled or energy expended over specific time intervals, the benefits of accelerometers are not limited to their objective data tracking abilities. Previous research has shown that pedometers and accelerometers are also beneficial as motivational tools for increasing the activity level of sedentary individuals (Tudor-Locke, 2002). A systematic review of literature showed that exercise programs incorporating a pedometer, a daily step goal, and a step diary have been shown to increase physical activity levels by an average of 2500 steps (Bravata, Smith-Spangler & Sundaram, 2007). Among the characteristics associated with significantly increasing physical activity through use of a pedometer is the inclusion of a step goal. Previous research studies that included a step goal of 10,000
steps per day showed an average increase in approximately 3000 steps per day compared to baseline (Araiza, Hewes & Gashetewa, 2006; Hultquist, Albright & Thompson, 2005; Lindberg, 2000; Schneider, Bassett & Thompson, 2006; Sidman, Corbin & Le Masurier, 2004; Swartz, Strath & Bassett, 2003; Thomas & Williams, 2006; Williams, Bezner & Chesbro, 2005), whereas studies that did not incorporate a step goal increased physical activity by an average of only 686 steps per day (Izawa, Watanabe & Onvy, 2005; Ransdell, Robertson & Ornes, 2004; Ornes, Ransdell & Robertson, 2005; VanWormer, Boucher & Pronk, 2004). Review of literature also suggests that the use of a pedometer is also associated with significant decreases in body mass index and blood pressure (Bravata, Smith-Spangler & Sundaram, 2007).

**Pedometer Indices**

When incorporating pedometers into a program to track physical activity, it is important to understand pedometer-determined physical activity indices for the purpose of assessment and motivation of physical activity patterns (Tudor-Locke & Bassett, 2004). To interpret these indices, it is necessary to establish their associations with important health-related outcomes and current recommended guidelines for physical activity. Previously proposed evidence-based public health guidelines advise at least 30 minutes of moderate-intensity daily physical activity (Safrit, 1986). Evidence has shown that this guideline can be met by 3000 to 4000 steps of at least moderate intensity walking for adults (Tudor-Locke, Williams & Reis, 2004; Berk, 1976). However, for this index to be considered a true equivalent of public health guidelines, it needs to be supplemental to a threshold steps per day index that is indicative of sedentary behavior.
Tudor-Locke, Bassett & Rutherford, 2008). Tudor-Lock and Bassett (2004) previously proposed a 5000 or less steps per day index for defining sedentary lifestyle. When supplementing this index with the previously proposed steps per day equivalent of public health guidelines, a value of 8000 to 9000 steps per day is produced. If prescribing exercise for the prevention of weight gain according to the guidelines proposed by the Institute of Medicine, at least 60 minutes of moderate-intensity daily physical activity, the supplemented values increase to 11,000 to 13,000 steps per day (Tudor-Locke & Myers, 2001). When dealing with a population largely consisting of middle-aged women, it may be important to consider another study that showed 7000 steps per day was sufficient in meeting the current recommendations for physical activity in post-menopausal women (Jordan, Jurca & Locke, 2005). However, for general guidelines, Tudor-Locke and Bassett (2004) proposed preliminary pedometer-determined physical activity indices to encompass all levels of the physical activity spectrum. Under this spectrum, we would describe individuals who achieve less than 5000 steps per day as ‘sedentary,’ 5000 to 7499 steps per day as ‘low active,’ 7500 to 9999 steps per day as ‘somewhat active,’ 10,000 to 12,500 steps per day as ‘active,’ and over 12,500 steps per day as ‘highly active’. The ‘low active’ category would be typical of daily activity excluding volitional exercise, while the ‘somewhat active’ category would include some volitional activities or elevated occupational demands. This proposal adds scientific validity to the widely popular prescription of 10,000 steps per day, which originated with a Japanese pedometer manufacturer (Yamasa Corporation, Tokyo, Japan) in the 1960s and had no scientific validation for improving health (Hatano, 1993). The recommendation of 10,000 steps per
day is now known to have many advantages such as being an easy to remember goal, applicable to individuals of all body sizes, and associated with indicators of good health such as decreased body fat and blood pressure (Hatano, 1993; Tudor-Locke, Ainsworth & Whitt, 2001).

**Exercise Interventions**

While the benefits of exercise are abundantly clear, the majority of adults are still sedentary (Barnes & Schoenborn, 2003). Therefore, it is important to understand successful methods of increasing physical activity in the sedentary population. Furthermore, it is important to determine which of these methods has the greatest effect on reducing cardiovascular disease risk factors. Previous work shows that supervised exercise programs have greater success than unsupervised exercise programs for the purpose of reducing cardiovascular disease risk factors, with supervised exercise resulting in greater improvements in resting diastolic blood pressure (DBP) and low-density lipoproteins (LDL) cholesterol (Hopewell, Harrington & Bass, 1992). One previous exercise intervention program that recruited sedentary men and women from the community to exercise under supervision at a local fitness center showed that a structured exercise program based on the recommended guidelines for exercise prescription is capable of increasing physical activity and improving cardiovascular disease risk factors after 6 months (Dunn, Marcus & Kampert, 1997). This particular study demonstrated an 85% success rate of prescribed exercise achievement while significantly reducing total cholesterol, diastolic blood pressure, and percentage of body fat. Interventions of this style, however, are still limited in rate of volunteers. With the average adult spending the
majority of their day at work, a seemingly ideal solution to increase the number of participants in these types of interventions would be to implement them at the worksite (Basner, Fomberstein & Razavi, 2007).

A recent systematic review of literature strongly supports the effectiveness of worksite exercise interventions for the purpose of reducing cardiovascular disease risk, particularly the reduction of body fat, one of the strongest predictors of risk (Groeneveld, Proper & van der Beek, 2010). Obtaining this effect is highly ideal to employers now that research shows the prevalence of illnesses that are at least partly caused by modifiable health risk factors and poor lifestyle habits are on an upward trend, including alarming increases in obesity and diabetes (Ogden, Fryar & Carroll, 2004). This information is even more alarming to employers considering that in 2006, average premiums for medical care were $3615 for single coverage and $8508 for family coverage (Kaiser Family Foundation, 2006). More so, some researchers estimate that employers pay approximately 80% of all private health insurance premiums (Clement & Gibbs, 1983). We can expect that as the trends in illness continue to increase so will the cost of medical care to employers and therefore reducing illness prevalence among employees becomes a primary concern. The good news for employers is that the majority of disease falls into the category of preventable or postponable illnesses which account for roughly 70% of the total burden of disease (Amler & Dull, 1987; Breslow & Breslow, 1993; McGinnis & Foege, 1993; Mokdad, Marks, Stroup & Gerberding, 2004). Furthermore, the primary methods of prevention of these diseases include habit cessation, diet, and exercise. This is where employers find the allure of a worksite exercise
intervention. Previous research examining modifiable risk factors and medical claims showed that obesity, hypercholesterolemia, hypertension, stress, depression, smoking, diet, excessive alcohol consumption, physical inactivity, and high blood glucose account for ~25% of employer health care expenditures (Aldana & Pronk, 2001; Baun, 1995). Furthermore, employees who were accountable for seven of these modifiable risk factors (smoking, hypertension, hypercholesterolemia, obesity, high blood glucose, stress, and physical inactivity) were responsible for 228% more in health care costs covered by their employer when compared to those who had no known risk factors. Further research suggests that workers with these risk factors have an increased likeliness for absenteeism, higher rates of disability, and are overall less productive workers (Aldana & Pronk 2001; Baun, 1995; Shephard, 1995).

**Exercise and Stress**

Previous research has shown that 97% of senior human resources professionals believe stress is the biggest threat to employee health (Fuller, 2013). In the UK alone, an estimated 175 million working days are lost each year due to sickness absence, half of which are stress-related (Health and Safety Executive, 2008). Worker compensation laws are increasingly including provisions for awarding benefits for injuries resulting from worksite stress (Ivancevich, Matteson & Richards, 1985). Thus said, employers have a clear interest in demonstrating the positive effect of a worksite exercise program on employee stress. Research has already demonstrated regular physical activity to be associated with a significant decline in stress-related mood disorders such as anxiety and depression (Biddle, Fox & Boutcher, 2000; Dunn & Dishman, 1991; Dunn, Trivedi &
O’Neal, 2001; Martinsen & Morgan, 1997). When translated to the worksite, even the results of just a short-term yoga program have shown to be effective for improving emotional well-being and response to stress in employees (Hartfiel, Havenhand & Khalsa, 2011). There is also evidence to suggest that even forced exercise can reduce stress, which may translate well to the idea of a worksite exercise intervention where many employees may not wish to exercise to begin with (Greenwood, Spence & Crevling, 2013).

**Conclusion**

There is a clear body of evidence supporting the inclusion of exercise programs at the worksite. While the employee may benefit from improved physical and psychological health, the employer becomes less vulnerable to the damaging consequences of physically and psychologically impaired employees. This hypothetical win-win situation is thus the driving force behind the worksite exercise model: increase employee health and productivity while decreasing employer healthcare costs. In our study, we look to build on the growing body of supporting research in the specific population of university employees. Our goals include reducing the number of physiological risk factors of cardiovascular disease, improving stress and well-being, and increasing overall levels of physical activity among workers both inside and outside of the worksite environment.
CHAPTER III

METHODS

Procedures

The study consisted of one group (gender-neutral) repeated measures design (baseline, 4-weeks, 8-weeks, 12-weeks. One-hundred participants were recruited into morning (6am) and noon (12pm) sessions consisting of 50 participants each. Of those one-hundred participants, a final number of 50 participants were consented and selected as data. The final group was further divided between compliers and non-compliers to the 10,000 steps per day (35 miles per week) guidelines for physical activity while wearing a physical activity tracker (accelerometer). The purpose of this division was to better understand the effect of physical activity on the selected health variables of the study. Applicants were required to be a current university faculty or staff member to qualify for participation. Individuals of all fitness levels were invited to participate with exception only to those with contraindications to exercise. Participants first reported to the Kent State University Applied Physiology Research Laboratory to complete written informed consent and baseline assessments. Following the completion of all baseline assessments, the participant then reported to the gymnasium 3 days a week (Mon, Wed, Fri) to participate in a 1 hour exercise program over a period of 12 weeks. The exercise program included a 5 minute warm-up and cool-down along with a combination of cardiovascular and strength training exercises.
Physical Activity Measurements (MOVband)

Each participant was provided a MOVband at the start of the program. The MOVband is a wrist-worn accelerometer, or physical activity monitor, that comes with software enabling individuals to upload their daily activity via a personal computer. Participants were instructed to wear their MOVband 24 hours a day and 7 days a week for the entirety of the study. MOVband data was synced regularly and will consist of daily steps, daily moves, and cumulative miles.

Anthropometric Measurements

Upon arrival to the laboratory participants underwent a variety of baseline assessments. Basic anthropometric measurements included height, weight, and body composition. Height and weight were assessed using a standard scale and stadiometer while body composition was assessed using the skin-fold method. For this method, we specifically used the 3-site method for both males (chest, abdominal, thigh) and females (triceps, suprailliac, thigh). These measurements were taken again during the final week.

Blood Biomarkers

Blood draws were done at baseline and 12-weeks for biochemical markers of physical health. Markers include cholesterol, lipid profile, and basic metabolic panel. Blood draws were performed within our facility by certified research staff and then sent out to be analyzed.

Psychological Measurements

The short-form version of the Depression, Anxiety, and Stress Scale (DASS-21) was used to measure the general dimensions of depression, anxiety, and stress. This is a
simple, one-page, self-report questionnaire that was used to assess the negative emotional states throughout the duration of the study. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Scoring was based on the total assessment score, which encompasses duration of sleep, sleep disturbance, sleep latency, day dysfunction due to sleepiness, sleep efficiency, overall sleep quality, and if medicines are needed to sleep.

Data Analysis

All statistical analyses were conducted using SPSS for Windows (version 19.0, SPSS Inc., Chicago, IL) with an a-priori α level of ≤ 0.05. Means and measures of variability (standard deviation) were calculated for all baseline characteristics (age, weight, percent body fat, miles per week, steps per day), physical activity patterns (average weekly miles), and the primary dependent variables: CVD risk factors including body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), impaired fasting glucose (IFG), total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL) and psychological measures (depression, anxiety, stress, sleep quality). As the physiological measurements for CVD risk factors were only taken at two time points (baseline, 12-weeks), a 2x2 repeated measures ANOVA was used to determine if a significant interaction was present between the two groups (compliers, non-compliers), with paired t-tests used to assess the observed changes as post hoc analysis. A 2x4 repeated measures ANOVA was used to compare the two groups (compliers, non-compliers) across the four assessment times (baseline, 4-weeks, 8-weeks, 12-weeks) for all measures of psychological health (DASS, PSQI) determine if a
significance in time effect is present. Post hoc analysis for these variables was done via paired samples t-tests.
CHAPTER IV

RESULTS

Subject Recruitment

A total of 64 individuals were recruited for the exercise program. A participant count of 52 was achieved after re-consenting the program participants for the approval to use their data for the study. After omitting 2 participants’ data for physical activity for being outliers, a final participant count of 50 was achieved. Primary inclusion criteria limited participants to university faculty and staff members who were sedentary prior to participation in the program.

Subject Baseline Characteristics

There was no significant difference ($p \geq 0.05$) between groups (compliers, non-compliers) at baseline for the following variables (Table 1): age ($p = 0.868$), weight ($p = 0.351$), and percent body fat ($p = 0.794$). There was a significant difference ($p = 0.001$) between groups for miles per week / steps per day, as compliers showed significantly elevated weekly mileage and step count in comparison to the non-compliers. When comparing for physical activity, the compliers were significantly more active than the non-compliers by an average difference of 38.6% in steps per day or miles per week. Comparison of the total number of compliers versus non-compliers shows that compliance to the 10,000 steps/day threshold was 34% of total participants.
Physical Activity Patterns

Figure 1 shows the physical activity levels of the study participants over the course of a 12-week period. There was no interaction between groups across the time points ($F_{3,46} = 0.986, p = 0.410$). However, there was a significant main effect of group ($F_{1,48} = 88.350, p = 0.001$). Post hoc analysis showed a significant difference between groups at each time point: baseline ($p = 0.001$), 4-weeks ($p = 0.001$), 8-weeks ($p = 0.001$), and 12-weeks ($p = 0.001$). Throughout the study, the compliers were consistently more physically active than the non-compliers and, on average, always meeting the 10,000 steps per day goal. However, the non-compliers did consistently meet the step value equivalent (7,000 steps per day) of the recommended guidelines for physical activity (Jordan, Jurca & Locke, 2005). There was no significant main effect found for time ($F_{3,46} = 1.374, p = 0.266$).

Table 1

Baseline Characteristics of the Study Participants

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Compliers</th>
<th>Non-compliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n = 50$</td>
<td>$n = 17$</td>
<td>$n = 33$</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>47.6 ± 10.2</td>
<td>47.9 ± 10.0</td>
<td>47.4 ± 10.5</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>93.6 ± 24.8</td>
<td>89.2 ± 16.4</td>
<td>96.2 ± 28.2</td>
</tr>
<tr>
<td>% Body Fat</td>
<td>36.8 ± 7.6</td>
<td>37.2 ± 8.3</td>
<td>36.6 ± 7.4</td>
</tr>
<tr>
<td>Miles/Week</td>
<td>33.0 ± 10.3</td>
<td>43.4 ± 5.9</td>
<td>26.6 ± 6.5†</td>
</tr>
<tr>
<td>Steps/Day</td>
<td>9422 ± 2942</td>
<td>12397 ± 1690</td>
<td>7614 ± 1858†</td>
</tr>
</tbody>
</table>

Table 1. Note: Values are means ± standard deviations; yr: year; kg: kilogram. Compliance was defined by achieving a minimum of 10,000 steps per day on average. †P < 0.05, significantly different from compliers group.
Figure 1. Effects of a 12-week exercise program on physical activity patterns.

Table 2 shows the effects of the 12-week exercise program on CVD risk factors divided between groups (compliers, non-compliers). There was no interaction between groups across the time points of main effect of group for BMI ($F_{1,47} = 2.259, \ p = 0.152$), SBP ($F_{1,47} = 1.304, \ p = 0.271$), DBP ($F_{1,47} = 0.954, \ p = 0.344$), IFG ($F_{1,47} = 0.063, \ p = 0.807$), total cholesterol ($F_{1,47} = 0.000, \ p = 0.984$), LDL ($F_{1,47} = 0.001, \ p = 0.972$), and HDL ($F_{1,47} = 1.458, \ p = 0.255$). There was a significant effect of time for BMI ($F_{1,47} =$
45.593, \( p = 0.001 \) and IFG (\( F_{1,47} = 9.767, p = 0.011 \)). Post hoc analysis showed a significant difference in BMI for compliers (\( p = 0.004 \)) and non-compliers (\( p = 0.001 \)) with both groups decreasing between time points. The analysis also showed a significant difference in IFG for compliers (\( p = 0.001 \)) and non-compliers (\( p = 0.001 \)) with both group’s values increasing.

Table 2

*Effects of 12-Week Exercise Program on CVD Risk Factors*

<table>
<thead>
<tr>
<th></th>
<th>Compliers (≥ 5mi, 10000steps/d)</th>
<th>Non-compliers (&lt; 5mi, 10000steps/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 12-Weeks</td>
<td>Baseline 12-Weeks</td>
</tr>
<tr>
<td></td>
<td>( n = 17 )</td>
<td>( n = 32 )</td>
</tr>
<tr>
<td>BMI</td>
<td>31.9 ± 6.1</td>
<td>31.4 ± 5.9*</td>
</tr>
<tr>
<td></td>
<td>( n = 16 )</td>
<td>( n = 32 )</td>
</tr>
<tr>
<td>SBP (mm Hg)</td>
<td>125.2 ± 16.1</td>
<td>121.4 ± 7.0</td>
</tr>
<tr>
<td>DBP (mm Hg)</td>
<td>76.2 ± 9.7</td>
<td>74.8 ± 5.7</td>
</tr>
<tr>
<td>IFG (mg/dL)</td>
<td>92.6 ± 18.6</td>
<td>101.9 ± 12.5*</td>
</tr>
<tr>
<td>TC (mg/dL)</td>
<td>178.4 ± 36.8</td>
<td>182.8 ± 35.6*</td>
</tr>
<tr>
<td>LDL-C (mg/dL)</td>
<td>105.9 ± 30.8</td>
<td>109.7 ± 28.3</td>
</tr>
<tr>
<td>HDL-C (mg/dL)</td>
<td>51.9 ± 11.1</td>
<td>50.9 ± 11.1</td>
</tr>
</tbody>
</table>

*\( P < 0.05 \), significantly different from baseline.

Table 2. Note: Values are means ± standard deviations; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; IFG: impaired fasting glucose; TC: total cholesterol; LDL-C: low-density lipoprotein; HDL-C: high-density lipoprotein; mi: miles; d: day; mm: millimeters; Hg: Mercury; mg: milligrams; dL: deciliter.

**DASS - Depression**

There was no interaction between groups across time points (\( F_{3,46} = 0.891, p = 0.498 \)) and no effect of group (\( F_{1,48} = 1.286, p = 0.374 \)) on depression scores. However, a significant effect of time was found for depression scores (\( F_{3,46} = 5.094, p = 0.043 \)). A
significant decrease in depression scores was present for compliers between baseline and 4-weeks ($p = 0.007$), baseline and 8-weeks ($p = 0.013$), and baseline and 12-weeks ($p = 0.008$). Non-compliers scores for depression followed a similar trend with a significant decreases between baseline and 4-weeks ($p = 0.010$), baseline and 8-weeks ($p = 0.004$), and baseline and 12-weeks ($p = 0.001$).

**DASS - Anxiety**

There was no interaction between groups across time points ($F_{3,46} = 0.088$, $p = 0.964$), no effect of group ($F_{1,48} = 0.653$, $p = 0.504$), and no effect of time ($F_{3,46} = 4.434$, $p = 0.057$) on anxiety scores. The anxiety scores for the compliers revealed no significant difference between baseline and 4-weeks ($p = 1.000$), however a significant decrease was observed between baseline and 8-weeks ($p = 0.039$), and baseline and 12-weeks ($p = 0.018$). The non-compliers anxiety scores showed significant decreases between baseline and 4-weeks ($p = 0.012$), baseline and 8-weeks ($p = 0.001$), and baseline and 12-weeks ($p = 0.001$).

**DASS - Stress**

There was no interaction between groups across time points ($F_{3,46} = 1.798$, $p = 0.201$) and no effect of group ($F_{1,48} = 0.248$, $p = 0.645$) on stress scores. However, a significant effect of time ($F_{3,46} = 13.178$, $p = 0.001$) was found for stress scores. The compliers stress scores showed significant decreases observed between baseline and 4-weeks ($p = 0.003$), baseline and 8-weeks ($p = 0.002$), and baseline and 12-weeks ($p = 0.001$). A similar trend was shown for non-compliers stress with significant differences
between baseline and 4-weeks (p = 0.001), baseline and 8-weeks (p = 0.001), and baseline and 12-weeks (p = 0.001).

**Figure 2.** Effects of a 12-week exercise program on psychological health

**Sleep Quality**

Figure 3 shows that throughout the length of the study, participants in both groups continuously perceived themselves to have bad quality of sleep. There was no interaction
between groups across time points ($F_{3,46} = 2.759, p = 0.134$), no effect of group ($F_{1,48} = 0.176, p = 0.716$), and no effect of time ($F_{3,46} = 0.267, p = 0.847$) observed in quality of sleep scores for either group across the 12-week period of the exercise program.

Figure 3. Effects of a 12-Week Exercise Program on Sleep Quality

**Figure 3.** Note: Values are means ± standard deviations. Compliance was defined by achieving a minimum of 10,000 steps per day on average. Scale ranges from a minimum of 0 (best) to a maximum of 21 (worst). A total score $\leq 5$ is associated with good sleep quality, while a score $> 5$ is associated with poor sleep quality.
CHAPTER V

DISCUSSION

Discussion and Implications

The purpose of this study was to examine the changes in physiological cardiovascular disease risk factors, psychological health, and physical activity patterns following a voluntary 12-week faculty/staff exercise program at a major university. Our primary findings are that there was a significant decrease in average BMI for both compliers and non-compliers after 12-weeks of participation. In addition, we also demonstrated a significant decrease in depression, anxiety, and stress for non-compliers, and a significant decrease in depression and stress for compliers after 4-weeks participation. There was also a significant reduction in anxiety of the compliers, but not until after 8-weeks.

According to previously proposed indices by Tuder-Lock and Bassett (2004), whereby individuals who achieve the 10,000 steps per day goal are considered ‘active,’ the average values obtained by the compliers (12,397 steps/day) would describe them as on the higher end of this category, being just shy of the 12,500 steps per day threshold of the ‘highly active’ category (Tudor-Locke & Bassett, 2004). Under the same scale, the average values of physical activity achieved by the non-compliers in the present study (7,614 steps/day) would put them in the category of ‘somewhat active’ (7,500 steps/day), being just over the threshold of what would still be considered ‘low active’ (5,000 steps/day). Under this scale, individuals who fail to achieve at least 5,000 steps per day would be considered sedentary, which were not present in this study.
The significant difference in physical activity between groups at baseline (4,783 steps/day) was constant throughout the study. While there was no effect of time, there was a noticeable initial increase in physical activity patterns, with the compliers increasing their physical activity by 16% and non-compliers increasing by 10% from baseline to week 4. However, by the end of the study, physical activity patterns for both groups had fallen back to within 4% of baseline values with the non-compliers actually achieving less physical activity than when they had started. The return of both groups’ physical activity levels to near baseline values at the end of the program may have been due to the timing of the study around the academic calendar. While the program started during mid-summer, participants may have been experiencing a reduced workload compared to the final weeks of the study, which ended well into the fall semester, a time which may be associated with heavier workloads for academic faculty and staff. Under this assumption, participants may have sacrificed any personal time spent on physical activity to make up for the increased work demand. However, it is important to note that the compliers continuously achieved a minimum of 10,000 steps per day across time points, while the non-compliers continuously achieved a minimum of 7,000 steps per day. It has been suggested that a minimum 7,000 steps per day is a sufficient equivalent to recommended physical activity guidelines (Jordan, Jurca & Locke, 2005). This suggestion builds on other evidence suggesting that 6,000-7,000 steps per day is indicative of usual daily activity patterns for healthy adults excluding exercise, therefore any additional activity would be considered due to exercise (Tudor-Locke & Bassett, 2004).
The difference in physical activity between groups had no effect on changes in CVD risk factors. Interestingly, over the period of 12 weeks, both groups significantly decreased their average BMI by roughly 2%. The compliers showed an average decrease in BMI of 0.5 kg/m\(^2\) while the non-compliers showed an average decrease in BMI of 0.6 kg/m\(^2\). These changes in BMI are directly associated with each groups average change in body weight. While the compliers showed an average decrease in body weight of 3.08 lbs., the non-compliers lost 5.8 lbs on average; a surprising increase of 88% compared to the more physically active participants. These results build a strong argument for participation in general considering the individuals who were less active actually lost more body weight on average. Furthermore, the reported changes are critically important considering that both groups average BMI scores were in the category of obese and therefore a considered risk factor for cardiovascular disease (Thompson, Gordon & Pescatello, 2010). The reported changes in CVD risk factors are consistent with previous literature stating that worksite physical activity interventions can produce modest to significant changes in body weight (Anderson, Quinn & Glanz, 2009; Benedict & Arterburn, 2008). In a 6 to 12 month follow-up of a worksite intervention, Anderson, et al. (2009) demonstrated an average decrease in BMI of 0.5 kg/m\(^2\) and an average decrease in body weight of 2.8 lbs. Benedict and Arterburn (2008) showed similar results in a worksite program with average decrease in body weight ranging from 0.44 to 14.11 lbs. Perhaps the time-constraining nature of the program (1 hour before work and during lunch) was the prohibiting factor in our participants achieving the significant improvements in blood pressure and cholesterol values seen in another study where
participants exercised for 1.25 hours a session (Bjurstrom & Alexion, 1978).

Alternatively, perhaps the duration of the present study (12 weeks) was the limiting factor in eliciting further desired effects. Previous literature shows that worksite interventions lasting 6 months showed significant improvements in blood cholesterol and both SBP and DBP (Yarvote, McDonagh & Goldman, 1974; Blair, Piserchia & Wilbur, 1986). A previous study by Haines, et al. (2007) examining a similar 12-week program demonstrated results that are consistent with the present study (Haines, Davis & Rancour, 2007). Participants of the program significantly improved BMI, while only moderately improving IFG and total cholesterol. Detailed results of the program include reductions in average BMI of 0.3 kg/m², average IFG values of 5.27 mg/ml, and average total cholesterol values of 5.19 mg/dL. These results suggest that prolonged program adherence is necessary to achieve any further desired effects. It is interesting to note that while Haines, et al. (2007) demonstrated a moderate reduction (p > 0.05) in IFG, the present study showed a significant increase, roughly 10%, in both compliers and non-compliers. It should be noted that several participants did change or begin their insulin medication during the program, which may be attributable to the significant increase in IFG. However, there are no other variables to attribute this to, so perhaps the non-compliance to healthy physical activity may be generalized to healthy eating for these individuals, or even more so, the ability to sufficiently fast as required for a blood test, as such a pronounced negative change is inconsistent with previous literature, although this theory doesn’t account for the negative change in compliers (Conn, Hafdahl & Cooper, 2009). A meta-analysis of worksite physical activity interventions by Conn, et al. (2009)
showed a difference of -12.6 mg/dL when comparing average baseline IFG values to average follow-up IFG values. We would most likely conclude that the significant increase in IFG in our study was primarily due to changes in participant medication during the program.

The data from the present study demonstrated that participation in the program alone, regardless of physical activity level, resulted in an immediate significant decrease in depression that was maintained throughout the duration of the study. The initial response for compliers from baseline to week 4 was roughly an 89% improvement, while non-compliers improved by 45%. It is also important to note that the change from baseline to week 4 for the non-compliers represents a change from categorically mild depression well into the range of normal. The results of the present study are consistent with several previous studies that suggest physical activity may reduce depression in clinical and non-clinical populations (Dimeo, Bauer & Vahram, 2001; Dunn, Madhukar & Trivedi, 2005; Doyne, Ossip-Klein & Bowman, 1987). Previous work by Dimeo, et al. (2001) suggests that 30 minutes of treadmill walking for a period of 10 consecutive days may be sufficient for a significant reduction in depression. While this suggests that relatively minimal exertion and duration is sufficient, a study by Dunn, et al. (2005) showed a dose-response effect in that greater energy expenditure is associated with larger reductions in depression. This may explain the consistently lower depression scores by the compliers throughout the duration of the present study. Furthermore, recognizing that participants in the present study engaged in a variety of exercise modalities, Doyne, et al. (1987) reported that both aerobic and anaerobic exercise activities were successful in
reducing depression with no significant difference. Based on the data from the present study and work by others it is clear that even engagement in low levels of physical activity is associated with decreases in depression.

Anxiety scores showed similar improvements to depression with non-compliers significantly reducing their self-reported anxiety from baseline to week 4 and maintaining this improvement throughout the duration of the study. Interestingly, the compliers showed a delayed response in their improvement, with a significant change not occurring until week 8. However, the delayed improvement in compliers anxiety scores was maintained through week 12. The initial improvement in non-compliers anxiety scores equates to a 50% improvement, while the compliers scores showed no change. The results of the present study clearly suggest exercise to be anxiolytic as consistent with previous literature (Long & van Stavel, 1995; Orwin, 1974; Muller & Armstrong, 1975). While modality was not a factor for depression, Petruzzelo, et al. (1991) showed that exercise associated reductions in anxiety are only present for aerobic exercise, and that at least 21 minutes seems necessary to achieve any desired reduction. A meta-analysis by Long and Satvel (1995) investigating the effects of a physical activity program as a method of anxiety-management treatment for healthy adults showed evidence of a moderate positive effect in anxiety reduction and also found that adults who were more prone to anxiety benefited more from physical activity than those who were not. This is important to consider for the population of the present study, who may be at risk of heightened job related anxiety (Higgins & Kotrlik, 2006). Regardless, our data support
the notion that a worksite wellness program can significantly reduce the average anxiety of participants in 4 to 8-weeks.

Changes in stress scores also followed a pattern of immediate improvement. Both compliers and non-compliers showed significant improvements in stress scores from baseline to week 4 that were maintained throughout the duration of the study. The initial improvement for compliers stress translates to a 67% improvement between baseline and week 4, during the same time non-compliers improved 33%. It is important to note that the initial improvement for compliers was a change from categorically moderate stress to normal stress scores, with a concurrent change in non-compliers from mild to normal stress scores. The evidence of a relationship between physical activity level and stress response in the present study is supported by several previous studies (Schnohr, Kristensen & Prescott, 2005; Ng & Jeffery, 2003). Schnohr, et al. (2005) demonstrated that physically active men and women are less prone to stress than individuals who are sedentary. Furthermore, they found that those who were more active had the lowest level of stress. Another study by Ng and Jeffery (2003) examining relationships between perceived stress and health behaviors in working adults showed that high stress was associated with less frequent exercise. Therefore, we conclude that our data is consistent with previous work that shows exercise is a successful strategy for reducing employee stress.

The marked changes in depression, anxiety, and stress in the present study are consistent with previous literature which suggests a link between regular physical activity and psychological well-being (Biddle, Fox & Boutcher, 2000; Dunn & Dishman, 1991;
This relationship was first brought to mainstream attention by position statements issued by the National Institute of Mental Health which were later endorsed by the International Society of Sport and Psychology (Physical Activity and Psychological Benefits, 2003; Morgan & Goldston, 1987). With previous literature suggesting the most powerful effects are seen among clinical populations, the improvements seen in the present study become relatively more important, as we would expect the population of the present study to be generally healthy adults (Biddle, Fox & Boutcher, 2000). Furthermore, the relatively dramatic improvements in negative emotional scores seen with the present study may suggest that participation alone, regardless of intensity, is a key factor for improving psychological health, as previous literature showed significant improvements with programs consisting of minimally demanding exercise or when participants did not wish to exercise to begin with (Hartfiel, Havenhand & Khalsa, 2011; Greenwood, Spence & Crevling, 2013). Hartfiel, et al. (2011) showed that a six-week yoga intervention significantly improved measures of depression, anxiety, and stress among a randomized group of adults employed at a British university (Hartfiel, Havenhand & Khalsa, 2011). A majority of those adults had rarely or never practiced yoga prior to starting the program. Throughout the six-weeks of the study, participant attendance was an average of 1.15 yoga classes per week. Another study by Greenwood, et al. (2013) found that forced treadmill exercise increases resistance against depression, anxiety, and stress and that controllability is not a critical factor in conferring the protective effects of exercise against stressor exposure (Hartfiel, Havenhand & Khalsa, 2011).
Throughout the duration of the present study, self-reported sleep scores showed no changes and were relatively similar between groups. However, it is important to note that both groups consistently reported scores associated with poor sleep quality throughout the duration of the study. The reported sleep scores are consistent with previous literature considering that both groups are considered obese, a condition associated with an increased risk of sleep related problems such as breathing pauses, snoring, delayed sleep onset, decreased sleep duration, disrupted sleep, daytime sleepiness, and restless legs (Beebe, Lewin & Zeller, 2007; Foley, Ancoli-Israel & Britz, 2004). Furthermore, previous literature also states that poor sleep quality is associated with depression and heart disease (Foley, Ancoli-Israel & Britz, 2004). However, it should be noted that during the present study, depression scores significantly improved regardless of no change in sleep quality. The consistence of the reported sleep quality scores may also have an association with the start time of the morning group, where participants may have been required to report to work earlier than their normal routine and therefore may have had an earlier rise time than to which they were accustomed.

Several factors limit the conclusions that can be drawn from our study. First, there were no restrictions for participant choice of exercise modality throughout the duration of the study. In addition, there was no method of data collection for participant choice of exercise modality. Therefore, there is no way of knowing the consistency of individuals to engage in a repetitive choice of exercise, or if a modification in chosen modality occurred based on intensity. Furthermore, this leaves no way of knowing the exact effect of the program intensity on the outcomes measured. As a result, the outcome
effects of the study have to be taken as the result of global physical activity participation ranging from the most minimally demanding exercise available to the most extreme. However, it should be noted that participants were encouraged to progress to more demanding exercise modalities as their participation in the program continued. Additional limitations include not having any dietary instructions upon enrollment, which eliminates control for the effect of dietary changes on the outcomes measured, and the relatively modest number of participants (N = 50) that included very few men.

In summary, the current study demonstrated that a 12-week faculty / staff exercise program at a major university was sufficient in decreasing employee CVD risk factors, as evidenced by a significant change in BMI (~2%) regardless of the average level of daily physical activity. Although there was a significant increase in IFG, it was likely due to changes in participant insulin medications during the program. A major finding of this study was the effectiveness of increasing physical activity such that even non-compliers were on average above the threshold of sedentary. This equates to 96% of participants who were on average above the threshold of sedentary. Future research is warranted to determine if prolonged participation (e.g. 6 months) in the program would elicit further improvements in blood cholesterol, IFG, and both SBP and DBP (Haines, Davis & Rancour, 2007; Yarvote, McDonagh & Goldman, 1974; Blair, Piserchia & Wilbur, 1986). The current study also demonstrated that a program of this nature is sufficient in significantly reducing the negative emotional states of depression, anxiety, and stress in participants regardless of the average level of daily physical activity. It is important to note that this program was successful in reducing mild depression and moderate stress
levels to normal within a period of 4-weeks, meaning that within 4-weeks, the program reduced all elevated scores of negative emotional states to within normal values. Furthermore, the study suggests that a 12-week university faculty and staff exercise program has no effect on employee sleep patterns. It is clear that involvement at any level in a worksite physical activity program has a positive effect on employee physical and psychological health.
APPENDIX A

LETTER OF INFORMED CONSENT
Appendix A

Letter of Informed Consent

*Title: The Physiological and Cognitive Effects of a Faculty / Staff Exercise Program in a University Setting*

This study focuses on analyzing the data collected from participants in the Faculty/Staff Exercise Program to determine the success and quantifying the results of the program. We are interested in the effectiveness of this program on multiple levels, individual and group, as it is the first of its kind – an exercise program targeting the faculty and staff at a university.

We would like you to take part in this project. Participants should be enrolled in either the 6am or 12pm session of the Faculty/Staff Exercise Program and be regular attendees. If you decide to participate in the research part of the program, we will use the data collected during the pre, mid, and post-session testing. This data will include both measures of physical health as well as cognitive health and will be stored in a repository that will include only the information obtained as part of this study. No data from participants from other studies will be included in the repository.

Measures of physical health will include the assessment of body fat. This will be done using the skin-fold method of analysis. For this method we will specifically use the 3-site method and will include using a handheld caliper to measure the thickness of your skin in three different locations on your body. Cholesterol, lipid profile, and basic metabolic panel measurements will be taken via blood draw analysis. This will be done within our facility by certified research staff and will include 3 vials taken pre and post only. A 6 or 12 minute walk test will be completed to measure aerobic capacity. For this test you will be asked to walk as far as possible for 6 or 12 minutes, depending on ability. You will be permitted to slow down, to stop, and to rest as necessary. Flexibility will be assessed via the sit-and-reach test while anaerobic strength and endurance will be assessed using sit-up and curl-up tests. Assessment of balance will be done using a Biodex Balance System that will measure your response to standing on an unstable surface. This test requires you to stand on a platform that when prompted via a viewing screen, will become unstable and sensitive to your center of gravity. The system is equipped with hand rails that you may grab at any time and there will also be trained staff within immediate proximity to assist you if you lose your balance.
The final assessments will be of cognitive health. For these you will be asked to complete several questionnaires that ask questions about your sleep habits, stress levels, and mood.

In addition to these assessments, you will be given a MOVband, which will track all physical activity. It should be worn at all times to best quantify activity levels throughout the day and not just during the workout sessions. In addition, this will allow for the analysis of activity levels on days when the organized exercise classes do not meet. The data from the MOVband will be uploaded to a computer program for tracking so that no manual entry is necessary.

With any type of physical activity, there are some risks. These risks are minimal but may include fatigue, shortness of breath, muscle soreness or dizziness. The risk of heart attack and stroke will be minimized by following the American College of Sports Medicine’s current guidelines for exercise testing and prescription. In the unlikely event that participation results in injury, medical assistance or emergency medical treatment by the University Health Center is provided only to currently registered students. Please be advised that for all others, “911” will be called for physical injuries occurring on the Kent State University main campus. Also, all of our staff is required to carry current CPR / AED certification throughout the entire duration of the program.

You or your medical insurance will be billed for this service. No other medical treatment or financial compensation for injury from participation in this project is available.

The direct benefits to you for your participation in this study include the use of the MOVband for personal motivation. Each participant will be able to upload their data to a tracking website and compare their activity levels to other participants. All identifying information will be removed and only the research staff will have the identifiers. The MOVband also allows for friendly competition and motivation to compete with others and achieve personal goals. The Faculty/Staff Exercise Program offers benefits to society with quantifiable data showing the success and benefits of an exercise program targeted to faculty and staff at a university. Lastly, participation in the program will help decrease health risks associated with sedentary behavior, increase the overall health of the communities, and may lower health care costs.

Confidentiality will be maintained to the limits of the law. Confidentiality may not be maintained if you indicate that you may do harm to yourself or may do/have done harm to others.

Records will be kept in a locked drawer in a locked room to ensure confidentiality. Names or other identifiable information will not be released with the data.
Participation is completely voluntary. If you take part, you may stop at any time. If you are a participant in the Faculty/Staff Exercise Program, you will not be at a disadvantage by not taking part in the research aspect.

If you want to know more about this research project, please call Dr. Ellen Glickman at 330-672-2930. The project has been approved by Kent State University. If you have questions about Kent State University's rules for research, please contact the Kent State University Institutional Review Board (IRB) 330-672-2704.

Sincerely,

Dr. Ellen Glickman, PhD, FACSM

CONSENT STATEMENT

I agree to take part in this project. I know what I will have to do and that I can stop at any time.

________________________________________________________________________
Print Name                                                                                                   Date

________________________________________________________________________
Signature                                                                                                      Date
Authorization to Use or Disclose Health Information that Identifies You for a Research Study

If you sign this document, you give permission to the Department of Exercise Physiology at Kent State University to use or disclose your health information that identifies you for the aforementioned research study.

The health information that we may use or disclose for this research includes medical records, results of physical examinations, medical history, lab tests, and certain health information indicating or relating to a particular condition. This includes the health history questionnaire that you completed previously upon joining the program.

The health information listed above may be used by and/or disclosed to the Department of Exercise Physiology at Kent State University:

- Dr. Ellen Glickman (Department Coordinator)
- Duane Corbett (Doctoral Student)
- Kylene Peroutky (Doctoral Student)
- Michael Rebold (Doctoral Student)

The Department of Exercise Physiology at Kent State University is required by law to protect your health information. By signing this document, you authorize the Department of Exercise Physiology at Kent State University to use and/or disclose your health information for this research. Those persons who receive your health information may not be required by Federal privacy laws (such as the Privacy Rule) to protect it and may share your information with others without your permission, if permitted by laws governing them.

Please note that you may change your mind and revoke this authorization at any time, except to the extent that the Department of Exercise Physiology at Kent State University has already acted based on this Authorization. To revoke this authorization, you must write to: ATTN: Faculty/Staff Exercise Program, Exercise Science Laboratory, 162 Gym Annex, Kent OH 44224-0001.
This authorization does not have an expiration date.

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>
APPENDIX B

HEALTH HISTORY QUESTIONNAIRE
Appendix B

Health History Questionnaire

KENT STATE UNIVERSITY
FACULTY/STAFF EXERCISE PROGRAM

HEALTH HISTORY
Thank you for enrolling in the Faculty/Staff Exercise Program. Because the purpose of this program is to improve physical health, some exercises may require strenuous exertion and hard effort. Consequently, it is important that we have an accurate assessment of your past and present health status to assure that you have no medical conditions that would make this program especially dangerous for you. Please complete the health history as accurately as you can.

THIS MEDICAL HISTORY IS CONFIDENTIAL AND WILL BE SEEN ONLY BE THE GRADUATE STUDENTS AND PROFESSORS OVERSEEING THE EXERCISE PROGRAM

Name__________________________________________ Date____/____/____
Date of Birth____/____/____ Present Age_____yrs

Ethnic Group:  ____White
____ African American
____ Hispanic
____ Asian
____ Pacific Islands
____ American Indian
____ Other_____________

HOSPITALIZATIONS AND SURGERIES
If you have ever been hospitalized for an illness or operation, please complete the chart below. Do not include normal pregnancies, childhood tonsillectomy, or broken bones.

YEAR______________ OPERATIONS OR ILLNESS
________________________________________________________________________
____

YEAR______________ OPERATIONS OR ILLNESS
Are you under long-term treatment for a protracted disease, even if presently not taking medication? [ ] Yes [ ] No
If Yes, explain: ________________________________________________________________
MEDICATIONS
Please list all medications that you have taken within the past 8 weeks: (Include prescriptions, vitamins, over-the-counter drugs, nasal sprays, aspirins, birth control pills, etc.)
Check this box [ ] if you have not taken any medication.
MEDICATION________________
DOSE_____________________
REASON FOR TAKING THIS
________________________________________________________________________
________________________________________________________________________
MEDICATION________________
DOSE_____________________
REASON FOR TAKING THIS
________________________________________________________________________
________________________________________________________________________
MEDICATION________________
DOSE_____________________
REASON FOR TAKING THIS
________________________________________________________________________
________________________________________________________________________
MEDICATION________________
DOSE_____________________
REASON FOR TAKING THIS
________________________________________________________________________
________________________________________________________________________
ALLERGIES
Please list all allergies you have (include pollen, drugs, alcohol, food, animals, etc.)
Check this box [ ] if you have no allergies.

1.______________________________________________________________________
2.______________________________________________________________________
3.______________________________________________________________________
4.______________________________________________________________________

When was the last time you were “sick”? (e.g. common cold, flu, fever, etc.)

________________________________________________________________________

PROBLEMS AND SYMPTOMS
Place an X in the box next to any of the following problems or symptoms that you have had:

General

[ ] Mononucleosis
   If yes, when_________________________________________________________

[ ] Excessive fatigue
[ ] Recent weight loss while not on a diet
[ ] Recent weight gain
[ ] Thyroid disease
[ ] Fever, chills, night sweats
[ ] Diabetes
[ ] Arthritis
[ ] Sickle Cell Anemia
[ ] Heat exhaustion or heat stroke
[ ] Recent sunburn

Heart and Lungs

[ ] Abnormal chest x-ray
[ ] Pain in chest (persistent and/or exercise related)
[ ] Heart attack
[ ] Coronary artery disease
[ ] High blood pressure
[ ] Rheumatic fever
[ ] Peripheral vascular disease
[ ] Blood clots, inflammation of veins (phlebitis)
[ ] Asthma, emphysema, bronchitis
[ ] Shortness of breath
  [ ] At rest
  [ ] On mild exertion
[ ] Discomfort in chest on exertion
[ ] Palpitation of the heart; skipped or extra beats
[ ] Heart murmur, click
[ ] Other heart trouble
[ ] Lightheadedness or fainting
[ ] Pain in legs when walking
[ ] Swelling of the ankles
[ ] Need to sleep in an elevated position with several pillows

G-U SYSTEM

[ ] Get up at night to urinate frequently
[ ] Frequent thirst
[ ] History of kidney stones, kidney disease

G.I. TRACT

[ ] Eating disorder (e.g. anorexia, bulimia)
[ ] Yellow jaundice
  If yes, when____________________________________________
[ ] Hepatitis
  If yes, when____________________________________________
[ ] Poor appetite
[ ] Frequent indigestion or heartburn
[ ] Tarry (black) stool
[ ] Frequent nausea or vomiting
[ ] Intolerance of fatty foods
[ ] Changes in bowel habits
[ ] Persistent constipation
[ ] Frequent diarrhea
[ ] Rectal bleeding
[ ] Unusually foul smelling or floating stools
[ ] Pancreatitis
Nervous System

[ ] Alcohol problem
[ ] Alcohol use
   If yes, how many drinks ingested per week? __________________
[ ] Frequent or severe headaches
[ ] Stroke
[ ] Attacks of staggering, loss of balance, dizziness
[ ] Persistent or recurrent numbness or tingling of hands or feet
[ ] Episode of difficulty in talking
[ ] Prolonged periods of feeling depressed or “blue”
[ ] Difficulty in concentrating
[ ] Suicidal thoughts
[ ] Have had psychiatric help

Have you ever passed out during or after exertion? YES NO
Do you have a family history of coronary artery disease YES NO
If yes, Who? (Grandparents, parents, siblings, uncles, and aunts)

________________________________________________________________________

Are there any other reasons not mentioned above that you feel you should not participate in this exercise program? YES NO

Do you currently smoke cigarettes? YES NO
Do you currently use any smokeless tobacco products? YES NO
APPENDIX C

PRESCREENING QUESTIONNAIRE
Appendix C

Prescreening Questionnaire

AHA/ACSM Health/Fitness Facility Preparticipation Screening Questionnaire

Assess your health status by marking all true statements

<table>
<thead>
<tr>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have had:</td>
</tr>
<tr>
<td>___ a heart attack</td>
</tr>
<tr>
<td>___ heart surgery</td>
</tr>
<tr>
<td>___ cardiac catheterization</td>
</tr>
<tr>
<td>___ coronary angioplasty (PTCA)</td>
</tr>
<tr>
<td>___ pacemaker/implantable cardiac</td>
</tr>
<tr>
<td>___ defibrillator/rhythm disturbance</td>
</tr>
<tr>
<td>___ heart valve disease</td>
</tr>
<tr>
<td>___ heart failure</td>
</tr>
<tr>
<td>___ heart transplantation</td>
</tr>
<tr>
<td>___ congenital heart disease</td>
</tr>
</tbody>
</table>

If you marked any of these statements in this section, consult your physician or other appropriate health care provider before engaging in exercise. You may need to use a facility with a medically qualified staff.

<table>
<thead>
<tr>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>You experience chest discomfort with exertion.</td>
</tr>
<tr>
<td>You experience unreasonable breathlessness.</td>
</tr>
<tr>
<td>You experience dizziness, fainting, or blackouts.</td>
</tr>
<tr>
<td>You take heart medications.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other health issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>You have diabetes.</td>
</tr>
<tr>
<td>You have asthma or other lung disease.</td>
</tr>
<tr>
<td>You have burning or cramping sensation in your lower legs when walking short distances.</td>
</tr>
<tr>
<td>You have musculoskeletal problems that limit your physical activity.</td>
</tr>
<tr>
<td>You have concerns about the safety of exercise.</td>
</tr>
<tr>
<td>You take prescription medication(s).</td>
</tr>
<tr>
<td>You are pregnant.</td>
</tr>
</tbody>
</table>

Cardiovascular risk factors

|___ You are a man older than 45 years. |
|___ You are a woman older than 55 years. |
|___ You smoke or have quit smoking within the previous 6 months. |
|___ Your blood pressure is >140/90 mm Hg. |
|___ You do not know your blood pressure. |
|___ You take blood pressure medication. |
|___ Your blood cholesterol level is >200 mg/dL. |
|___ You do not know your cholesterol level. |
|___ You have a close blood relative who had a heart attack or heart surgery before age 55 (father or brother) or age 65 (mother or sister). |
|___ You are physically inactive (i.e., you get <30 minutes of physical activity on at least 3 days per week). |
|___ You are > 20 pounds overweight. |

If you marked two or more of the statements in this section you should consult your physician or other appropriate health care provider before engaging in exercise. You might benefit from using a facility with a professionally qualified exercise staff to guide your exercise program.

___ None of the above

You should be able to exercise safely without consulting your physician or other appropriate health care provider in a self-guided program or almost any facility that meets your exercise program needs.
Appendix D

DASS21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I found it hard to wind down</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>I was aware of dryness of my mouth</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>I couldn't seem to experience any positive feeling at all</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>I found it difficult to work up the initiative to do things</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>I tended to over-react to situations</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>I experienced trembling (eg, in the hands)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>I felt that I was using a lot of nervous energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>I was worried about situations in which I might panic and make a fool of myself</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>I felt that I had nothing to look forward to</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>I found myself getting agitated</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>I found it difficult to relax</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>I felt down-hearted and blue</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>I was intolerant of anything that kept me from getting on with what I was doing</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>I felt I was close to panic</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>I was unable to become enthusiastic about anything</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>I felt I wasn't worth much as a person</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>I felt that I was rather touchy</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>I felt scared without any good reason</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>I felt that life was meaningless</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
APPENDIX E

PITTSBURGH SLEEP QUALITY INDEX
Appendix E

Pittsburgh Sleep Quality Index

PSQI

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?
   BED TIME:__________________

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
   NUMBER OF MINUTES:__________

3. During the past month, what time have you usually gotten up in the morning?
   GETTING UP TIME:______________

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed).
   HOURS OF SLEEP PER NIGHT:__________

For each of the remaining questions, check the best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you....

   (a) Cannot get to sleep within 30 minutes:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (b) Wake up in the middle of the night or early morning:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (c) Have to get up to use the bathroom:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (d) Cannot breathe comfortably:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (e) Cough or snore loudly:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (f) Feel too cold:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (g) Feel too hot:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (h) Had bad dreams:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (i) Had Pain:
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week

   (j) Other reason(s), please describe:
       How often during the past month have you had trouble sleeping because of this?
       Not during the past month
       Less than once a week
       Once or twice a week
       Three or more times a week
6. During the past month, how would you rate your sleep quality overall?

- Very Bad
- Fairly Bad
- Fairly Good
- Very Good

<table>
<thead>
<tr>
<th></th>
<th>Not during the past month</th>
<th>Less than once a week</th>
<th>Once or twice a week</th>
<th>Three or more times a week</th>
</tr>
</thead>
</table>

7. During the past month, how often have you taken medication (prescribed or "over the counter") to help you sleep?

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

- No problem at all
- Only a very slight problem
- Somewhat of a problem
- A very big problem
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