THE EFFECTS OF A 16-WEEK EXERCISE PROGRAM AND CELL PHONE USE ON PHYSICAL ACTIVITY, SEDENTARY BEHAVIOR, AND HEALTH-RELATED OUTCOMES

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American adults participate in low physical activity and high sedentary behavior. Specific Aim #1 assessed the effects of a 16-week worksite exercise program on physical activity, sedentary behavior, fitness-related variables, and health-related psychometric trait changes. Specific Aim #2 examined the relationship between cell phone use, physical activity, and sedentary behavior in adults 30 years of age and older. Employees participated in a 16-week exercise intervention (Intervention group: n = 47, n = 38 females) or served as a control (Control group: n = 15, n = 11 females), completed fitness testing, wore accelerometers, and completed questionnaires assessing their physical and sedentary behavior, psychometric traits, and cell phone use. Results revealed both groups participated in recommended physical activity with no differences between groups (p ≥ 0.2 for all measures). Sedentary behavior significantly decreased (p = 0.003) in the Intervention group. Fitness-related variables and health behavior improved in both groups, but to a greater extent in the Intervention group. Cell phone use was not associated with objective physical activity (r ≤ 0.1, p ≥ 0.3 for both), subjective physical activity, (r ≤ 0.1, p ≥ 0.3 for all), or sedentary behavior (r = - 0.11, p = 0.4). These results suggest participating in a worksite exercise program or participating in regular fitness assessments may foster positive health outcomes, but the worksite exercise program may
lead to greater improvements. Adults 30 years and older may prefer other more traditional forms of activity during their sedentary time than the use of a cell phone.
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CHAPTER I

INTRODUCTION

The participation in physical activity is associated with many positive health benefits (Garber et al., 2011; Physical-Activity-Guidelines-Committee, 2008; Vogel et al., 2009). These benefits include improved functional and cognitive health, reduced risk of falls, decreased risk of premature mortality, and prevention of diseases such as cardiovascular disease/coronary artery disease, hypertension, stroke, osteoporosis, type 2 diabetes mellitus, metabolic syndrome, obesity, colon cancer, breast cancer, and depression (Physical-Activity-Guidelines-Committee, 2008). Conversely, inadequate participation in physical activity and excessive sedentary (i.e., sitting) behavior are associated with an increased risk of developing a variety of diseases, including cardiovascular disease and type 2 diabetes (Kohl et al., 2012; Lee et al., 2012).

The public health perspective for current physical activity recommendations from the American College of Sports Medicine suggest that to gain health benefits, the minimum physical activity is that adults should participate in 150 minutes a week of moderate-intensity aerobic physical activity, or 75 minutes per week of vigorous-intensity aerobic physical activity, or a combination of moderate and vigorous physical activity (Garber et al., 2011). Moderate-intensity physical activity is defined as physical activity that is performed at 40-59% of heart rate reserve, 64-76% of maximal heart rate, or 3-5.9 times the intensity as rest Metabolic Equivalent of Task (Garber et al., 2011). The Metabolic Equivalent of Task is the rate of physiologic energy cost of physical activities, where a single Metabolic Equivalent of Task is equivalent to 3.5 milliliters of
oxygen consumption per kilogram of body weight per minute. Vigorous-intensity physical activity is defined as physical activity that is done at 60-89% of heart rate reserve, 77-95% of maximal heart rate, or 6-8.7 or more Metabolic Equivalent of Task (Garber et al., 2011). It is recommended to achieve a minimum of 500 Metabolic Equivalent of Task-minutes each week. It is also suggested that simply expending energy throughout the day can help prolong life longevity (Manini et al., 2006) and that habitual physical activity may reduce disease development risk. Hence it is suggested that acquiring about 8,000 steps per day will improve health (C Tudor-Locke, 2014; Catrine Tudor-Locke & Bassett Jr, 2004). Additionally, the American College of Sports Medicine provides guidelines for muscle-strengthening activities which should be performed on two or more days per week, using exercises that work all major muscle groups (Garber et al., 2011). Muscle-strengthening activities include exercises that increase skeletal muscle strength, power, endurance, and mass. The guidelines to improve these variables include performing 1-4 sets of resistance exercises per muscle group with rest intervals of 2-3 minutes. For hypertrophy and strength gains, 60%-80% of the individual’s one-repetition maximal effort should be performed. For novice to intermediate resistance-training participants, a weight of 60%-70% of the one-repetition maximal effort should be used, completing 8-12 repetitions per set or the amount of repetitions to achieve muscle fatigue but not exhaustion. To improve muscular endurance, a load of <50% of one-repetition maximum to complete 15-25 repetitions per set, for 1-2 sets should be performed. Physical activity and health benefits do have a dose-response relationship, as participating in greater physical activity may lead to
additional and more pronounced health benefits (Garber et al., 2011; Jakicic, Clark, & Coleman, 2001; Saris et al., 2003).

A large body of research is available regarding the impact a lack of physical activity has among varied populations (American-College-Health-Association, 2012; Garber et al., 2011; Haskell et al., 2007; Troiano et al., 2008), including the United States. On average, American adults’ participation in physical activity is below the recommendations for health improvements (Kruger, Ham, & Kohl III, 2005; Physical-Activity-Guidelines-Committee, 2008; Troiano et al., 2008; Tucker, Welk, & Beyler, 2011). In 2005, it was concluded that nationwide, 49.1% of the United States population met the physical activity guideline (Kruger et al., 2005). In 2013, the Center for Disease Control stated that 51.6% of the United States population met the aerobic recommendations for physical activity, 29.3% of United States adults met the muscle-strengthening guideline, and 20.6% met both (Center for Disease Control and Prevention, 2013). A study measuring self-reported and objectively measured physical activity among 3,082 American adults demonstrated a large variation when assessing self-reported and objectively-measured physical activity. According to this study, approximately 62% of adults met the physical activity guidelines using self-reported measures, while only 10% met the physical activity guidelines using objective measurements (Tucker et al., 2011). Overall, the percent of the adult population participating in adequate amounts of physical activity in the United States is below what is needed to achieve population-level health improvements.
An estimated 3.2 million people around the world may die each year due to disorders that are associated with excessive sedentary behavior, marking this as the fourth leading risk factor of mortality (Pratt, Norris, Lobelo, Roux, & Wang, 2014). Hence, sedentary behavior places a large burden on healthcare systems (Oldridge, 2008; Pratt et al., 2014). In 2010, 86% of the United States health care expenditure was for individuals with one or more chronic medical condition (Gerteis et al., 2014). This is of great concern since health care is $2.9 trillion and total national health expenditures are 17.4% of the Gross Domestic Product (Center for Disease Control, 2013). Because reducing sedentary behavior and increasing physical activity can help prevent many of these costly chronic conditions (Chandrashekhar & Anand, 1991; Jennings, Deakin, Dewar, Laufer, & Nelson, 1989; Smith et al., 1995; Warburton, Nicol, & Bredin, 2006), it is important to focus on research that identifies ways to increase physical activity and decrease sedentary behavior.

The lack of participation in physical activity may be influenced by a number of psychometric factors such as personality (R. E. Rhodes, Fiala, & Conner, 2009), self-efficacy for physical activity (S. Williams & French, 2011), and self-determination for physical activity (Ng et al., 2012). Determining which traits are associated with engagement of physical activity and changes in health behavior may be beneficial so future interventions can focus on the enhancement of these traits. Much of the previous research examining psychometric factors and physical activity engagement have relied upon self-reported questionnaires to assess physical activity and sedentary behavior (Hansen, Ommundsen, Holme, Kolle, & Anderssen, 2014; Sebire, Standage, &
Vansteenkiste, 2009; K. E. Wilson & Dishman, 2015). These instruments may be inferior to objective physical activity measurements due to their subjective nature (Centers-for-Disease-Control-Prevention, 2013; Leenders, Sherman, & Nagaraja, 2000; Sallis & Saelens, 2000; Seefeldt, Malina, & Clark, 2002; Shephard, 2003; Tucker et al., 2011). This means individuals may overestimate or underestimate their physical activity behavior, which may cause the results of the population’s physical activity behavior to be unreliable. Therefore, further research into the psychometric factors that are most strongly associated with exercise participation and adherence, using objective measures of physical activity, is warranted.

**Specific Aim 1**

One promising approach to increase physical activity and minimize sedentary behavior is the use of worksite health promotion programs which have been shown to improve health status and health behavior (Dugdill, Coulson, McKenna, & Field, 2008). These programs may also reduce employee medical costs (Baicker, Cutler, & Song, 2010). Recently, research from our group demonstrated that a 12-week faculty and staff exercise program (exercising three times per week) caused significant improvements in measures of muscular endurance, flexibility, and balance (Rebold, Kobak, Peroutky, & Glickman, 2015). Even minimal physical activity using a 12-week walking program at a worksite has shown to reduce body mass index (BMI), blood glucose, and total cholesterol (Haines et al., 2007). Additionally, a meta-analysis concluded that employer-based wellness initiatives may improve health (Baicker et al., 2010). While the overall ability of these programs to increase physical activity has been modest, even these
modest increases elicit improvements in many health behaviors (e.g., smoking, diet, physical activity, alcohol consumption, biometric measures, and fitness measures) (Goetzel et al., 2014). However, these findings are equivocal, as the effectiveness of worksite health promotion programs is questioned. For example, a review examining worksite health promotion programs concluded that eight of the 13 were beneficial for improving physical activity behavior (Osilla et al., 2012). This review also found out of 12 studies examining physiological markers (e.g. BMI or weight, cholesterol, blood pressure), six studies showed improvements. Hence, there is a need for future research examining if worksite health promotion programs are successful in improving healthy behavior and what human traits motivate one to engage in regular physical activity within these programs and how the traits change throughout a program.

**Specific Aim 2**

While we are interested in assessing factors that may promote physical activity, we are also interested in better understanding factors that may limit physical activity and which contribute to sedentary behavior. A device owned by 91% of American adults is the cellular telephone, or cell phone (Pew-Research-Center, 2014). Modern cell phones (i.e., “smart” phones) provide constant access to entertainment activities (e.g., surfing the internet, playing video games, and watching videos) which are traditionally positively associated with sedentary behavior (Ford, Kohl, Mokdad, & Ajani, 2005; Must & Tybor, 2005; Santos et al., 2013; Tremblay et al., 2011). However, the cell phone, unlike a television or desktop computer, is a portable device. Therefore, it is possible to participate in these traditionally sedentary behaviors while simultaneously participating
in physical activity. Previous research on college-aged adults has indicated that cell phone use is positively associated with sedentary behavior (Barkley & Lepp, 2016b; Barkley, Lepp, & Salehi-Esfahani, 2015) and negatively associated with fitness (Lepp, Barkley, Sanders, Rebold, & Gates, 2013). Public data indicates that cell phone use is also inversely associated with age (Pew-Research-Center, 2014), meaning older individuals use the device less than younger individuals. Therefore, research examining the relationship between cell phone use and physical activity and sedentary behavior among adults beyond the college age (i.e., ≥ 30 years old) is warranted as their use of the device may differ from that of college-aged adults. And, due to cell phones traditionally “sedentary” nature, it may be important to investigate the affect cell phones may have on American adults’ physical activity and sedentary behavior (Rosenberg et al., 2010).

In summary, the benefits of participating in adequate physical activity and reducing sedentary behavior are important as these behaviors have important consequences for daily health and well-being (Garber et al., 2011; Physical-Activity-Guidelines-Committee, 2008), making physical activity promotion a basic pillar of national policy. Several correlates to physical activity and sedentary behavior have been identified, including personality (R. Rhodes & Smith, 2006), self-efficacy (S. Williams & French, 2011), self-determination (E. L. Deci & R. Ryan, 2002), and cell phone use (Barkley & Lepp, 2016b; Barkley et al., 2015; Rebold, Kobak, et al., 2015). However, because physical activity participation is largely inadequate and sedentary behavior is high in the American (and other) population(s), greater understanding of how
psychometric and behavioral factors are related to physical activity and sedentary behavior participation and success of physical activity interventions are needed.

**Statement of the Problem**

Although the positive reasons to engage in physical activity are well documented, current data demonstrates that a majority of the United States population does not participate in the minimum amount of physical activity set by the American College of Sports Medicine (Garber et al., 2011; Physical-Activity-Guidelines-Committee, 2008). Additionally, although the detrimental effects of high sedentary behavior are well documented, many adults are highly sedentary (Centers-for-Disease-Control-Prevention, 2013). Therefore, American adults may be missing the important health benefits gained from engaging in physical activity and exercise. Given these low physical activity levels in this population, it is important to understand the factors that influence the choice to engage or not engage in physical activity and sedentary behavior. A strategy to increase physical activity and healthy behaviors is implementing effective worksite health promotion programs (Goetzel et al., 2014; Sorensen & Barbeau, 2004). Understanding the reasons for participation and success of physical activity interventions among American adults in a worksite exercise program may provide information such as personality traits and motivational constructs which are associated with participation in the program and physical activity engagement (Bauman et al., 2012). Unfortunately, prior work in this area has relied on self-reported measures to assess physical activity and sedentary behavior; and most examinations of workplace health promotion programs focus only on fitness outcomes and ignore psychometric variables. Furthermore, while
they appear to be a predictor of sedentary behavior in college-aged students, there is no research examining the relationship between modern cell phone use and physical activity and sedentary behavior in adults older than college age. Using objective measurements of physical activity to discover behavioral-psychosocial traits and if the use of cell phones are associated with physical activity may allow future interventions and public health messages to target these traits so there is improvement of interventions and increased physical activity participation (M. L. Booth, Bauman, Owen, & Gore, 1997).

**Purpose of the Study**

The purpose of the study is twofold:

1. To determine if a worksite exercise program is effective in promoting physical activity, reducing sedentary behavior, improving fitness, and improving psychological factors positively associated with health in a group of faculty and staff participating in a worksite exercise intervention here at Kent State University and a group not participating in the exercise intervention

2. To test the relationship between cell phone use, physical activity and sedentary behavior in adults that are greater than college age (i.e., ≥ 30 years)
CHAPTER II
LITERATURE REVIEW

Specific Aim 1

Less than half of the American adult population participates in the minimum recommendation of aerobic physical activity for health benefits and less than 21% participate in the minimum muscle-strengthening activities (Centers-for-Disease-Control-Prevention, 2013; Kruger et al., 2005; Physical-Activity-Guidelines-Committee, 2008). This is of great concern because physical activity has many health benefits such as improving cardiovascular health, decreasing risk of premature mortality, and increasing cognition (Garber et al., 2011; Kruger et al., 2005). Excessive sedentary behavior can lead to many negative health outcomes such as development of coronary heart disease, cancer, and diabetes, as well as decreased life expectancy (Haskell et al., 2007; Saris et al., 2003; P. T. Williams, 2001). Factors which influence the participation in physical activity and sedentary behavior include psychometric variables such as personality (K. E. Wilson & Dishman, 2015), self-efficacy (McAuley & Blissmer, 2000), and self-determination (Bauman et al., 2012). Much prior research has used self-reported instruments to identify psychometric variables associated with physical activity and sedentary behavior, with a lack of research using objective instruments (Bauman et al., 2012; K. E. Wilson & Dishman, 2015). Worksite exercise programs may be useful in improving healthy behavior because a majority of American adults’ time is spent at work (Baicker et al., 2010; Dugdill et al., 2008; Goetzel et al., 2014; Matthews et al., 2008). Identifying which variables are associated with physical activity and sedentary behavior
and improvements of these variables in worksite exercise programs may help to improve future interventions that focus on promoting healthy behaviors. Additionally, previous research has identified cell phone use to be positively associated with sedentary behavior in college-aged individuals (Barkley & Lepp, 2016b; Barkley et al., 2015; Lepp et al., 2013). However, there is a dearth in the research as to how cell phone use in adults above the college age affects healthy behavior. Overall, this review focuses on the worksite exercise programs’ effect on healthy behavior, the association of psychometric variables with physical activity, and the association of cell phone use with healthy behavior.

**Worksite Health Promotion Programs**

A majority of the American population spends a great amount of time at work, which leads to the work environment having a large influence on employee health (Linnan et al., 2008). Focusing on health behavior at the work environment may produce positive outcomes in employee health (Sorensen & Barbeau, 2004) such as improved physical fitness and improved mental outcomes. About 70% of diseases are caused by poor lifestyle habits and can be modified if proper health behavior is taken; making implementing exercise programs of great benefit to employers (Amler & Dull, 1987; McGinnis & Foege, 1993; Mokdad, Marks, Stroup, & Gerberding, 2004). Worksite health promotion programs range from traditional exercise classes, walking or step programs, and cosmetic and structural enhancements to encourage physical activity, including behavior and counseling techniques (Goetzel et al., 2014). Depending on the program in place, some of these worksite health promotion programs have been shown to
improve healthy behavior (Freak-Poli, Wolfe, Walls, Backholer, & Peeters, 2011; Gazmararian, Elon, Newsome, Schild, & Jacobson, 2013; Rebold, Kobak, et al., 2015) while others have not (French et al., 2010; Leininger, Harris, Tracz, & Marshall, 2013; Tveito & Eriksen, 2009). These programs sometimes have a high dropout rate (Albury, Forsythe, & Thorpe, 2014). Programs may be biased if the individuals who participate in the program are already physically active or desire to be physically active. There seems to be a lack of knowledge in the literature as to how effective worksite health promotion programs are in improving healthy behavior among all employees at worksites. Additionally, research has not determined the most effective design of a worksite health promotion program in improving healthy behavior. Therefore, research is needed to determine the reasons as to why some engage in worksite health promotion programs and others do not. Well-designed, effectively executed, and properly evaluated programs have shown to be beneficial, while poorly designed programs that do not follow evidence-base methods from prior research may fail to increase health behavior (Goetzel et al., 2014; Hill-Mey et al., 2015).

Previous literature examining effects of worksite health promotion programs on physical activity behavior have been shown to increase physical activity (Campbell et al., 2002; Chyou, Scheuer, & Linneman, 2006; Conn, Hafdahl, Cooper, Brown, & Lusk, 2009; Goetzel et al., 2014; Malik, Blake, & Suggs, 2014; Purath, Michaels Miller, McCabe, & Wilbur, 2004). Conn et al., (2009) completed a meta-analysis involving 38,231 employees from different companies. In studies that tracked daily steps, the intervention groups achieved 8,869 steps per day while the Controls reached 8,257 steps.
per day. This difference is 612 more per day, or a 7% increase in steps in intervention
groups. The effect size of increased physical activity was calculated to be 0.21 and the
effect size of the increase in fitness measures was 0.57 (Conn et al., 2009). This
demonstrates the worksite programs may be effective in improving healthy behavior.
The following studies will describe the results of worksite physical activity interventions.

An intervention was implemented at a worksite which involved four groups:
health screening (control); health screening and health education; health screening, health
education, follow-up counseling; health screening, health education, follow-up
counseling, and organized physical activities. After three years, the results showed that
only the intervention group that was subjected to the health education, follow-up
counseling, and organized physical activities experienced significant weight loss (Erfurt,

An intervention among 37 blue collar female workers involved participants
engaging in progressive walking, jogging, or cycling for three days per week. After 24
weeks, the intervention group lost a mean of 2 kilograms compared to the control group,
with no difference between the groups in body fat. This study also had 100% compliance
(Grandjean, Oden, Crouse, Brown, & Green, 1996).

A study examined the health-related effects of two different worksite
interventions to promote health and physical activity. Six workplaces were randomized
to either 2.5 hours per week of mandatory physical exercise of moderate-to-high intensity
during work hours (n = 62), a reduction of work hours from 40 to 37.5 (n = 50), or a
control group (n = 65). The participants self-reported their physical activity and
intensity. There was a significant increase in physical activity in all three groups, with the physical-exercise group demonstrating significantly greater physical activity than the other groups. There was also a positive change in fitness-related variables (waist-to-hip ratio, blood pressure) in all of the groups, with the largest change in the mandatory-exercise group. This study demonstrates not only is reduced work hours beneficial at improving physical activity, but when mandatory physical activity is implemented, the impact is greater (von Thiele Schwarz, Lindfors, & Lundberg, 2008).

Yancey et al., (2004), randomized 449 participants to an intervention, \( n = 189 \) or control \( n = 260 \) group at a worksite. The intervention consisted of a 10-minute cardio-dance type class at 26 work meetings over the course of one year that was offered during the work meetings. There was a 90% participation rate in these 10 minute classes. The participation was associated with feelings of greater satisfaction with health. However, there were no significant differences in self-reported physical levels or levels of sedentary behavior between the two groups. This study demonstrates that a short bout of exercise offered at a work-site may be effective at improving health-related variables but may not support improvement of physical activity behavior (Yancey et al., 2004). A three-year study consisted of an intervention \( n = 365 \) and control \( n = 433 \) groups. There was 90% compliance during this three year intervention. The intervention consisted of two, 10-week phases which began with an interview with a physical education instructor who prescribed aerobic and strength activities which were done at a scheduled time at the work-site. Phase 2 consisted of a higher intensity of physical activity followed by a physical fitness test every six months if he or she so wanted. After three years, 102
individuals remained in the intervention group (263 dropped out). This group significantly improved physical fitness (maximum oxygen uptake) as the control group exhibited deterioration in their physical fitness. This suggests that long-term physical fitness benefits can be achieved in a worksite program that is supportive and continue for a long period of time. However, the attrition rate was high, which may have only improved physical fitness among those who remained in the program (Talvi, Järvisalo, & Knuts, 1999).

Freak-Poli, Wolfe, Walls, Backholer, and Peeters (2011) implemented a pedometer physical activity program in 762 middle-aged participants. Each participant was told to achieve 10,000 steps each day for 125 days. A total of 604 participants finished the program, indicating a 79% compliance rate. The results revealed a significant difference in waist circumference reduction by education group. The group that was educated about the benefits of walking had a 2.1 cm larger reduction than less educated participants. Of those who completed the investigation, the physical activity data revealed 538 reached the step requirement per day (359 exceeded), 179 did not (Freak-Poli et al., 2011).

When targeting university employees, first, Coleman et al. (1999), implemented a 16-week walking program and 32-week follow-up in faculty and staff employees. A behavioral intervention was also implemented, which included feedback, self-management techniques, problem solving, goal setting and mastery, and contracts for completion of measurements. The attrition rate was 11%, as 36 participants began the program and 32 completed. The 32 participants were divided into three groups that
participated in a different duration of brisk walking six days per week: three walks for 10 minutes \((n = 10)\), one walk for 30 minutes \((n = 10)\), and accumulated 30 minutes of any combination of bouts of at least 5 minutes duration \((n = 11)\). Participants were asked to self-report all of their sedentary and physical activity behavior and they also wore an accelerometer to objectively measure physical activity. Results indicated that there was a significant increase in physical activity with every group, and no difference between the groups. This study suggests that engaging in a worksite walking program, as long as the duration of walking is 5 minutes, is beneficial at improving physical activity (Coleman et al., 1999).

A study by Rebold, Kobak, Peroutky, and Glickman (2015) examined the effect of a 12-week exercise program on fitness variables using 57 faculty and staff employees. The exercise program consisted of three days a week of 60 minute sessions in which participants self-select into an aerobic or strength-based class. The results indicate a significant increase in curl-ups, push-ups, sit-and-reach, and balance in the intervention group. This study did not assess physical activity as a measure, drop-out rate was not reported, and there was lack of a control group. This suggests further research to assess these variables should be conducted (Rebold, Kobak, et al., 2015).

A randomized controlled trial at a university among 410 employees measured the effect of different groups on physical activity behavior. The five groups consisted of: (a) control, (b) gym membership, (c) gym and physical activity education, (d) gym and time during the workday to exercise, (e) gym, education, and time. There was greater physical activity behavior in all groups compared to the control, but no difference between the
other groups. These authors conclude that addressing more than one barrier (i.e., time and education) did not promote more activity than addressing only a single barrier. In addition, since all four of the intervention groups had a gym membership, this may have caused the greater physical activity behavior (Gazmararian et al., 2013).

The above studies report a positive change towards physical activity behavior and health-related variables when a physical activity intervention was manipulated; however, other studies have reported no change in physical activity and health-related variables after a worksite health promotion program.

French et al., (2010), examined a large group of employees, consisting of 1123 individuals who initially entered into the program and 1070 completed the study (95% compliance). The participants were randomized to intervention and control groups. The intervention groups were exposed to a change in their vending machines, so that healthier food options were offered and new fitness equipment in the fitness facilities. There were several programs offered during the intervention to improve physical activity behaviors, such as exercise competitions, personal training, and exercise instruction. Participants self-reported physical activity, weight, and BMI were measured. After 18 months, there was a 74% participation rate in the intervention group. Results indicated there were no significant differences of BMI, weight, or physical activity between the two groups after 18 months. These authors conclude this intervention may not have been effective because of the amount of time employees spend outside of work (French et al., 2010).

Tveito and Eriksen (2009), randomized 40 employees to an intervention (n = 19) or control (n = 21) group. Originally there were 62 employees, but final results consist of
only 40 employees, which indicate a high number of drop-outs. The intervention group was subjected to physical exercise with an aerobics instructor, 15 hours of health information/stress management training, and a practical examination of the workplace. These were held once per week for one hour of time. The results report there was no difference in subjective health between the control and intervention groups (Tveito & Eriksen, 2009).

Furthermore, a study assessed physical activity in faculty and staff at four universities that have a worksite health promotion program compared to three universities that do not have a worksite health promotion program. The self-reported physical activity results revealed no difference between the two groups for moderate or vigorous physical activity, but walking more days per week was demonstrated in the health promotion program group. However, there was a small effect size with only 1.2% difference in walking amounts between the two groups. These results suggest that there may not be a difference in physical activity intensity or amount of walking each week when universities have a worksite health promotion program compared with universities that do not (Leininger et al., 2013).

Additionally, a study with university employees assessed self-reported physical activity, fasting blood work measurements, resting blood pressure, and waist circumference ($N = 47$). Participants were instructed to exercise for at least 30 minutes per day, four days per week for 12 weeks. After the 12 weeks, there was a significant decrease in blood pressure but not in any other variables. There was also a 26.6% attrition rate, suggesting high rate of dropout. Of those who completed the program, an
average of 49 days of exercise over the 12 week program was recorded. The exercise recommendation was a total of 48 days during the intervention. This may suggest that the intervention was beneficial at improving physical activity; however, 73% of the participants were previously active at least three days a week (Albury et al., 2014).

Overall, research on worksite exercise and health promotion programs in increasing healthy behavior and improving health-related variables is limited, with mixed data. When examining the effectiveness of worksite programs to improve health behavior, a small positive effect has been shown (Abraham & Graham-Rowe, 2009; Rongen, Robroek, van Lenthe, & Burdorf, 2013; To, Chen, Magnussen, & To, 2013). One review demonstrated twelve (60%) of 20 interventions reported improvement in physical activity level, steps, or BMI in the intervention groups (To et al., 2013). The interventions that only used counseling/behavior interventions, with no physical activity interventions, found less changes in weight loss or BMI (Jeffery, Forster, & Snell, 1985; Stunkard, Cohen, & Felix, 1989). Other studies reported improvement in health, physical fitness, and maintenance of health when physical activity regimens were implemented (Tveito & Eriksen, 2009). Many studies in the current literature report a large attrition rate among worksite health promotion programs, so reasons as to why there is a large attrition rate need to be explored. Specifically worksite programs in the university setting have demonstrated both positive health outcomes (Coleman et al., 1999; Rebold, Kobak, et al., 2015) and also no changes or differences between the intervention and control group (Albury et al., 2014; Gazmararian et al., 2013; Leininger et al., 2013). Some studies do not report the number of employees eligible to participate in the worksite
program who do not participate. The reasons for the lack of the participation and high attrition rate are unknown, but it is suggested that time and education of health benefits may be a contributing factor. Further research into the psychometric properties pertaining to the reasons employees engage in worksite health promotion programs need further research. Many studies suggest that well-designed physical activity interventions using objective measurements of physical activity are needed in future research (Abraham & Graham-Rowe, 2009; Bardus, Blake, Lloyd, & Suzanne Suggs, 2014; Conn et al., 2009; Rongen et al., 2013; To et al., 2013). Research is needed which evaluates what motivates one to participate in the worksite program, and what types of programs are effective in increasing healthy behavior and health-related variables, so that future interventions and programs may use the proper methods which are effective in improving health-related behaviors.

**Psychometric Traits**

**Personality.** It has been suggested that personality traits explain some of the natural variation of physical activity and healthy behavior in individuals (R. Rhodes & Smith, 2006). Personality among adults consists of fairly stable traits which have individual differences between persons. The association between specific personality traits and physical activity are important to identify to improve physical activity interventions. This allows interventions to be able to target the personality traits appropriately in order to increase physical activity (Bauman et al., 2012). Robust evidence exists of the “Big Five” primary dimensions of personality: extraversion, neuroticism, conscientiousness, agreeableness, and openness (Digman, 1989; Goldberg,
Extraversion is the desire and reward from external activity/situations, and energy gained from external means (McCrae & Costa, 1987). Neuroticism is the tendency to feel unpleasant emotions easily in situations (McCrae & Costa, 1987). Conscientiousness is having self-discipline and sense of achievement which is related to directing one’s impulses (Costa & McCrae, 1992). Agreeableness is a trait that desires concern for social harmony and togetherness (Rothmann & Coetzer, 2003). Openness is the appreciation for experience, ideas, and new ways of thinking (McCrae & Costa Jr, 1999). The majority of the literature involving personality and physical activity has used the Five Factor Model of personality to measure the five dimensions of personality (McCrae & Costa Jr, 1999), with only the “Big Five” yielding the greatest amount of effects (K. E. Wilson & Dishman, 2015). These studies are based on data collected with physical activity measures from validated recall interviews and questionnaires, single-item or author-adapted self-reports, and objective methods using accelerometers.

Using the five primary dimensions of personality, previous research has suggested conscientiousness and extraversion are the greatest predictors of exercise (Bogg & Roberts, 2004). Conscientiousness may be a predictor because individuals participating in physical activity may have a desire to achieve with high persistence (Bogg & Roberts, 2004). Extraversion may be a predictor because physical activity is a high-arousal activity (Eysenck, 1991). Openness may also predict engagement in physical activity because individuals with high levels of openness are usually receptive to new ideas and experiences, which physical activity may induce.
There is equivocal evidence to the findings above, as other studies have found varying results. Booth-Kewley & Vickers, (1994) assessed a sample of United States Navy recruits ($N = 103$) and United States Marine Corps ($N = 76$) using the five model of personality and health behavior. The most important personality correlates of health behaviors were conscientiousness and agreeableness, whereas extraversion was positively related to greater wellness behaviors, but lesser than conscientiousness and agreeableness (Booth-Kewley & Vickers, 1994). One study (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006) examined whether regular exercise is associated with personality in adolescent and adult twins and their families ($N = 19,288$). The results demonstrate that regular exercise is inversely related with neuroticism and positively associated with extraversion. One study examined the relationship of personality and physical performance in a large group ($N = 201$) of undergraduate students, indicating that only extraversion is related to self-reported fitness. These authors reported that conscientiousness was not positively associated with exercising more or with physical performance (Bogg, Voss, Wood, & Roberts, 2008).

A meta-analysis by R. Rhodes & Smith, (2006) demonstrated correlations between physical activity and extraversion ($r = 0.23$), neuroticism ($r = -0.11$), and conscientiousness ($r = 0.20$). This means extraversion and conscientiousness were positively associated with physical activity and neuroticism was negatively associated with physical activity. Extraversion and conscientiousness being positively associated with physical activity is in agreeance with other studies (Bogg & Roberts, 2004; Courneya & Hellsten, 1998). Similar results were found by De Moor et al., (2006) as
there was a positive association with extraversion and inverse association with neuroticism in this investigation. However, these individual investigations do not have the same results as this meta-analysis.

Further investigations were conducted to examine the five-factor model of personality with physical activity and health behavior. In agreement with Rhodes and Smith (2006), Tolea et al. (2012) measured physical activity and muscular strength in individuals aged 20 to 94 years (N = 1220), finding that only conscientiousness and extraversion were positively associated with physical activity. Additionally, neuroticism was negatively associated with muscle strength and positively associated with extraversion. Stephan, Sutin, and Terracciano (2014), used a longitudinal design in midlife to retirement (N = 3758) to find that more physically active individuals declined less on conscientiousness, extraversion, openness and agreeableness. These findings suggest that physical activity may help preserve personality stability and prevent maladaptive personality changes across adulthood and old age.

A more recent meta-analysis reported small correlations of physical activity with extraversion (r = 0.1076), neuroticism (r = - 0.0710), conscientiousness (r = 0.1037), and openness (r = 0.344) (K. E. Wilson & Dishman, 2015). Agreeableness was found to have an age dependent, negative relationship with physical activity. Agreeableness is very stable across one’s lifespan, but significantly increases after age 50 (Roberts, Walton, & Viechtbauer, 2006). And physical activity after age 35 remains stable through middle adulthood, with a small increase around retirement, followed by a steady decline during the later stages of life (Caspersen, Pereira, & Curran, 2000). Together, these results
indicate extraversion and conscientiousness are positively associated with physical activity, while neuroticism is negatively associated. Openness may also be positively associated with physical activity and agreeableness may be inversely related as aging occurs. Although, the effect size in these studies and meta-analyses are somewhat small, a 7-10% difference in physical activity between low and high personality scores in a normal distribution is demonstrated. These results are supported by an earlier study by Rosenthal (1991). This indicates personality may influence physical activity in one out of 10 people (Rosenthal, 1991). Given these results, further study of the relationship between physical activity and personality traits is needed in order to understand the effectiveness of interventions designed to increase physical activity behavior. (K. E. Wilson & Dishman, 2015). In other words, understanding the correlates of personality traits and physical activity could help with future designs of studies; to implement interventions that increase physical activity based on one’s personality type.

In addition to assessing the five-factor model of personality with physical activity, personality and physical inactivity has also been assessed. (Ebstrup, Aadahl, Eplov, Pisinger, & Jørgensen, 2013) conducted a cross-sectional design study in men and women aged 18 to 69 using self-reported physical activity and the five-factor personality model. Negative associations were found between leisure-time sitting-time and extraversion, conscientiousness, and openness, while neuroticism showed a positive association. Sitting-time is opposite to physical activity time. The negative associations of extroversion, conscientiousness, and openness in this investigation is opposite of the
meta-analyses by Wilson and Dishman (2015), which measured the association of physical activity and personality. Hence these investigations have similar results.

Overall, previous studies demonstrate varying relationships between physical activity and the five personality traits with low effect sizes (R. Rhodes & Smith, 2006; K. E. Wilson & Dishman, 2015). Thus, further research utilizing objective measures of physical activity, implementing longitudinal designs and different populations, is needed to examine the variations in personality, physical activity, and fitness-related variables. Wilson and Dishman (2015) suggest using objective physical activity measures in conjunction with a self-report of physical activity mode to assess physical activity and personality. This will allow additional the examination of potential moderators of personality and physical activity. Hence, identifying personality traits associated with worksite exercise program participation is needed so that interventions may target certain personality traits.

**Self-efficacy.** Self-efficacy is defined as the belief in the capability to organize and execute the courses of action required to produce a given outcome (Bandura, 1997). Self-efficacy is an important element within health psychology which is involved in multiple theories used to explain behavior such as social cognitive theory (Bandura, 1977), protection motivation theory (Prochaska & DiClemente, 1982) and theory of planned behavior (Ajzen, 1991). Among healthy adults, self-efficacy for physical activity behavior (hereafter self-efficacy) is malleable, so it can be altered over time. It has been repeatedly shown to predict the adoption and maintenance of physical activity behavior (S. Williams & French, 2011).
Since self-efficacy has been consistently shown to predict participation in physical activity, interventions should target self-efficacy as a potentially modifiable psychometric variable that, if enhanced, may lead to greater adoption and maintenance of physical activity. Previous reviews have demonstrated when increasing self-efficacy for physical activity, it is important for the individual to implement certain behaviors such as: ‘action planning,’ ‘provide instruction’ and ‘reinforcing effort towards behavior,’ all of which are associated with higher levels of self-efficacy and physical activity (Ashford, Edmunds, & French, 2010; S. Williams & French, 2011). Action planning refers to setting specific, detailed plans of when, where, and how to perform the behavior. Providing instruction consists of learning how to properly engage in the behavior from an external source. Reinforcing effort towards behavior includes providing positive feedback about participants’ efforts to be more active, independent of achievement of a specific physical activity goal (e.g., weight loss).

A major criticism of self-efficacy in relation to physical activity is that there is a paucity of research that has assessed its relationship to objectively measured physical activity. The use of self-reports of physical activity likely provides imprecise measurements of physical activity, due to the subjective nature of the instruments (Hansen, 2013; Hansen, Kolle, Dyrstad, Holme, & Anderssen, 2012; Haskell et al., 2007). Hansen et al. (2013) objectively assessed healthy adults for seven days to demonstrate self-efficacy was associated with physical activity engagement. However, this study was cross-sectional in design by age which prohibits the establishment of causality. This means the groups were separated and compared by age over seven days.
of activity. Hence, there is a lack of comparison of each individual over time from pre to post, using repeated measures, which is a more reliable method in statistical design since the comparisons are made with each individual over time. Thus, there was no long-term assessment of self-efficacy with physical activity behavior.

Longitudinal workplace exercise interventions may be an effective strategy to build self-efficacy since it provides at least two of the three methods to build self-efficacy, according to (Ashford et al., 2010; S. Williams & French, 2011) which include action planning and providing instruction. Action planning is provided during an exercise intervention because the exercise session meeting place and time are planned ahead of time. Instruction of how to exercise appropriately is implemented by the instructors of the intervention. Together, while there appears to be a positive association between self-efficacy and physical activity, these findings are largely from self-report measures of physical activity. Furthermore, there are no studies we are aware of which have examined fluctuations in both physical activity and sedentary behavior in regards to changes in self-efficacy over the course of a workplace exercise intervention using longitudinal designs.

**Self-determination theory.** Self-determination Theory (SDT) is a widely accepted theory which is concerned with the natural or intrinsic motivation behind choices individuals make without any external influence. SDT suggests there are basic psychological needs for autonomy, competence, and relatedness, which each individual desires to develop and attain, and leads to feelings of vitality and well-being (E. L. Deci & R. Ryan, 2002). It concentrates on the degree to which an individual’s behavior is
self-motivated and self-determined (E. L. Deci & R. Ryan, 2002). There is robust
evidence supporting the association between physical activity and SDT to understand
health behaviors and motivational processes related to well-being and health outcomes
(Ng et al., 2012; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). Deci and Ryan
(1985) suggest there are three primary levels of human behavioral regulation that lie on a
continuum scale: amotivation (not motivated), extrinsic motivation (motivated by
external factors), and intrinsic motivation (internal drive). Among these three levels of
self-determination for a behavior, there are sub-levels. These specific levels consist of:
amotivation; four levels of extrinsic motivation: external regulation, introjected
regulation, identified regulation, integrated regulation; and one level of intrinsic
motivation: intrinsic regulation. These levels are illustrated in Table 1. External
regulation is motivation from outcomes that are not within oneself, such as social reward.
Introjected regulation is motivation to simply keep oneself self-worth; not to improve.
Identified regulation is motivation because of long-term benefit attainment and personal
achievement. Integrated regulation is an extrinsic motivation which one believes is very
close to intrinsic motivation, which is doing the behavior for personal value. Last,
intrinsic regulation is the natural, inherent desire to seek out a behavior for personal
development and to derive feelings of autonomy, competence, and relatedness. Thus, an
individual may not consistently participate in a behavior until the behavior becomes
intrinsically driven. One may begin unmotivated to engage in a behavior, and then move
through the levels of extrinsic motivation, thereafter becoming intrinsically motivated.
Table 1

The varying levels of the self-determination theory on a continuum scale

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<th>Extrinsic Motivation</th>
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<td>Amotivation</td>
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If an individual participates in regular physical activity, then he may be intrinsically motivated. It is important to build intrinsic motivation for physical activity in individuals so that regular physical activity is engaged. When one feels that physical activity derives feelings of autonomy, competence, and relatedness, then the motivation for the activity is increased. SDT contains macro level framework of five mini theories of human motivation and personality to participate in effective and healthy activities (E. L. Deci & R. M. Ryan, 2002). The five mini theories of the multiple-level framework of SDT help explain select aspects of human motivation, behavior, and personal well-being and are constructed to determine what motivates the individual by assessing the levels of self-determination, including amotivation, extrinsic motivation, and intrinsic motivation. Three of these theories have been the primary focus when using SDT to study physical activity. These three mini theories include: Basic Psychological Needs Theory, Organismic Integration Theory, and Goal Contents Theory (Gunnell, Crocker, Mack, Wilson, & Zumbo, 2014; Sebire et al., 2009; Sebire, Standage, & Vansteenkiste, 2011). These theories are used to understand if changes in relative intrinsic goals lead to changes in motivation, which lead to changes in psychological need satisfaction, which then lead to changes in well-being and physical activity behavior. These three mini theories, including Organismic Integration Theory, Basic Psychological Needs Theory, and Goal Contents Theory will be used in this dissertation to examine aspects of SDT.

Organismic Integration Theory distinguishes intrinsic and extrinsic motivation in regulating one’s behavior. With intrinsic motivation, the individual experiences enjoyment, the use of their skills, excitement, and personal accomplishment (Deci &
Ryan, 1985b). Physical activity participation can be engaged in for enjoyment, skill-related behavior, thrill seeking, and goal seeking. Extrinsic motivation is engaging in an activity for external reward outcomes such as to avoid disapproval. Extrinsic motivation can be considered controlled motivation in that it is to fulfill a perceived social obligation; whereas, autonomous motivation is participating in the behavior to fulfill personal value. This theory separates intrinsic and extrinsic motivation by using autonomous or controlled motivation. Autonomous meaning self-determined and self-governed, while controlled is less self-determined. Controlled motivation consists of external regulation and introjected regulation, which are aspects of external locus of control. Autonomous motivation consists of identified (activity is personally valued), integrated (activities assimilated with self), and intrinsic (activity that is engaged in for no separable consequences besides the behavior itself). Research examining Organismic Integration Theory have demonstrated that more autonomous, motivational regulations (self-determined) are associated with physical activity, well-being, and psychological needs satisfaction (McDonough & Crocker, 2007).

The Basic Psychological Needs Theory involves searching to fulfill basic psychological needs, including autonomy, competence, and relatedness. Participating in physical activity may help one to fulfill basic psychological needs by achieving feelings of autonomy, competence, and relatedness. For example, one may feel autonomous when exercising because he is participating in goal-oriented behavior, which the outcome of the exercise bout and the long-term effects can be controlled, while feeling creative in moving his body by his own manner. One may feel competent that she/he can fulfill the
task of exercising by completing the exercise session and periodization in an efficient and proper manner (E. L. Deci & R. M. Ryan, 2002). One may feel related to others who exercise such that she/he can feel empathy for others from having experienced similar activities (Deci & Ryan, 2011). Deci and Ryan (2011) hypothesize that when psychological needs are reached, this will predict behavioral engagement. Thus if one feels autonomous, competent, and related during an activity, the likelihood of participating in the behavior again is greater. This has been supported by research that has demonstrated psychological need satisfaction links with well-being outcomes in physical activity (Adie, Duda, & Ntoumanis, 2012; Mack et al., 2012).

Third, and most recent, goal contents have been assessed as a form of SDT, which are the outcomes individuals pursue by engaging in the behavior (Deci & Ryan, 2000). These motives can be intrinsic (e.g., seeking personal health) or extrinsic (e.g., seeking social acceptance). SDT suggests individuals may have causality orientations, which is the way in which they adapt to their environment (Deci & Ryan, 1985a). Some individuals may be more motivated internally, externally, or amotivated (Deci & Ryan, 2000). This is different than Organismic Integration Theory because the Goal Contents Theory focuses on “what” a person is expecting to obtain from participating in a behavior (e.g., I expect to feel better after I exercise) while the motivational regulation focuses on “why” a person undertakes the behavior (e.g. I exercise so that I have a greater chance to live longer).

Continued research with SDT is useful to measure the change in constructs of SDT over time and how physical activity is associated with those changes. It is
suggested that SDT should be measured among members of physical activity programs (Gunnell et al., 2014). Additionally, there is also need for this examination across different age groups (Brunet & Sabiston, 2011). Longitudinal investigations over multiple time points should be conducted to understand how trajectories of change influence well-being or physical activity behavior (Gunnell et al., 2014). Moreover, it is suggested that future studies should include biological markers of successful outcomes of exercise interventions, such as improved fitness-related variables (Teixeira et al., 2012). Psychometric markers of well-being and mental health are also warranted for future research studies. Hence, since SDT is an important behavioral construct associated with physical activity participation, it is useful to measure SDT when testing the effectiveness of exercise interventions on health-related outcomes.

**Fitness-related Variables**

Participating in physical activity leads to improvements in a wide array of fitness-related variables, which can reduce the risk of the development of disease and mortality (Garber et al., 2011). This relationship between physical activity and fitness-related variables still has room for investigation (Hansen et al., 2012). Since many American adults are not physically active and do develop diseases and mortality associated with physical inactivity, it is important to study which psychometric traits are associated with healthy fitness-related variables and improvement of fitness-related variables (Marr & Wilcox, 2015). Thus, future research is needed which concentrates on mediators of fitness-related variables, including personality traits, self-efficacy for exercise, and motivation for exercise. Furthermore, comparing if an exercise intervention
and a control group have an effect on fitness-related variables is needed in future research (Bardus et al., 2014; Cairns, Bambra, Hillier-Brown, Moore, & Summerbell, 2014; To et al., 2013). This will prove the effectiveness of exercise interventions versus control groups.

**Rationale**

Many American adults do not participate in adequate physical activity and over-participate in sedentary behavior. Worksite exercise programs may be a means to improve these variables as well as fitness-related outcomes. In addition to this, it is important to test how and why worksite exercise programs are effective or ineffective in improving health. This can be accomplished by measuring changes in psychometric factors (personality, self-efficacy, motivation) that are related to successful adoption of greater physical activity participation and if the factors are modifiable during an exercise intervention. These may be factors (e.g., psychological, attitudes, etc.) that are sometimes overlooked in favor of examinations of measures of fitness. Future research is needed to examine potential predictors of successful exercise adoption. Worksite physical activity programs may be a means to increase physical activity and reduce sedentary behavior and can provide the context in which researchers can examine traits that are associated with participation in physical activity, attending a worksite intervention, and improving health-related variables.

**Purpose**

To determine the effects of participation in a 16-week faculty and staff university worksite exercise program on physical activity, sedentary behavior, and fitness-related
variables (i.e. push-ups, curl-ups). Additionally, to assess relationships of changes in psychometric (e.g., personality, self-efficacy, motivation) and changes physical activity and sedentary behavior over the 16-weeks.

**Hypothesis**

**H_1** We hypothesized that participants of the worksite exercise program would engage in greater physical activity over time and more so than the Control participants. Sedentary behavior would be reduced in the Intervention group over time, but the Control group would not. The greatest changes in fitness-related variables would occur in participants in the exercise program, specifically those who have participated the least amount of time in the program (i.e. the greatest change in fitness-related variables would occur in the group who has participated the least in the program, followed by the second least, etc.). The Control group would have the lowest change of fitness-related variables than all other groups.

**H_2** We hypothesized that initially, the greatest self-determination and self-efficacy for physical activity would be demonstrated in the groups that have participated in the program the greatest amount of time. Specifically for self-determination, on the Goal Content Exercise Questionnaire, the longer duration of previous participation would have higher intrinsic motivation than other groups. For the Behavioral Regulation Exercise Questionnaire, the longer duration of previous participation would higher autonomous motivation. For the Psychological Needs Exercise Questionnaire, the longer duration of previous participation would higher autonomy, competence, and relatedness. Extraversion, conscientiousness, and openness would also initially be greater and
neuroticism would be lower in the groups who have previously spent the greatest amount of time in the program. The Control group would have lower extraversion, conscientiousness, openness, and higher neuroticism than all of the exercise groups at baseline and after 16 weeks. Over the course of 16 weeks, the change in self-determination and self-efficacy for physical activity would be greater over time in the Intervention group and relative to the Control group and be greatest in the groups who have participated in the program the least amount of time (i.e., a group that has participated for less than four months will have a greater change than a group that has already participated for four months, and the four month group would have a greater change than a group that has previously participated for the past eight months).

Specific Aim 2

Cellular phone (i.e. cell phone) use has become increasingly common in the last decade, as 91% of United States adults own this device; 64% of which are smart phones (electronic device which is generally connected to other devices or networks which operate interactively and autonomously). This number has increased from 35% in the spring of 2011 (Pew-Research-Center, 2014). The cell phone is used for leisure time entertainment such as calling, texting, email, social networking, data management, and information gathering. Because of the explosion of cell phone use in daily life, emerging research has sought to examine the impact of heavy cell phone use among a group of individuals for which a cell phone in hand is almost ubiquitous: college-aged (i.e., 18-29 year old) individuals (Barkley & Lepp, 2016b; Lepp, Barkley, & Karpinski, 2014; Li, Lepp, & Barkley, 2015; Pew-Research-Center, 2014). These investigations have
demonstrated that high cell phone use is associated with a variety of negative outcomes including reduced academic performance (Dietz & Henrich, 2014; Jacobsen & Forste, 2011; Junco & Cotten, 2012; Lepp et al., 2014; Lepp, Barkley, & Karpinski, 2015; Rosen et al., 2014; Wei, Wang, & Klausner, 2012; Wood et al., 2012), decreased sleep quality (Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, & Grob, 2014; Munezawa et al., 2011; Murdock, 2013), poor mental health (Beranuy, Oberst, Carbonell, & Chamarro, 2009; Rosen et al., 2014), increased sedentary behavior, decreased cardiorespiratory fitness, and decreased intensity of planned exercise (Barkley & Lepp, 2016a, 2016b; Barkley et al., 2015; Lepp et al., 2013; Rebold, Lepp, Sanders, & Barkley, 2015). Recently, an investigation found that having an external locus of control is likely to coincide with less control over cell phone use than having an internal locus of control (Li et al., 2015). Additionally, life satisfaction may be indirectly and inversely associated with cell phone use (Lepp et al., 2014). One study linked problematic cell phone users with greater anxiety (Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007) and Lepp, et al., (2014) also showed anxiety to be positively associated with cell phone use. This greater anxiety among high cell phone users may be because cell phone users experience anxiety as a result of a perceived, and even overwhelming, obligation to stay connected to social networks (Merlo, 2008). Additionally, cell phone involvement, but not use, is associated with higher levels of depression and stress, which suggests the manner in which an individual uses the smart-device is predictive of depression and stress (Harwood, Dooley, Scott, & Joiner, 2014). Therefore, the cell phone may contribute to unhealthy behavior. Recently, among individuals 18-29 years old, high cell
phone use has been associated with high sedentary behavior (Barkley & Lepp, 2016b; Barkley et al., 2015). Thus, cell phone use among young adults may be largely contributing to sedentary time, which is not a positive health outcome. Furthermore, cell phone use among this age group has been shown to reduce physical activity intensity (Barkley & Lepp, 2016a), and thus may lead to lower levels of fitness.

As stated, the outcomes of these investigations examining cell phone use and health/behavioral outcomes have been used almost exclusively on college-aged individuals (research described above), leaving paucity in the literature on cell phone use in non-college aged adults (i.e., ≥ 30 years old). Cell phone use has been shown to be inversely associated with age meaning older individuals use the phone less than younger individuals (Bianchi & Phillips, 2005). These differences in use may also effect the previously demonstrated relationships between cell phone use and various behavioral (e.g., increased sedentary behavior) and/or health (e.g., decreased cardiorespiratory fitness) outcomes and psychometric variables. Therefore, additional research is needed in adults that are beyond college age to examine the relationship between cell phone use and physical activity and sedentary behavior. The use of objective measures to study physical activity and cell phone use among adults would be novel when measuring cell phone use (Barkley et al., 2015; Lepp et al., 2013).

**Rationale**

There is a dearth of research examining how cell phone use may be associated with physical activity and sedentary behavior in middle-aged adults. There is emerging evidence that the use of modern cell phones is associated with decreased
cardiorespiratory fitness. These devices may promote sedentary behavior and interfere with exercise in college-aged adults. However, no studies have examined these relationships in middle-aged adults. This is important, as there do appear to be generational differences in cell-phone-use behaviors. Previous research has shown cell phone use being inversely associated with age. Therefore, if adults beyond college-age (e.g., ≥30 years old) use these devices differently than young adults, the relationships between cell phone use and physical activity and sedentary behavior may also be different.

**Purpose**

The primary purpose of this study was to assess the relationships between cell phone use and physical activity and sedentary behavior in adults 30 years and older. Previous research has demonstrated positive relationships between cell phone use and sedentary behavior in college-aged individuals (18-29 years old) but this has not been examined in adults above the college-age.

**Hypothesis**

Because previous research with college-age individuals exhibits a positive relationship with cell phone use and sedentary behavior but no relationship with cell phone use and physical activity, we hypothesized there would be a positive relationship between cell phone use and sedentary behavior and no relationship between cell phone use and physical activity in individuals 30 years and older.
CHAPTER III

 METHODOLOGY

 Specific Aim 1

 Participants

 Faculty and staff employees ($N = 62$) at Kent State University volunteered to participate in a 16-week exercise program intervention (Intervention group), or volunteered to be monitored for a similar period but not participate in the exercise intervention (Control group). This program was open to all faculty and staff employees on campus. Participants were recruited by advertisement through e-mail and website links. Additionally, previous participants in a worksite exercise program at Kent State University were recruited. Prior to enrolling in the intervention, all participants were familiarized with the 16-week protocol, including instruction on the benefits and risks of the exercise program, and given the Institutional Review Board consent to read and sign. Medical history forms and Physician’s Consent were completed prior to participation to ensure participants are healthy enough to exercise. Participants were excluded if they reported a history of medical disorders and did not receive clearance from their physician beforehand for such issues as orthopedic injuries, cardiovascular disorder, etc. The participant’s in the Control group were compensated with a $5 gift card after fitness testing at the three time points. The Kent State University Institutional Review Board approved this study.
Procedures

There were two main groups: those participating in the exercise intervention \( n = 47 \) and those who were not (control, \( n = 15 \)). The Intervention group was further divided into three groups based on the duration of time the individual was participating in the program: 0 months (was participating in the program for the first time, \( n = 17 \)), 4 months (has participated in the program for the last four months, \( n = 6 \)), and 8 or more months (has participated in the program for the last eight or more months, \( n = 24 \)). Measurements for this investigation occurred at three time points: baseline (week 1), midpoint (week 8), and final (week 16).

Objective measurements of physical activity behavior were obtained via the Movband (Movable, Cleveland, OH) accelerometer which has been validated against the Actigraph (Actigraph Corporation, Pensacola, FL) and by indirect calorimetry (Barkley, Rebold, Carnes, Glickman, & Kobak, 2014). This wrist-mounted physical activity monitor, which provided visual feedback, was worn throughout the study and used for data collection during one week at the three time points (pre, mid, post) over the 16-week exercise intervention. Self-reported physical activity and sedentary behavior were also assessed using validated survey instruments. Validated questionnaires assessing individual’s personality, self-efficacy for physical activity, and self-determination for physical activity were completed at the three time points of this investigation. Fitness-related variables (e.g., push-ups, sit-ups, cardiorespiratory fitness, etc.) were also measured at these three time points. Finally, attendance of the Intervention group was measured at each session. Therefore, this was a four group (Control, 0 months, 4 months,
≥8 months) by three time points (baseline, midpoint, final) mixed-factorial, cross-sectional design with the cross-sectional groups serving as the between-subjects independent variable and time point serving as the within-subjects variable. Table 2 illustrates this research design. Table 3 depicts the timeline for this investigation.

Table 2

*Research design for study 1*

<table>
<thead>
<tr>
<th></th>
<th>Baseline (Week 1)</th>
<th>Midpoint (Week 8)</th>
<th>Final (Week 16)</th>
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<tbody>
<tr>
<td>Control (<em>n</em> = 15)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Intervention (<em>n</em> = 47)</td>
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<td></td>
<td></td>
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<tr>
<td>- 0 months (<em>n</em> = 17)</td>
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<tr>
<td>- 4 months (<em>n</em> = 6)</td>
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<tr>
<td>- 8 months (<em>n</em> = 24)</td>
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Table 3

*Timeline for study 1*

<table>
<thead>
<tr>
<th>INTERVENTION (participation in exercise program)</th>
<th>Collection of attendance</th>
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</thead>
<tbody>
<tr>
<td>Questionnaires, Physical activity assessment, and Fitness testing</td>
<td>Questionnaires, Physical activity assessment, and Fitness testing</td>
</tr>
<tr>
<td>Questionnaires, Physical activity assessment, and Fitness testing</td>
<td>Questionnaires, Physical activity assessment, and Fitness testing</td>
</tr>
</tbody>
</table>

| CONTROL | Questionnaires, Physical activity assessment, and Fitness testing | Questionnaires, Physical activity assessment, and Fitness testing | Questionnaires, Physical activity assessment, and Fitness testing |

↑ Week 1 ↑ Week 8 ↑ Week 16
**Intervention**

All participants (Intervention and Control groups) were given a Movband accelerometer to wear with instructions to wear it on the dominant wrist as much as possibly daily, although physical activity data were only collected at the three time points. The Intervention and Control group completed the questionnaires and fitness-related variable assessments at the three time points. The individuals in the exercise Intervention group were offered 60 minute classes, three times per week, for 16 weeks. These classes included a five-minute warm-up and five minute cool-down. Additionally, on each day, participants chose one of six class options to attend: boot camp, cardio dance, circuit training, shallow water aqua, walking/jogging, or weight training. All classes were led by one or two members of the research staff who were trained to teach the class. Attendance to the intervention was measured daily. The boot camp class used exercise equipment (dumbbells and medicine balls) with intervals of high intensity exercise. The cardio dance class involved following the instructor in moving to the beat of the music at a pace that ranged from moderate to vigorous exercise intensity. The circuit training class consisted of classic circuit training using resistance training machines, free weights, and cardio machines. The shallow water aqua class includes lower impact, dynamic water aerobics. The walking/jogging class consisted of walking and/or jogging at an intensity the participant felt comfortable on dry land or the treadmill. Weight training incorporated stationary exercises using dumbbells and body weight.
Measurements

**Objective physical activity measurement.** To measure physical activity, each participant was given a Movband accelerometer. The Movband is a three-plane accelerometer that measures movement to quantify an accurate estimate of each participant’s physical activity, and offers visual feedback. The Movband was previously validated against the Acti-graph accelerometer and indirect calorimetry (Barkley et al., 2014). Physical activity was recorded as moves. A built-in algorithm was used to convert the movement data from moves to steps and miles (http://www.movable.com/), which the use of steps and miles is more widely understood. To quantify the objective physical activity, participants completed an activity monitor report at the end of each day which asked the participant at what times during the day the Movband was worn. This was used to convert physical activity into steps per minute and miles per minute. All participants were instructed to wear the Movband as much as possible throughout the day. Furthermore, at the end of every one-week time span, each participant completed a self-reported questionnaire which assessed how often they wore the Movband. This was done to quantify the amount of minutes the participant wore the Movband relative to their movement (i.e., to assess the number of moves per minute).

**Objective fitness-related variables measurement.** Fitness parameters were assessed prior to beginning the intervention (baseline), at week 8 (midpoint), and at week 16 (post). Each research team member was trained on how to measure each test. The specific order of testing was the order it is mentioned in this paragraph. This testing included resting measurements of height and weight. Active measurements included the
12-minute cooper test, push-ups to failure, partial curl-up, which measures the maximal number of curl-ups performed in one minute, and flexibility. These tests are based on American College of Sports Medicine guidelines for exercise testing (Pescatello, 2014).

**Height and weight.** Participants were measured for height to the nearest centimeter via a stadiometer. Weight was measured to the nearest kilogram using a balance beam scale (Health O Meter, Chicago, IL). Body mass index (BMI) was calculated by dividing the participants’ weight in kilograms over the height squared in centimeters.

**Cardiorespiratory endurance.** The 12 minute cooper test is an assessment of cardiorespiratory endurance (Grant, Corbett, Amjad, Wilson, & Aitchison, 1995; Zwiren, Freedson, Ward, Wilke, & Rippe, 1991). This included participants walking and/or running around a measured gymnasium floor for 12 minutes. Participants were instructed to cover as far of distance possible in the 12 minutes. The dependent variable of this test is the distance, which will be measured by the investigators.

**Push-ups.** Push-ups are a measurement of upper-body muscular endurance and were performed herein according to American College of Sports Medicine guidelines (Garber et al., 2011; Pescatello, 2014). Males were instructed to complete the test from their toes while females were to perform the push-ups from their knees. All participants were instructed to maintain a straight line from the shoulders through the hips to either the knees or toes. The research staff supervised the test and commented on incorrect form. Participants were to complete as many push-ups as possible without pausing. A completed push-up counted if the arms were bent to 90 degrees in the down position and
extended fully in the starting position. Participants are instructed to keep a steady pace for the duration of the test. Any pause or break in form was not acceptable. If the corrections were not made immediately, the research staff member terminated the test.

**Partial curl-ups.** Partial curl-ups were performed based on American College of Sports Medicine guidelines for physical fitness assessments, as this is a valid measurement for abdominal muscular endurance (Garber et al., 2011; Pescatello, 2014). Participants laid supine on an exercise mat with their knees bent to 90 degrees and the soles of their feet flat on the ground. Their arms laid by their side with the hands relaxed and the middle fingers touching a piece of tape that is placed 10 cm from the end and parallel to the edge of the exercise mat. Participants were instructed to use the abdominal muscles to curl-up so their middle fingers reach the edge of the exercise mat, then to return to the resting position. This motion was completed as many times as possible in 60 seconds without pausing. The research staff counted the repetitions for each participant.

**Flexibility.** Flexibility was measured using the sit-and-reach test recommended by the American College of Sports Medicine (Garber et al., 2011; Pescatello, 2014). A sit-and-reach box was used (Finder Flex-Tester, Novel Products Inc. Rockton, IL) for assessment. Participants were instructed to remove their shoes while sitting on the ground in an upright position with knees extended and their feet and heels flat against the box. Next, participants placed one hand over the other and extended their arms straight forward. Then, participants bent forward and held their final position for approximately
two seconds. The most distant point reached with the finger tips was the score. The better of three trials, as seen by the member of the research team, was recorded.

**Questionnaires.** Data collection at the three time points began on the first day of week one of the intervention. Control and Intervention participants were given a questionnaire with instructions to complete and return the questionnaire in one week. They were told to complete the subjective physical activity questionnaire for the current week. These directions were given so the objective physical activity data collection and subjective physical activity questionnaire were analogous, since the objective physical activity data were collected from the first week, ninth week, and sixteenth weeks of usage. The questionnaires consisted of the following. (a) Demographic information (e.g., gender, age, occupational status, etc.); (b) Physical activity and sedentary behavior assessment using the International Physical Activity Questionnaire (M. L. Booth et al., 2003); (c) International Personality Item Pool (Goldberg, 1999); (d) Measures self-efficacy for exercise by the Self-Efficacy and Exercise Habits Survey (Sallis, Pinski, Grossman, Patterson, & Nader, 1988); (e) SDT constructs, which measure aspects of motivation from Deci and Ryan's (1985) SDT. The instruments used for SDT are 5a) Behavioral Regulations in Exercise Questionnaire-3 (Markland & Tobin, 2004) (P. M. Wilson, Rodgers, Loitz, & Scime, 2006), 5b) Goal Content for Exercise Questionnaire (Sebire, Standage, & Vansteenkiste, 2008), and 5c) The Psychological Need Satisfaction in Exercise Questionnaire (P. M. Wilson et al., 2006), (6) Total cell phone use (Lepp et al., 2014, 2015; Lepp et al., 2013). The demographic questionnaire was only completed at baseline. The other questionnaires were completed at the three time points over 16 weeks.
**Self-reported physical activity and sedentary behavior.** The International Physical Activity Questionnaire instrument is a self-reported measure of physical activity and sedentary behavior (Craig et al., 2003). Physical activity is assessed as behaviors performed for at least 10 minutes and time spent performing three intensities of activity: walking (low intensity), moderate, and vigorous. Sedentary behavior is included on the questionnaire as sitting time is expressed as minutes per day. The measures of physical activity are summed to estimate the total amount of time spent doing physical activity per week or day. Total daily physical activity in Metabolic Equivalent of Task-minutes per day is estimated by using the product of reported time within each intensity by a Metabolic Equivalent of Task value specific to each category of physical activity. It is then expressed as a daily average Metabolic Equivalent of Task score according to the official International Physical Activity Questionnaire scoring protocol (IPAQ Guidelines). Vigorous-intensity physical activity receives 8 Metabolic Equivalent of Tasks, moderate-intensity activity to 4 Metabolic Equivalent of Tasks, and walking to 3.3 Metabolic Equivalent of Tasks. Sitting time is also expressed in two forms: weekday and weekend day.

**Personality.** Personality was assessed with the International Personality Item Pool (Goldberg, 1999) which measures the “Big Five” dimensions of personality (neuroticism, extraversion, consciousness, openness, and agreeableness). This instrument lies on a five-point Likert scale from 1 (Very Inaccurate) to 5 (Very accurate) with 50 items. Each of the five factors of personality is represented 10 times on this form. The instrument represents opposite ends of the “Big Five” spectrum, which contain reverse
coded items and non-reverse coded items. The directions state to “use the rating scale to describe how accurately each statement describes you” and to “describe yourself as you honestly see yourself.” An example of extraversion is “Am the life of the party,” where it is reverse-coded as “Have little to say.” Scores are calculated by summing each of the 10 items from each of the five personality domains. The scores can range from a negative score to a positive score. It has been proven to represent a wide range of personality factors, which is communicable to scientists (Goldberg, 1992).

**Self-efficacy for physical activity and exercise.** Self-efficacy for exercise behavior was measured with the Self-Efficacy and Exercise Habits Survey (Sallis et al., 1988). This is a 12-item, self-report survey on one’s belief in their ability to exercise in certain situations for at least six months. A 5-point scale from 1 (I know I cannot) to 5 (I know I can) and 8 (Does not apply) is applied for the subject responses. Examples are “Stick to your exercise program even when you have excessive demands at work” and “Get up early, even on weekends, to exercise.”

**Self-determination theory for physical activity and exercise.** Measures of the SDT assess the functional significance of exercise motives from the perspective of Deci & Ryan, (1985). The instruments used herein include the Behavioral Regulation in Exercise Questionnaire-3, Psychological Need Satisfaction in Exercise, and Goal Contents in Exercise Questionnaire.

To measure participants underlying decisions to engage or not engage in physical exercise, the Behavioral Regulation in Exercise Questionnaire-3 was used. This measures autonomous or controlled based self-determination that is present. This
instrument is a primary measure of self-determination to participate in physical activity which assesses autonomous determination and controlled determination; whereas autonomous is self-determined and controlled is less self-determined. Autonomous motivation consists of Identified (activity is personally valued), Integrated (activities assimilated with self), and Intrinsic (behavior engagement for no consequences besides the behavior itself). Controlled motivation consists of External regulation and Introjected regulation, which are aspects of external locus of control. The Behavioral Regulation in Exercise Questionnaire-3 is a 24-item scale which has points from 0 (Not true for me) to 4 (Very true for me) that has been validated (Markland & Tobin, 2004; P. M. Wilson et al., 2006).

The Psychological Need Satisfaction in Exercise Questionnaire (P. M. Wilson et al., 2006) was used to assess perceptions of psychological need fulfillment. The Psychological Need Satisfaction in Exercise Questionnaire is an 18-item measurement developed using SDT to measure perceptions of competence (6 items), autonomy (6 items), and relatedness (6 items) with exercise. This questionnaire has been modified to a physical activity version (Psychological Need Satisfaction in Exercise Questionnaire - physical activity; (Gunnell et al., 2014). The scoring is on a Likert scale from 1=False to 6=True. An example of a question from competence includes, “I feel confident I can do even the most challenging exercises.” A question from Autonomy includes, “I feel free to exercise in my own way.” A question from relatedness include, I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons.”
To measure goal contents, the 20-item Goal Contents in Exercise Questionnaire is used and validated (Sebire et al., 2008). This instrument measures intrinsic (health, social affiliation, and skill development) and extrinsic (image and social recognition) goal contents. This questionnaire asks to “please indicate on the scale provided how important each goal is for you with reference to your physical activity.” The scale is on a Likert scale from 1 (not at all important) to 7 (extremely important). An example of a question from this instrument includes, “To increase my energy level.” Scores from this instrument have shown initial reliability and validity evidence (Sebire et al., 2008, 2009).

**Specific Aim 2**

**Participants**

A sample of 69 employees (50.5 ± 8.2 years old, n = 54 women) at a large, public university in the Midwestern United States were recruited to participate in the current investigation via advertisement through e-mail and a website. Prior to data collection, all participants were familiarized with the protocol, including instruction on the benefits and risks of the study, and provided written consent. Medical history forms were completed prior to participation. Participants were excluded if they reported a history of medical disorders for issues such as orthopedic injuries, cardiovascular disorder, and so forth that would preclude them for participating in regular physical activity. The Kent State University Institutional Review Board approved this study.
Procedures

Subsequently, the participants reported to the exercise physiology laboratory on two separate occasions, separated by one week. During the first visit, participants were given a validated accelerometer (Movband, Movable, Cleveland, OH) to wear around the dominant wrist as much as possible (a minimum of ≥ 10 hours per day) during waking hours for a one week period (Barkley et al., 2014). Participants were given an activity monitor report to complete each night which assesses when the Movband accelerometer was worn that day. Participant’s data were excluded if they did not wear the accelerometer for a minimum of ≥ 10 hours per day, which was monitored by an activity monitor report completed each day. A questionnaire assessing age and sex was completed by each participant. The subjects also self-reported physical activity and sedentary behavior using the International Physical Activity Questionnaire (IPAQ) (M. L. Booth et al., 2003). Finally, self-reported cell phone use was assessed via a validated survey (Lepp et al., 2014, 2015; Lepp et al., 2013). Participants were given instructions to complete the IPAQ and cell phone use survey for the upcoming week in which they wore the Movband accelerometer. After the one week, participants returned to the laboratory to return the questionnaire. All procedures were approved by the University Institutional Review Board.

Measurements

**Objective physical activity measurement.** Physical activity behavior was measured objectively via the Movband (Movable, Cleveland, OH) accelerometer, which has been validated against the Actigraph (Actigraph Corporation, Pensacola, FL)
accelerometer and indirect calorimetry (Barkley et al., 2014). The Movband is a three-plane accelerometer that measures acceleration to quantify an accurate estimate of physical activity. Physical activity is recorded as “moves” and a built-in algorithm is used to convert the movement data from “moves” to steps and miles, and these data are downloadable with free software provided by the manufacturer http://www.movable.com/. All participants were instructed to wear the Movband a minimum of ≥ 10 hours per day for seven days during waking hours. Participants were asked to complete a daily self-reported questionnaire which assesses how often they wore the Movband. This is done to quantify the amount of minutes the participant wore the Movband. That information was then used to calculate “moves” per minute (“moves” per minute = total “moves” ÷ time worn).

**Self-reported physical activity and sedentary behavior measurement.** The IPAQ instrument is a validated self-reported measure of physical activity and sedentary behavior. The IPAQ has been validated in many studies carried out by a number of countries (Craig et al., 2003). Physical activity is assessed as behaviors performed for at least 10 minutes and time spent performing three intensities of activity: walking (low intensity), moderate, and vigorous. Sitting time is also expressed in two forms: weekday and weekend day. The measures of physical activity are summed to estimate the total amount of time spent doing physical activity per week. Total daily physical activity is calculated into Metabolic Equivalent of Task (METS). The METS are estimated using the product of reported time in three intensities by a Metabolic Equivalent of Task value specific to each intensity of physical activity. Then, it is expressed as a daily average
Metabolic Equivalent of Task score (MET-minutes per day) according to the IPAQ scoring protocol. Vigorous-intensity physical activity receives 8 Metabolic Equivalent of Tasks, moderate-intensity activity to 4 Metabolic Equivalent of Tasks, and walking to 3.3 Metabolic Equivalent of Tasks. Users are given a “Categorical score” (1-3 scale) and a “Continuous score” (Metabolic Equivalent of Task for the week). The measures used for analysis in this study included the Categorical score (IPAQ Categorical), Continuous score (IPAQ METS-min per week), vigorous (IPAQ Vigorous), moderate (IPAQ Moderate), and walking (IPAQ walking).

**Cell phone use.** Questions measuring cell phone included the total daily cell phone use. The total daily cell phone use question states as follows, “As accurately as possible, please estimate the total amount of time you spend using your mobile phone each day. Please consider all uses except listening to music. For example, consider calling, texting, Facebook, e-mail, sending photos, gaming, surfing the Internet, watching videos, and all other uses driven by ‘apps’ and software” (Lepp et al., 2014, 2015; Lepp et al., 2013). Participants were then asked to fill in a blank line for hours of cell phone use per day and minutes per day. An equation to total the minutes used per day was used accordingly: Total Minutes per Day = Hours * 60 + Minutes.
CHAPTER IV
THE EFFECTIVENESS OF A WORKSITE EXERCISE PROGRAM ON PHYSICAL ACTIVITY, SEDENTARY BEHAVIOR, FITNESS, AND CHANGES IN PSYCHOMETRIC VARIABLES

Abstract

The effects of a 16-week worksite exercise intervention on physical activity and sedentary behavior, changes in fitness-related variables, and psychometric traits in employees at a major university were measured. Employees willingly signed-up for a 16-week, three times per week exercise program ($n = 47$, $n = 38$ females) and employees not participating in the program were recruited for a Control group ($n = 15$, $n = 11$ females). Groups wore a visual feedback accelerometer which measured steps and completed subjective physical activity and sedentary behavior measurements, fitness testing, and questionnaires regarding psychometric traits for physical activity at three time points (week 1, week 8, week 16). Data were analyzed by a two condition by three-time point ANOVA. Results indicated both the Intervention and Control groups met recommended physical activity guidelines with no significant differences ($p = 0.3$) between the two groups and no significant changes ($p = 0.6$) over time. Throughout the 16-weeks, across all groups, there were significant increases in cardiorespiratory fitness ($p = 0.01$), abdominal curl-up repetitions ($p = < 0.001$), making time for exercise ($p = 0.03$), competence of physical activity ($p = 0.04$), and intrinsic health motivation ($p = 0.004$). In only the Intervention group, there was a significant reduction ($p = 0.003$) in sedentary behavior and significant increase ($p \leq 0.02$ for all) in push-up repetitions. In
conclusion, both the worksite exercise program and fitness testing every eight weeks were effective at improving health behavior, but better improvements were made in the exercise program group.

**Introduction**

Presently, the majority of adults in the United States do not participate in adequate amounts of physical activity, as only approximately 10%-50% of the population participate in minimum recommendations (Centers-for-Disease-Control-Prevention, 2013; Garber et al., 2011; Physical-Activity-Guidelines-Committee, 2008; Tucker et al., 2011). Additionally, excessive sedentary (i.e., sitting) behavior is of major concern for American adults, since the average American may sit for more than 7-9 hours per day (Matthews et al., 2008; Owen, Healy, Matthews, & Dunstan, 2010). These data are troubling as both physical inactivity and sedentary behavior are independent risk factors for developing a multitude of adverse health consequences, including cardio-metabolic disease, diabetes, and all-cause mortality (Lee et al., 2012; Warren et al., 2010; Wijndaele et al., 2010). Conversely, physical activity is associated with many health benefits, including prevention of all-cause mortality and cardiovascular disease, type 2 diabetes, and osteoporosis, while improving functional and cognitive health (Martinsen, 2008; Physical-Activity-Guidelines-Committee, 2008; Vogel et al., 2009). Not only are these poor health behaviors detrimental to health, but also places a large burden on healthcare systems (Oldridge, 2008; Pratt et al., 2014).

Current recommendations from the American College of Sports Medicine suggest that to gain health benefits, one should participate in a minimum of 150 minutes per week
of moderate-intensity (3-6 metabolic equivalents or METs) aerobic physical activity, or 75 minutes per week of vigorous-intensity aerobic physical activity, or a combination of moderate and vigorous (>6 METs) physical activity (Garber et al., 2011). In addition to this, energy expenditure through routine activities of daily living which are of light intensity is recommended (Garber et al., 2011). Hence it is suggested that acquiring about ≥8,000 steps will improve health (C Tudor-Locke, 2014; Catrine Tudor-Locke & Bassett Jr, 2004). Additionally, the American College of Sports Medicine provides guidelines for muscle-strengthening activities which should be performed on two or more days per week, using exercises that work all major muscle groups (Garber et al., 2011) to prevent all-cause mortality (FitzGerald et al., 2004) and improve muscular fitness (Brill, Macera, Davis, Blair, & Gordon, 2000).

A promising strategy to increase physical activity, reduce sedentary behavior and thereby improve health, may be the use of worksite exercise programs (Goetzel et al., 2014). A majority of the American population spends a great amount of time at work, which leads to the work environment having a large influence on employee health (Linnan et al., 2008). Focusing on health behavior at the work environment may produce positive outcomes in employee health (Sorensen & Barbeau, 2004) such as improved physical fitness and improved mental outcomes.

These programs may also reduce employee medical costs (Baicker et al., 2010). Worksite interventions range from traditional exercise classes, walking or step programs, use of pedometers, and cosmetic and structural enhancements to encourage physical
activity including behavior and counseling techniques (Bravata et al., 2007; Goetzel et al., 2014; Haines et al., 2007).

Depending on the program in place, some of these worksite health promotion programs have been shown to improve healthy behavior (Freak-Poli et al., 2011; Gazmararian et al., 2013; Rebold, Kobak, et al., 2015; von Thiele Schwarz et al., 2008), while other studies do not show a change in improvement (French et al., 2010; Leininger et al., 2013; Tveito & Eriksen, 2009) and had high attrition rates (Albury et al., 2014; Leininger et al., 2013; Tveito & Eriksen, 2009). Recently, research from our group demonstrated that a 12-week faculty and staff exercise program (exercising three times per week) caused significant improvements in measures of muscular endurance, flexibility, and balance (Rebold, Kobak, et al., 2015). Even minimal physical activity interventions using a 12-week walking program at a worksite has shown to reduce body mass index (BMI), blood glucose, and total cholesterol (Haines et al., 2007). On the contrary, French et al., 2010 reported after 18 months of the worksite offering exercise competitions, personal training, and exercise instruction, there were no significant differences of BMI, weight, or physical activity between controls and those in the program. Likewise, Tveito and Eriksen (2009) randomized 62 employees, but final results consist of only 40 employees, to an intervention group who were subjected to physical exercise with an aerobics instructor, 15 hours of health information/stress management training, and a practical examination of the workplace. These were held once per week for one hour of time. The results reported there was no difference in subjective health between the control and intervention groups. Overall, it seems that
worksite programs may only lead to modest improvements in many health behaviors (Baicker et al., 2010; Goetzel et al., 2014) and leaves questions regarding the effectiveness of worksite health promotion programs (Osilla et al., 2012). This, in turn, warrants further research to determine the reasons as to why some engage in worksite exercise programs and others do not (Goetzel et al., 2014; Hill-Mey et al., 2015).

Given these aforementioned low physical activity levels in this population, it is important to understand the factors influencing the choice to engage or not engage in physical activity. Understanding the reasons for participation and success of physical activity interventions among American adults in a worksite exercise program may provide information such as personality traits and motivational constructs which are associated with participation in the program and physical activity engagement (Bauman et al., 2012) and changes which may occur over time (Kern, Hampson, Goldberg, & Friedman, 2014; Magee, Heaven, & Miller, 2013). Unfortunately, prior work in this area has relied on self-reported measures to assess physical activity and sedentary behavior; and most examinations of workplace health promotion programs focus only on fitness outcomes and ignore psychometric variables. Discovering what types of worksite exercise programs improve health-related variables (physical activity behavior, cardiorespiratory endurance, muscular endurance) and what psychometric variables (self-efficacy and self-determination for physical activity) are associated with these improvements are needed in future research.

Therefore, the purpose of this investigation is two-fold: (a) to examine the effectiveness of a worksite exercise program on physical activity, sedentary behavior, and
fitness-related variables compared with those not participating in the program; (b) to assess the relationship between the change in psychometric traits which are associated with changes in increased physical activity, decreased sedentary behavior, and improved fitness-related variables of individuals participating in the worksite exercise program compared with those who are not. Our hypotheses were participation in a worksite exercise program would result in greater physical activity, lower sedentary behavior, improvements in fitness-related variables, and positive changes in psychometric health-related variables over the worksite exercise program and relative to individuals not participating in the program (i.e., control group). Additionally, the relationship between changes exhibited in the participant’s physical activity, sedentary behavior, and fitness-related variables would be associated with changes in psychometric variables previously shown to predict positive health behavior.

**Methods**

**Participants**

A total of 67 \( n = 53 \) females faculty and staff employees at Kent State University volunteered to participate in a 16-week exercise program intervention (Intervention group) or to be monitored for a similar period but not participate in the exercise intervention (Control group). Of the 67 who agreed to participate, five individuals dropped-out from the study due to time constraints or did not complete the measures of data collection. Therefore, 62 \( n = 49 \) females individuals volunteered for the Control group \( n = 15, n = 11 \) females or the Intervention group \( n = 47, n = 39 \) females. Figure 1 provides a consort of participant enrollment, recruitment, and
drop-out. This program was open to all faculty and staff members on campus. Participants were recruited by advertisement through e-mail, and website pages. The Intervention group, who volunteered for the exercise program, included individuals who either were \( n = 31 \) and were not \( n = 16 \) presently meeting the American College of Sports Medicine threshold for being considered physically active of achieving >500 MET-minutes per week, as indicated from baseline self-reported physical activity. Therefore, a Control group of individuals who either were \( n = 10 \) and were not \( n = 5 \) presently meeting the American College of Sports Medicine threshold for being considered physically active were selected to allow a proper comparison of groups. This was done per American College of Sports Medicine recommendations that suggest physically active individuals should be assigned to control groups to avoid a misinterpretation of findings (F. W. Booth & Lees, 2006). These misinterpretations could occur due to the controls continuing their sedentary behavior compared with an intervention group with scheduled exercise classes; hence it would be expected that the intervention group would improve health-related variables and controls would not. However, with a mix of sedentary and active controls, the true effectiveness of the worksite exercise program can be better examined as previous behaviors of both groups were similar. Prior to enrolling in the intervention, all participants were familiarized with the 16-week protocol, including instruction on the benefits and risks of the exercise program, and provided written consent. Medical history forms and physician’s consent were completed prior to participation to ensure there were no contraindications to safely participating in exercise. Participants were excluded if they reported a history of medical
disorders (orthopedic injuries, cardiovascular disorder, etc.) and/or did not receive clearance from their physician beforehand for such issues as orthopedic injuries, cardiovascular disorder, and so forth. The university Institutional Review Board approved all procedures.

**Figure 1.** Flow diagram of participants in enrollment, allocation, and analysis phases

**Procedures**

The Intervention group was further divided into three groups based on the duration of time the individual previously participated in the on-going program: 0 months (were participating in the program for the first time, $n = 17$ total, $n = 15$ females), 4 months (had participated in the program for the last four months, $n = 6$ total, $n = 5$ females).
females), and ≥8 months (had participated in the program for the last eight or more months, \( n = 24 \) total, \( n = 18 \) females). These separate groups were established as the response to the intervention (e.g., changes in physical activity, fitness) likely differ between those participating for the first time versus those who were prior participants (Lambert, 2016). The measurements for this investigation were conducted on all groups (Control, 0 months, 4 months, ≥8 months) at three time points: baseline (week 1), midpoint (week 8), and final (week 16).

Objective measurements of physical activity behavior were obtained for three one-week periods of time (week 1, week 8, week 16) over the course of the 16-week exercise intervention. Fitness-related variables (e.g., push-ups, sit-ups, cardiorespiratory fitness, etc.) were also measured at these three time points. Self-reported physical activity and sedentary behavior were also assessed using validated survey instruments. Validated questionnaires assessing individual’s personality, self-efficacy for physical activity, motivation for physical activity, and cell phone use were completed at the three time points for this investigation. Finally, attendance of the intervention group was measured at each session. Therefore, this was a four group (control, 0 months, 4 months, ≥8 months) by three time points (baseline, midpoint, final) mixed-factorial, cross-sectional design with the cross-sectional groups serving as the between-subjects independent variable and time point serving as the within-subjects variable. Table 1 illustrates this research design. Table 2 depicts the timeline of this investigation.
**Intervention**

All participants (Intervention and Control groups) were given a Movband accelerometer with instructions to wear it on the dominant wrist as much as possibly daily, although physical activity data were only collected at the three time points. The Intervention and Control group completed the questionnaires and fitness-related variable assessments at the three time points. Included in the intervention group were those participating in the worksite exercise program consisting of 60 minute classes, three times per week, for 16 weeks. These classes included a five minute warm-up and five minute cool-down. Each session, participants chose one of six class options to attend: jogging, boot camp, cardio dance, weight training, weight and cardio circuit training, or shallow water aqua. All classes were be led by one or two members of the research staff who were trained in the specific area of exercise. Attendance to the intervention was measured daily. The boot camp class used exercise equipment (dumbbells and medicine balls) with intervals of high-intensity exercise. The cardio dance class involved following the instructor in moving to the beat of the music at a pace that ranged from moderate to vigorous exercise intensity. The circuit training class consisted of classic circuit training using resistance training machines, free weights, and cardio machines. The shallow water aqua class included lower impact, dynamic water aerobics. The walking/jogging class consisted of walking and/or jogging at an intensity the participant feels comfortable on dry land or the treadmill. Weight training incorporated stationary exercises using dumbbells and body weight.
Measurements

**Objective physical activity measurement.** To measure physical activity, each participant was given a Movband (Movable, Cleveland, OH) accelerometer. The Movband is a three-plane accelerometer that measures movement to quantify an accurate estimate of each participant’s physical activity, which was previously validated against the Actigraph (Actigraph Corporation, Pensacola, FL) accelerometer and indirect calorimetry (Barkley et al., 2014). Physical activity was recorded as moves. A built-in algorithm was used to convert the movement data from moves to steps and miles (http/www.movable.com), which is more widely understood. On measurement weeks’ participants were asked to wear the Movband as much as possible, specifically a minimum of 10 hours throughout the day. The participants were also given an activity monitor report to complete at the end of each day which asks the participant at what times during the day the Movband was worn. This was done to quantify the amount of minutes the participant wore the Movband. That information was then used to calculate “moves” per minute (“moves” per minute = total “moves” ÷ time worn).

**Objective fitness-related variables measurement.** Fitness parameters were assessed prior to beginning the intervention (baseline), at week 8 (midpoint), and at week 16 (post). Each individual test was measured by a member of the research staff who is trained in the current fitness testing protocols. The specific order of testing was in the order it is mentioned in this paragraph. This testing included resting measurements of height and weight. Active measurements included the 12-minute cooper test, push-ups to failure, partial curl-up, which measures the maximal number of curl-ups performed in one
minute, and flexibility. These tests are based on American College of Sports Medicine guidelines for exercise testing (Pescatello, 2014). Post-testing occurred after the 16-week intervention.

**Height and weight.** Participants were measured for height to the nearest centimeter via a stadiometer. Weight was measured to the nearest kilogram using a balance beam scale (Health O Meter, Chicago, IL). Body mass index (BMI) was calculated by dividing the participants’ weight in kilograms over the height squared in centimeters.

**Cardiorespiratory endurance.** The 12-minute Cooper test is an assessment of cardiorespiratory endurance (Grant et al., 1995; Zwiren et al., 1991). This included participants walking and/or running around a measured gymnasium floor for 12 minutes. Participants were instructed to cover as much distance as possible in the 12 minutes. The dependent variable of this test is the distance, which was measured by the investigators.

**Push-ups.** Push-ups are a measurement of upper-body muscular endurance and were performed herein according to American College of Sports Medicine guidelines (Garber et al., 2011; Pescatello, 2014). Males were instructed to complete the test from their toes while females were to perform the push-ups from their knees. All participants were instructed to maintain a straight line from the shoulders through the hips to either the knees or toes. The research staff supervised the test and commented on incorrect form. Participants completed as many push-ups as possible without pausing. A completed push-up counted if the arms were bent to 90 degrees in the down position and extended fully in the starting position. Participants were instructed to keep a steady pace
for the duration of the test. Any pause or break in form was not acceptable. If the corrections were not made immediately, the research staff member terminated the test.

**Partial curl-ups.** Partial curl-ups were performed based on American College of Sports Medicine guidelines for physical fitness assessments, as this is a valid measurement for abdominal muscular endurance (Garber et al., 2011; Pescatello, 2014). Participants laid supine on an exercise mat with their knees bent to 90 degrees and the soles of their feet flat on the ground. Their arms laid by their side with the hands relaxed and the middle fingers touching a piece of tape that is placed 10 cm from the end and parallel to the edge of the exercise mat. Participants were instructed to use the abdominal muscles to curl-up so their middle fingers reached the edge of the exercise mat, then to return to the resting position. This motion was completed as many times as possible in 60 seconds without pausing. The research staff counted the repetitions for each participant.

**Flexibility.** Flexibility was measured using the sit-and-reach test recommended by the American College of Sports Medicine (Garber et al., 2011; Pescatello, 2014). A sit-and-reach box was used (Finder Flex-Tester, Novel Products Inc. Rockton, IL) for assessment. Participants were instructed to remove their shoes while sitting on the ground in an upright position with knees extended and their feet and heels flat against the box. Next, participants placed one hand over the other and extended their arms straight forward. Then, participants bent forward and held their final position for approximately two seconds. The most distant point reached with the finger tips is the score. The better of three trials, as seen by the member of the research team was recorded.
**Questionnaires.** Data collection at the three time points began on the first day of week one of the intervention. Participants were given a questionnaire with instructions to complete and return the questionnaire in one week. They were told to complete the subjective physical activity questionnaire for the current week. These directions were given so the objective physical activity data collection and subjective physical activity questionnaire would be analogous, since the objective physical activity data would be collected from the first week of usage. The questionnaires consisted of the following.

1. Demographic information (e.g., gender, age, occupational status, etc.).
3. The five factor model of personality using items from the International Personality Item Pool (Goldberg, 1999).
5. SDT constructs, which measure aspects of motivation from Deci and Ryan's (1985) SDT. The instruments used for SDT are 5a) Behavioral Regulations in Exercise Questionnaire-3 (Markland & Tobin, 2004; P. M. Wilson et al., 2006), 5b) Goal Content for Exercise Questionnaire (Sebire et al., 2008), and 5c) The Psychological Need Satisfaction in Exercise Questionnaire (P. M. Wilson et al., 2006). The demographic questionnaire was only completed at baseline. The other questionnaires were completed at the three time points over 16 weeks.

**Self-reported physical activity and sedentary behavior measurement.** The International Physical Activity Questionnaire (IPAQ) instrument is a validated self-reported measure of physical activity and sedentary behavior. The IPAQ has been
validated in many studies carried out by a number of countries (Craig et al., 2003). Physical activity is assessed as behaviors performed for at least 10 minutes and time spent performing three intensities of activity: walking (low intensity), moderate, and vigorous. Sitting time is also expressed in two forms: weekday and weekend day. The measures of physical activity are summed to estimate the total amount of time spent doing physical activity per week. Total daily physical activity is calculated into Metabolic Equivalent of Task-minutes per day (MET minutes per day). The Metabolic Equivalent of Task is estimated using the product of reported time in three intensities by a Metabolic Equivalent of Task value specific to each intensity of physical activity. Then, it is expressed as a daily average Metabolic Equivalent of Task score (MET minutes per day) according to the IPAQ scoring protocol. Vigorous-intensity physical activity receives 8 Metabolic Equivalent of Tasks, moderate-intensity activity to 4 Metabolic Equivalent of Tasks, and walking to 3.3 Metabolic Equivalent of Tasks. Users are given a “Categorical score” (1-3 scale) and a “Continuous score” (Metabolic Equivalent of Task for the week).

**Personality.** Personality was assessed with the International Personality Item Pool (Goldberg, 1999) which measures the “Big Five” dimensions of personality (neuroticism, extraversion, consciousness, openness, and agreeableness). This instrument lies on a five-point Likert scale from 1 (Very Inaccurate) to 5 (Very accurate) with 50 items. Each of the five factors of personality is represented 10 times on this form. The instrument represents opposite ends of the “Big Five” spectrum, which contain reverse coded items and non-reverse coded items. The directions state to “use the rating scale to
describe how accurately each statement describes you” and to “describe yourself as you honestly see yourself.” An example of extraversion is “Am the life of the party,” where it is reverse-coded as “Have little to say.” Scores are calculated by summing each of the 10 items from each of the five personality domains. The scores can range from a negative score to a positive score. This instrument has proven to have good convergent validity and discriminant validity, test-retest reliability, and patterns of external correlates (Goldberg, 1992). It has been proven to represent a wide range of personality factors, which is communicable to scientists.

**Self-efficacy for physical activity and exercise.** Self-efficacy for exercise behavior was measured with the Self-Efficacy and Exercise Habits Survey (Sallis et al., 1988). This is a 12-item, self-report survey on one’s belief in their ability to exercise in certain situations for at least six months. This measure consist of two subscales of ‘resisting relapse’ (Cronbach’s $\alpha = 0.79$) and ‘making time’ (Cronbach’s $\alpha = 0.72$), each containing five items. A 5-point scale from 1 (I know I cannot) to 5 (I know I can) and 8 (Does not apply) is applied for the subject responses. Examples are “Stick to your exercise program even when you have excessive demands at work” and “Get up early, even on weekends, to exercise.”

**Self-determination for physical activity and exercise.** Measures of the self-determination theory assess the functional significance of exercise motives from the perspective of Deci & Ryan, (1985). The instruments used herein include the Goal Contents in Exercise Questionnaire (GCEQ), Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3), and Psychological Need Satisfaction in Exercise (PNSE).
To measure goal contents, the 20-item Goal Contents in Exercise Questionnaire was used and validated (Sebire et al., 2008). This instrument measures intrinsic (health, social affiliation, and skill development) and extrinsic (image and social recognition) goal contents. This questionnaire asks to “please indicate on the scale provided how important each goal is for you with reference to your physical activity.” The scale is on a Likert scale from 1 (not at all important) to 7 (extremely important). An example of a question from this instrument includes, “To increase my energy level.” Scores from this instrument have shown initial reliability and validity evidence (Sebire et al., 2008, 2009).

To measure participants underlying decisions to engage or not engage in physical exercise, the Behavioral Regulation in Exercise Questionnaire-3 was used. This measures autonomous or controlled based self-determination that is present. This instrument is a primary measure of self-determination to participate in physical activity which assesses autonomous determination and controlled determination; whereas autonomous is self-determined and controlled is less self-determined. Autonomous motivation consists of Identified (activity is personally valued), Integrated (activities assimilated with self), and Intrinsic (behavior engagement for no consequences besides the behavior itself). Controlled motivation consists of External regulation and Introjected regulation, which are aspects of external locus of control. The BREQ-3 is a 24-item scale which has points from 0 (Not true for me) to 4 (Very true for me) that has been validated (Markland & Tobin, 2004; P. M. Wilson et al., 2006).

The Psychological Need Satisfaction in Exercise Questionnaire (P. M. Wilson et al., 2006) was used to assess perceptions of psychological need fulfillment. The PNSE
Questionnaire is an 18-item measurement developed using SDT to measure perceptions of competence (6 items), autonomy (6 items), and relatedness (6 items) with exercise. This questionnaire has been modified to a physical activity version (Psychological Need Satisfaction in Exercise Questionnaire - physical activity; (Gunnell et al., 2014). The scoring is on a Likert scale from 1=False to 6=True. An example of a question from competence includes, “I feel confident I can do even the most challenging exercises.” A question from Autonomy includes, “I feel free to exercise in my own way.” A question from relatedness include, I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons.”

**Analytic Plan**

These data were analyzed with Statistical Packages for the Social Sciences version 21.0. Significance was set *a priori* at $p \leq 0.05$. Multiple four group (control, 0, 4, ≥8 month previous participation) by three time-point (baseline, mid, final) Analyses of Variance (ANOVAs) were conducted to assess differences in the following dependent variables: objectively measured physical activity (Movband accelerometer), subjectively measured physical activity and sedentary behavior (IPAQ), fitness-related variables (Cooper 12-minute test, push-ups, curl-ups, sit-and-reach), psychometric variables (personality, self-efficacy for physical activity, self-determination for physical activity) over the course of the 16-week intervention. Subsequently, two group (control, intervention) by three time-point (baseline, mid, final) ANOVAs were conducted to examine differences in the same dependent variables. Since there is mixed research on effectiveness of worksite interventions, we wanted to use a two group ANOVA in
addition to the four group. This would examine the differences between the Intervention and Control groups and changes over time.

Change scores from baseline to final assessment were calculated ($\Delta$ score = final assessment – baseline assessment) for the objective physical activity (steps per minute), subjective physical activity (IPAQ METs), sedentary behavior (IPAQ), fitness variables (12-minute Cooper test, push-ups, curl-ups, sit-and-reach) and psychometric variables (personality, self-efficacy for physical activity, self-determination for physical activity). Pearson’s correlation assessments were then performed on the entire group to assess the relationship among these change scores. Additionally, Pearson’s correlations were then conducted to assess the relationship among change scores in the Control and Intervention (combined ≥8 months, 4 months, and 0 months) groups independently.

The four group by three time-point ANOVA, while there were a few slight differences between the three intervention groups, the differences relative to the Controls (i.e. interactions) were unaffected. Therefore, we chose to report only the two group design data.

**Results**

Of the 50 participants who initially consented to the intervention, three withdrew from the program due to time constraints and personal reasons. Of the 17 Controls who initially consented, two withdrew due to time constraints. Thus there was a final sample size of $N = 62$ (47 Intervention, $n = 38$ females; 15 Controls, $n = 11$ females). If a participant did not complete an assessment they were dropped from that assessment. The data are presented as mean $\pm$ Standard Deviation (SD). Baseline physical characteristics
of the two groups are presented in Table 4. Attendance to the exercise program for the Intervention group was 66%.

Table 4

*Baseline physical characteristics (data are mean ± SD)*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intervention (n = 47)</th>
<th>Controls (n = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>51 ± 8</td>
<td>49 ± 8</td>
</tr>
<tr>
<td>Sex</td>
<td>9 m, 38 f</td>
<td>4 m, 11 f</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.7 ± 7.9</td>
<td>167.5 ± 10.8</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>83.6 ± 18.2</td>
<td>80.0 ± 18.5</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.7 ± 6.7</td>
<td>28.5 ± 6.4</td>
</tr>
</tbody>
</table>

**Physical Activity and Sedentary Behavior Measures**

There were no significant main effects of time ($F = 0.4, p = 0.6$), group ($F = 1.3, p = 0.3$), or interactions ($F = 0.1, p = 0.9$) for steps per minute, (Table 5).

For IPAQ MET-min per week there was a significant main effect of time ($F = 4.8, p = 0.01$) due to a significant increase ($t = 3.2, p = 0.002$) in METS from pre (1582.7 ± 2114.7 METS) to mid (2743.1 ± 2796.3 METS) and significant increase ($t = 3.8, p < 0.001$) in METS from pre to post (2336.6 ± 1672.8 METS). There was no significant increase ($t = 1.0, p = 0.3$) from mid to post. There was no significant main effect of group ($F = 1.5, p = 0.2$) or interactions ($F = 0.7, p = 0.5$), (Table 5).
# Table 5

Pre, mid, and post physical Activity, sedentary behavior, and fitness-related variables in control and intervention groups (data are mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 15)</th>
<th>Intervention (n = 47)</th>
<th>Control &amp; Intervention (n = 62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Sum</td>
<td>Pre</td>
<td>Mid</td>
<td>Post</td>
</tr>
<tr>
<td>Steps per min (min)</td>
<td>10.9 ± 2.3</td>
<td>10.5 ± 3.7</td>
<td>10.9 ± 3.3</td>
</tr>
<tr>
<td>IPAQ METS-min per week (METS)</td>
<td>1293.7 ± 1948.6</td>
<td>1948.3 ± 3434.1</td>
<td>1676.5 ± 2996.7</td>
</tr>
<tr>
<td>IPAQ sedentary time per week (min)</td>
<td>2671.9 ± 2978.0</td>
<td>2722.5 ± 3194.6</td>
<td>2657.5 ± 2606.7</td>
</tr>
<tr>
<td>Cooper 12-min test (m)</td>
<td>1508.9 ± 1493.6</td>
<td>1614.4 ± 1503.0</td>
<td>1545.8 ± 1547.1</td>
</tr>
<tr>
<td>Push-ups (repetitions)</td>
<td>22.4 ± 15.9</td>
<td>24.5 ± 15.8</td>
<td>21.9 ± 8.3</td>
</tr>
<tr>
<td>Curl-ups (repetitions)</td>
<td>28.3 ± 19.6</td>
<td>36.0 ± 22.2</td>
<td>31.4 ± 20.8</td>
</tr>
<tr>
<td>Sit-and-reach (cm)</td>
<td>33.7 ± 10.5</td>
<td>35.0 ± 9.6</td>
<td>35.3 ± 9.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28.5 ± 6.4</td>
<td>28.3 ± 5.9</td>
<td>28.3 ± 6.0</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>80.0 ± 18.5</td>
<td>79.3 ± 17.2</td>
<td>79.4 ± 17.3</td>
</tr>
</tbody>
</table>

*Significantly different from pre p ≤ 0.05
#Significantly different from mid p ≤ 0.05
†Significantly different from Control p ≤ 0.05
For IPAQ Sedentary behavior time there was a significant group by time interaction ($F = 3.1, p = 0.05$) (Figure 1) such that the Intervention group significantly decreased ($t \geq 3.13, p \leq 0.003$ for both) sedentary minutes per week pre (3194.6 ± 1224.4 min) to mid (2657.5 ± 1156.0 min) and pre to post (2606.7 ± 1134.3 min). There was no significant difference ($t = 0.1, p = 0.9$) from mid to post. For the Control group there were no significant differences ($t \leq 0.1, p \geq 0.4$ for all) at any time points. There were no main effects of time ($F = 0.8, p = 0.4$) or group ($F = 0.01, p = 0.9$), (Table 5).

![IPAQ Sedentary Behavior](image)

**Figure 2.** Sedentary time during week 1, week 8, and week 16 (mean ± SEM). *Significant difference for Intervention group from pre $p \leq 0.05$.

**Fitness-related Variables**

For the Cooper test there was a significant main effect of time ($F = 4.5, p = 0.01$) due to a significant increase in meters ($t = 3.4, p = 0.001$) from pre (1458.2 ± 382.3 m) to mid (1533.7 ± 432.6 m) and significant increase ($t = 2.8, p = 0.01$) pre to post (1570.4 ± 502.8 m). There were no significant differences ($t = 1.5, p = 0.1$) from mid to post.
There were no significant main effects of group \((F = 0.0, p = 1.0)\) or interactions \((F = 0.1, p = 0.9)\), (Table 5).

For the push-up test there was a significant interaction \((F = 5.7, p = 0.005)\) (Figure 2) and main effect of time \((F = 17.1, p < 0.001)\). Push-up repetitions revealed a significant, stepwise increase \((t \geq 7.5, p < 0.01\) for all) in the Intervention group from pre \((16.2 \pm 8.3\) reps) to mid \((21.6 \pm 9.1\) reps) and mid to post \((24.1 \pm 9.7\) reps). There were no significant differences in the Control group \((t \leq 1.5, p \geq 0.15)\). The main effect of time was due to the significant, stepwise increase \((t \geq 7.0, p < 0.02\) for all) in push-up repetitions at all time points. There was not a significant main effect of group \((F = 0.1, p = 0.8)\), (Table 5).

For the one-minute curl-up test there was a significant main effect of time \((F = 15.3, p < 0.001)\) due to a significant stepwise \((t \geq 4.2, p \leq 0.001\) for all) increase of repetitions in one minute (pre: \(33.9 \pm 18.7\) reps, mid: \(38.8 \pm 20.8\) reps, post: \(44.8 \pm 20.6\) reps). There was no significant main effects of group \((F = 2.8, p = 0.1)\) or interactions \((F = 2.3, p = 0.1)\), (Table 5).

For sit-and-reach there were no significant main effects of time \((F = 0.5, p = 0.6)\), main effects of group \((F = 1.4, p = 0.2)\), or interactions \((F = 0.2, p = 0.8)\), (Table 5).

For BMI there were no significant main effects of time \((F = 2.3, p = 0.1)\), main effects of group \((F = 1.3, p = 0.3)\), or interactions \((F = 0.5, p = 0.6)\). For weight there were no significant main effects of time \((F = 2.4, p = 0.1)\), main effects of group \((F = 1.0, p = 0.5)\), or interactions \((F = 0.4, p = 0.7)\), (Table 5).
Psychometric Variables

For personality there was a significant interaction ($F = 4.7, p = 0.02$) for extraversion due to a significant decrease ($t = 2.4, p = 0.02$) from pre (8.5 ± 6.0) to mid (7.1 ± 6.2) and significant increase ($t = 2.3, p = 0.03$) from mid to post (8.2 ± 5.6) in the Intervention group, but not pre to post or in the Control group ($t \leq 2.5, p \geq 1.0$). For Conscientiousness there was a significant main effect of group ($F = 4.3, p = 0.04$) due to a significantly higher score ($t = 2.1, p = 0.04$) for the Control (18.5 ± 5.3) compared to the Intervention (15.1 ± 5.4). There were no other significant main effects ($F \leq 1.6, p \geq 0.11$) or interactions ($F \leq 1.6, p \geq 0.08$), (Table 6).

For Self-efficacy ‘Sticking to It’ there were no significant main effects of time ($F = 1.3, p = 0.3$), main effects of group ($F = 0.3, p = 0.6$), or interactions ($F = 0.4, p = 0.7$).
Table 6

**Pre, mid, and post psychometric variables in control and intervention groups (data are mean ± SD)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 15)</th>
<th>Sum Mean</th>
<th>Intervention (n = 47)</th>
<th>Sum Mean</th>
<th>Control &amp; Intervention (n = 62)</th>
<th>Sum Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Mid</td>
<td>Post</td>
<td>Pre</td>
<td>Mid</td>
<td>Post</td>
</tr>
<tr>
<td>Extraversion</td>
<td>7.8 ±</td>
<td>9.3 ±</td>
<td>7.6 ±</td>
<td>8.3 ±</td>
<td>8.5 ±</td>
<td>7.1 ±</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-13.4 ±</td>
<td>-11.9 ±</td>
<td>-11.6 ±</td>
<td>-12.3 ±</td>
<td>-10.6 ±</td>
<td>-11.0 ±</td>
</tr>
<tr>
<td>Openness</td>
<td>20.5 ±</td>
<td>19.9 ±</td>
<td>21.1 ±</td>
<td>20.7 ±</td>
<td>18.5 ±</td>
<td>18.0 ±</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>19.3 ±</td>
<td>18.3 ±</td>
<td>18.8 ±</td>
<td>18.9 ±</td>
<td>17.8 ±</td>
<td>16.5 ±</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>18.7 ±</td>
<td>18.2 ±</td>
<td>17.5 ±</td>
<td>18.5 ±</td>
<td>14.9 ±</td>
<td>15.1 ±</td>
</tr>
<tr>
<td>Self-efficacy Sticking to It</td>
<td>28.9 ±</td>
<td>30.5 ±</td>
<td>30.8 ±</td>
<td>30.2 ±</td>
<td>31.4 ±</td>
<td>31.0 ±</td>
</tr>
<tr>
<td>Self-efficacy Making Time</td>
<td>12.4 ±</td>
<td>14.1 ±</td>
<td>15.4 ±</td>
<td>14.0 ±</td>
<td>16.2 ±</td>
<td>16.5 ±</td>
</tr>
<tr>
<td>Amotivation</td>
<td>4.7 ±</td>
<td>5.6 ±</td>
<td>5.0 ±</td>
<td>4.6 ±</td>
<td>4.1 ±</td>
<td>4.2 ±</td>
</tr>
<tr>
<td>External Regulation</td>
<td>1.9 ±</td>
<td>1.0 ±</td>
<td>1.6 ±</td>
<td>1.6 ±</td>
<td>3.3 ±</td>
<td>2.7 ±</td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>8.6 ±</td>
<td>8.5 ±</td>
<td>8.6 ±</td>
<td>8.8 ±</td>
<td>8.9 ±</td>
<td>8.9 ±</td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>4.0 ±</td>
<td>4.2 ±</td>
<td>3.6 ±</td>
<td>3.0 ±</td>
<td>3.7 ±</td>
<td>3.8 ±</td>
</tr>
<tr>
<td>Integrated Regulation</td>
<td>10.7 ±</td>
<td>10.8 ±</td>
<td>11.8 ±</td>
<td>11.1 ±</td>
<td>12.3 ±</td>
<td>12.6 ±</td>
</tr>
<tr>
<td>Intrinsic Regulation</td>
<td>3.1 ±</td>
<td>2.9 ±</td>
<td>3.0 ±</td>
<td>2.4 ±</td>
<td>2.7 ±</td>
<td>2.4 ±</td>
</tr>
<tr>
<td></td>
<td>4.4 ±</td>
<td>4.2 ±</td>
<td>3.9 ±</td>
<td>3.6 ±</td>
<td>4.0 ±</td>
<td>3.7 ±</td>
</tr>
<tr>
<td></td>
<td>10.8 ±</td>
<td>11.7 ±</td>
<td>11.2 ±</td>
<td>11.3 ±</td>
<td>11.3 ±</td>
<td>11.8 ±</td>
</tr>
</tbody>
</table>

*(table continues)*
Table 6 (continued)

*Pre, mid, and post psychometric variables in control and intervention groups (data are mean ± SD)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 15)</th>
<th>Sum Mean</th>
<th>Intervention (n = 47)</th>
<th>Sum Mean</th>
<th>Control &amp; Intervention (n = 62)</th>
<th>Sum Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td></td>
<td></td>
<td>Time</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Pre Mid Post</td>
<td></td>
<td>Pre Mid Post</td>
<td>Pre Mid Post</td>
<td>Control &amp; Intervention Pre Mid Post</td>
<td></td>
</tr>
<tr>
<td>Autonomy</td>
<td>32.3 ± 32.1 ± 32.3 ± 32.4 ± 39.6 ± 31.0 ± 32.9 ± 31.2 ±</td>
<td>24.33 ± 25.6 ± 26.5 ±</td>
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</tr>
<tr>
<td>Competence</td>
<td>23.7 ± 24.0 ± 26.8 ± 25.0 ± 24.6 ± 26.0 ± 26.6 ± 25.7 ±</td>
<td>24.4 ± 25.5 ± 26.6 ±</td>
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</tr>
<tr>
<td>Relatedness</td>
<td>21.0 ± 22.6 ± 20.3 ± 21.0 ± 24.6 ± 25.8 ± 25.9 ± 25.5 ±</td>
<td>23.7 ± 25.0 ± 24.5 ±</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic Health</td>
<td>25.3 ± 24.9 ± 24.1 ± 24.7 ± 25.5 ± 24.2 ± 24.5 ± 24.9 ±</td>
<td>25.5 ± 24.3 ± 24.4 ±</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic Social</td>
<td>10.2 ± 9.6 ± 10.1 ± 9.9 ± 13.3 ± 13.4 ± 13.4 ± 13.2 ±</td>
<td>12.5 ± 12.5 ± 12.5 ±</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Intrinsic Skill</td>
<td>17.9 ± 17.5 ± 17.8 ± 17.9 ± 19.7 ± 17.8 ± 18.7 ± 18.7 ±</td>
<td>19.2 ± 17.7 ± 18.5 ±</td>
<td></td>
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</tr>
<tr>
<td>Extrinsic Image</td>
<td>19.9 ± 19.6 ± 19.6 ± 19.8 ± 18.9 ± 18.1 ± 19.0 ± 18.6 ±</td>
<td>19.2 ± 18.5 ± 19.2 ±</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extrinsic Social</td>
<td>11.6 ± 11.7 ± 11.4 ± 11.0 ± 12.0 ± 11.8 ± 13.1 ± 11.9 ±</td>
<td>11.8 ± 12.7 ± 12.1 ±</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significantly different from pre p ≤ 0.05  
†Significantly different from Control p ≤ 0.05*
For Self-efficacy ‘Making time’ there was a significant main effect of time ($F = 3.2, p = 0.05$) and a significant main effect of group ($F = 6.2, p = 0.02$). The effect of time revealed a significant increase ($t = 2.5, p = 0.03$) from pre (12.4 ± 4.7) to post (15.4 ± 5.0). There were no significant differences ($t \leq 1.6, p \geq 0.1$ for both) from pre to mid (15.9 ± 4.6), or mid to post. The effect of group revealed the Intervention group had a significantly higher ($t = 2.5, p = 0.02$) score (16.7 ± 3.4) than the Control group (14.0 ± 4.6). There were no significant interactions ($F = 0.9, p = 0.4$), (Table 6).

For the BREQ-3 domain of Identified Regulation there was a significant main effect of group ($F = 3.8, p = 0.05$) due to a significantly greater ($t = 2.0, p = 0.05$) score in the Intervention group (12.5 ± 2.3) compared to the Control (11.1 ± 2.7). There were no other significant main effects of time ($F \leq 2.3, p \geq 0.1$ for all), main effects of group ($F \leq 1.1, p \geq 0.5$ for all), or interactions ($F \leq 0.8, p \geq 0.1$ for all) for any of the remaining BREQ-3 assessments, (Table 6).

For the PNSE there was a significant main effect of time ($F = 3.8, p = 0.03$) for Competence such that there was a significant increase ($t = 2.14, p = 0.036$) from pre (24.33 ± 7.5) to post (26.5 ± 8.0), but no significant differences ($t \leq 1.5, p \geq 0.1$ for both) from pre to mid (25.6 ± 7.01) or mid to post. There was a significant main effect of group for Relatedness ($F = 4.0, p = 0.05$) due to a significantly greater ($t = 2.0, p = 0.05$) score in the Intervention group (25.5 ± 7.0) compared to the Control group (21.0 ± 8.5). There were no other significant main effects of time ($F \leq 1.7, p \geq 0.2$ for all), main effects of group ($F \leq 1.1, p \geq 0.3$ for all), or interactions ($F \leq 2.3, p \geq 0.1$ for all) for the other PNSE domains, (Table 6).
On the GCEQ Intrinsic Health domain there was a significant main effect of time ($F = 4.1, p = 0.02$) for Intrinsic Health due to a significant decrease ($t \leq 3.3, p \geq 0.004$ for both) from pre (25.5 ± 2.2) to mid (24.3 ± 3.2) and pre to post (24.4 ± 3.33), but no significant difference ($t = 0.1, p = 0.9$) from mid to post. The Intrinsic Social revealed a significant main effect of group ($F = 5.6, p = 0.02$) due to a significantly higher ($t = 2.4, p = 0.02$) score in the Intervention group (13.2 ± 4.2) versus the Control group (9.9 ± 5.5). There were no other significant main effects of time ($F \leq 1.1, p \geq 0.2$ for all), main effects of group ($F \leq 0.8, p \geq 0.9$ for all), or interactions ($F \leq 0.9, p \geq 0.4$ for all) for the GCEQ assessments, (Table 6).

**Pearson’s Correlations Δ Score Combined Groups**

Pearson’s Correlations of the pre to post changes with the groups combined revealed ΔSteps per minute to be positively ($r = 0.3, p = 0.05$) associated with ΔBMI, meaning a greater positive change in steps per minute were predictive of a greater positive change in BMI. ΔSteps per minute was positively ($r = 0.3, p = 0.04$) associated with ΔNeuroticism score. In other words, an increasing change in steps was associated with a positive change of neuroticism score. However, it is important to note that a greater neuroticism score equates to lower levels of neuroticism. ΔSteps per minute was positively ($r = 0.3, p = 0.04$) associated with ΔRelatedness. This means a positive change in physical activity was predictive of an increasing change in other’s easily connecting with the individual. ΔSteps per minute was positively ($r = 0.3, p = 0.04$) associated with ΔGCEQ Extrinsic Social. This means that as the change in steps increased participants reported an increasing change of being more concerned with others approval of their
exercise habits (Table 7). The ΔIPAQ METS-min per week was not associated with any variable, (Table 7).

The ΔIPAQ Sedentary questionnaire was negatively associated with the ΔCooper test \( r = -0.3, p = 0.04 \), meaning the negative change in sedentary behavior were predictive of positive changes in cardiorespiratory fitness. The ΔIPAQ Sedentary questionnaire was positively \( r = 0.5, p < 0.001 \) associated with ΔBREQ-3 Introjected Regulation. In other words the positive change of sedentary behavior was predictive of an increasing change in not desiring to make health and exercise improvements, (Table 7).

**Pearson’s Correlations Δ Score Separated Groups**

This section will be reported in order by the variable then group (e.g. ΔSteps per minute: Control then Intervention). In the Control group, ΔSteps per minute demonstrated a positive \( r = 0.5, p = 0.04 \) relationship with the ΔCooper test. In other words, a positive change in steps were predictive of a positive change in cardiorespiratory fitness. ΔSteps per minute was positively \( r = 0.7, p = 0.02 \) associated with Δpush-ups, meaning a positive change of physical activity was predictive of a positive change of push-ups. ΔSteps per minute was positively \( r = 0.5, p = 0.04 \) associated with ΔRelatedness. This means a positive change in steps per minute was predictive of a positive change in easily developing similarities with others. For the Intervention group, Δsteps per minute was positively \( r = 0.4, p = 0.02 \) associated with ΔBMI, meaning predictive of a positive change of weight-to-height ratio. ΔSteps per minute was
Table 7

*Correlations of \( \Delta \) from pre to post of \( \Delta \) steps per min, \( \Delta \) MET-min per week, and \( \Delta \) sitting time in combined groups*

<table>
<thead>
<tr>
<th></th>
<th>( \Delta ) Steps per min</th>
<th>( \Delta ) MET-min per week</th>
<th>( \Delta ) Sitting Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta ) Cooper 12-min test (m)</td>
<td>( r = 0.1, p = 0.7 )</td>
<td>( r = -0.2, p = 0.1 )</td>
<td>( r = -0.3, p = 0.04^* )</td>
</tr>
<tr>
<td>( \Delta ) Push-ups repetitions</td>
<td>( r = 0.0, p = 0.4 )</td>
<td>( r = 0.1, p = 0.5 )</td>
<td>( r = -0.07, p = 0.6 )</td>
</tr>
<tr>
<td>( \Delta ) Curl-ups repetitions</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.1, p = 0.4 )</td>
<td>( r = -0.1, p = 0.5 )</td>
</tr>
<tr>
<td>( \Delta ) Sit-and-reach (cm)</td>
<td>( r = 0.0, p = 0.8 )</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.1, p = 0.9 )</td>
</tr>
<tr>
<td>( \Delta ) BMI (kg/m(^2))</td>
<td>( r = 0.6, p = 0.05^* )</td>
<td>( r = -0.1, p = 0.3 )</td>
<td>( r = 0.1, p = 0.7 )</td>
</tr>
<tr>
<td>( \Delta ) Weight (kg)</td>
<td>( r = 0.2, p = 0.3 )</td>
<td>( r = -0.9, p = 0.5 )</td>
<td>( r = 0.1, p = 0.6 )</td>
</tr>
<tr>
<td>( \Delta ) Extraversion</td>
<td>( r = 0.2, p = 0.2 )</td>
<td>( r = -0.1, p = 0.9 )</td>
<td>( r = -0.1, p = 0.3 )</td>
</tr>
<tr>
<td>( \Delta ) Neuroticism</td>
<td>( r = 0.3, p = 0.04^* )</td>
<td>( r = 0.05, p = 0.7 )</td>
<td>( r = -0.4, p = 0.8 )</td>
</tr>
<tr>
<td>( \Delta ) Openness</td>
<td>( r = 0.2, p = 0.1 )</td>
<td>( r = -0.1, p = 0.7 )</td>
<td>( r = -0.2, p = 0.2 )</td>
</tr>
<tr>
<td>( \Delta ) Agreeableness</td>
<td>( r = 0.2, p = 0.07 )</td>
<td>( r = 0.2, p = 0.3 )</td>
<td>( r = 0.1, p = 0.6 )</td>
</tr>
<tr>
<td>( \Delta ) Conscientiousness</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.0, p = 0.9 )</td>
<td>( r = 0.0, p = 0.8 )</td>
</tr>
<tr>
<td>( \Delta ) Self-efficacy Sticking to It</td>
<td>( r = 0.0, p = 0.3 )</td>
<td>( r = 0.1, p = 0.3 )</td>
<td>( r = -0.1, p = 0.4 )</td>
</tr>
<tr>
<td>( \Delta ) Self-efficacy Making Time</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = 0.1, p = 0.5 )</td>
<td>( r = -0.0, p = 0.9 )</td>
</tr>
<tr>
<td>( \Delta ) Amotivation</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.0, p = 0.07 )</td>
<td>( r = -0.1, p = 0.3 )</td>
</tr>
<tr>
<td>( \Delta ) Regulation</td>
<td>( r = 0.1, p = 0.4 )</td>
<td>( r = 0.1, p = 0.4 )</td>
<td>( r = 0.2, p = 0.2 )</td>
</tr>
<tr>
<td>( \Delta ) Interojected Regulation</td>
<td>( r = 0.2, p = 0.2 )</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = 0.5, p &lt; 0.001^* )</td>
</tr>
<tr>
<td>( \Delta ) Identified Regulation</td>
<td>( r = 0.1, p = 0.4 )</td>
<td>( r = 0.2, p = 0.08 )</td>
<td>( r = 0.0, p = 0.9 )</td>
</tr>
<tr>
<td>( \Delta ) Integrated Regulation</td>
<td>( r = 0.1, p = 0.5 )</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.0, p = 0.8 )</td>
</tr>
<tr>
<td>( \Delta ) Intrinsic Regulation</td>
<td>( r = 0.1, p = 0.7 )</td>
<td>( r = 0.1, p = 0.3 )</td>
<td>( r = -0.2, p = 0.2 )</td>
</tr>
<tr>
<td>( \Delta ) Autonomy</td>
<td>( r = 0.0, p = 0.7 )</td>
<td>( r = 0.05, p = 0.7 )</td>
<td>( r = -0.2, p = 0.1 )</td>
</tr>
<tr>
<td>( \Delta ) Competence</td>
<td>( r = 0.2, p = 0.1 )</td>
<td>( r = -0.0, p = 0.9 )</td>
<td>( r = -0.4, p = 0.7 )</td>
</tr>
<tr>
<td>( \Delta ) Relatedness</td>
<td>( r = 0.3, p = 0.04^* )</td>
<td>( r = -0.1, p = 0.3 )</td>
<td>( r = 0.1, p = 0.7 )</td>
</tr>
<tr>
<td>( \Delta ) Intrinsic Health</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = -0.2, p = 0.08 )</td>
<td>( r = -0.2, p = 0.1 )</td>
</tr>
<tr>
<td>( \Delta ) Intrinsic Social</td>
<td>( r = 0.0, p = 0.9 )</td>
<td>( r = 0.3, p = 0.8 )</td>
<td>( r = -0.0, p = 0.9 )</td>
</tr>
<tr>
<td>( \Delta ) Intrinsic Skill</td>
<td>( r = 0.1, p = 0.4 )</td>
<td>( r = 0.1, p = 0.9 )</td>
<td>( r = -0.8, p = 0.5 )</td>
</tr>
<tr>
<td>( \Delta ) Extrinsic Image</td>
<td>( r = 0.0, p = 0.7 )</td>
<td>( r = -0.5, p = 0.7 )</td>
<td>( r = 0.1, p = 0.5 )</td>
</tr>
<tr>
<td>( \Delta ) Extrinsic Social</td>
<td>( r = 0.3, p = 0.04^* )</td>
<td>( r = 0.6, p = 0.7 )</td>
<td>( r = 0.1, p = 0.4 )</td>
</tr>
</tbody>
</table>

*Significant relationship \( p \leq 0.05 \)
positively \((r = 0.4, p = 0.01)\) associated with \(\Delta\)Neuroticism. The \(\Delta\)neuroticism score is an inverse score, which means a positive change in steps per minute was predictive of a change towards less neurotic activity. \(\Delta\)Steps per minute was positively \((r = 0.4, p = 0.01)\) associated with \(\Delta\)Openness. This means a positive change of physical activity was predictive of a positive change of appreciation for experience and new ideas. \(\Delta\)Steps per minute was positively \((r = 0.3, p = 0.05)\) associated with \(\Delta\)Agreeableness. In other words, a positive change in steps per minute was predictive of a positive change in desire for social harmony. \(\Delta\)Steps per minute was positively \((r = 0.3, p = 0.03)\) associated with \(\Delta\)GCEQ Extrinsic Social. GCEQ Extrinsic Social is the concern of how others perceive your exercise habits. Thus a positive change in physical activity was predictive of a positive change of increasing desire to receive gratification from others because of exercise habits, (Table 8). There were no associations between \(\Delta\)IPAQ METS-min per week and any of the variables in either group, (Table 8).

For \(\Delta\)IPAQ Sedentary time, in the Control group there was a positive \((r = 0.6, p = 0.01)\) relationship between \(\Delta\)BREQ-3 Introjected Regulation. This means as the change in sedentary behavior increased, the change in lack of desire to improve fitness-related realms increased. \(\Delta\)IPAQ Sedentary time was inversely \((r = -0.6, p = 0.02)\) associated with \(\Delta\)Autonomy. In other words a change towards less sedentary time was predictive of a change of feeling in control and self-regulated. \(\Delta\)IPAQ Sedentary time was inversely \((r = -0.7, p = 0.004)\) associated with \(\Delta\)GCEQ Intrinsic Health. This means a change of engaging in less sedentary behavior was predictive of a negative change in the desire to
Table 8

Correlations of Δ from pre to post of Δ steps per min, Δ METS-min per week, and Δ sitting time in control and intervention groups

<table>
<thead>
<tr>
<th></th>
<th>ΔSteps per min (min)</th>
<th>ΔMETs-min per week (METS)</th>
<th>Δ Sitting Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
</tr>
<tr>
<td>Δ Cooper 12-min test (m)</td>
<td>$r = 0.6, p = 0.02^*$</td>
<td>$r = 0.0, p = 1.0$</td>
<td>$r = -0.2, p = 0.5$</td>
</tr>
<tr>
<td>Δ Push-ups (repetitions)</td>
<td>$r = 0.7, p = 0.003^*$</td>
<td>$r = 0.1, p = 0.5$</td>
<td>$r = 0.3, p = 0.4$</td>
</tr>
<tr>
<td>Δ Curl-ups (repetitions)</td>
<td>$r = -0.0, p = 0.9$</td>
<td>$r = 0.03, p = 0.8$</td>
<td>$r = -0.4, p = 0.2$</td>
</tr>
<tr>
<td>Δ Sit-and-reach (cm)</td>
<td>$r = -0.5, p = 0.8$</td>
<td>$r = 0.1, p = 0.5$</td>
<td>$r = 0.3, p = 0.2$</td>
</tr>
<tr>
<td>Δ BMI (kg/m$^2$)</td>
<td>$r = -0.2, p = 0.9$</td>
<td>$r = 0.4, p = 0.02^*$</td>
<td>$r = -0.3, p = 0.3$</td>
</tr>
<tr>
<td>Δ Weight (kg)</td>
<td>$r = -0.4, p = 0.9$</td>
<td>$r = 0.2, p = 0.1$</td>
<td>$r = -0.3, p = 0.3$</td>
</tr>
<tr>
<td>Δ Extraversion</td>
<td>$r = -0.2, p = 0.5$</td>
<td>$r = 0.2, p = 0.1$</td>
<td>$r = -0.1, p = 1.0$</td>
</tr>
<tr>
<td>Δ Neuroticism</td>
<td>$r = -0.2, p = 0.5$</td>
<td>$r = 0.4, p = 0.01^*$</td>
<td>$r = -0.4, p = 0.1$</td>
</tr>
<tr>
<td>Δ Openness</td>
<td>$r = -0.1, p = 0.7$</td>
<td>$r = 0.3, p = 0.05^*$</td>
<td>$r = -0.2, p = 0.6$</td>
</tr>
<tr>
<td>Δ Agreeableness</td>
<td>$r = -0.0, p = 1.0$</td>
<td>$r = 0.3, p = 0.05^*$</td>
<td>$r = -0.3, p = 0.2$</td>
</tr>
<tr>
<td>Δ Conscientiousness</td>
<td>$r = -0.1, p = 0.7$</td>
<td>$r = -0.0, p = 0.9$</td>
<td>$r = 0.0, p = 0.9$</td>
</tr>
<tr>
<td>Δ Self-efficacy</td>
<td>$r = 0.4, p = 0.2$</td>
<td>$r = 0.1, p = 0.5$</td>
<td>$r = 0.4, p = 0.1$</td>
</tr>
</tbody>
</table>

Sticking to It

|                      | ΔSelf-efficacy | Making Time | ΔAmotivation | $r = -0.1, p = 0.6$ | $r = 0.0, p = 0.9$ | $r = -0.4, p = 0.1$ | $r = -0.2, p = 0.1$ | $r = -0.7, p = 0.8$ | $r = -0.2, p = 0.3$ |
| ΔMotivation | $r = 0.4, p = 0.1$ | $r = -0.0, p = 0.9$ | $r = 0.0, p = 0.9$ | $r = -0.4, p = 0.1$ | $r = -0.2, p = 0.1$ | $r = -0.7, p = 0.8$ | $r = -0.2, p = 0.3$ |
| Δ Regulation | $r = -0.0, p = 0.9$ | $r = 0.2, p = 0.2$ | $r = 0.3, p = 0.2$ | $r = 0.0, p = 0.9$ | $r = 0.4, p = 0.2$ | $r = 0.0, p = 0.9$ |
| Δ Introspection | $r = -0.3, p = 0.2$ | $r = -0.1, p = 0.4$ | $r = 0.2, p = 0.6$ | $r = -1.0, p = 0.5$ | $r = 0.6, p = 0.007^*$ | $r = 0.3, p = 0.05^*$ |
| Δ Identified | $r = 0.1, p = 0.7$ | $r = 0.1, p = 0.4$ | $r = 0.4, p = 0.1$ | $r = 0.1, p = 0.4$ | $r = -0.0, p = 1.0$ | $r = -0.3, p = 0.9$ |
| Δ Integrated | $r = 0.06, p = 0.8$ | $r = 0.1, p = 0.6$ | $r = 0.3, p = 0.2$ | $r = -0.2, p = 0.2$ | $r = -0.6, p = 0.8$ | $r = -0.1, p = 0.9$ |

(table continues)
Table 8 (continued)

**Correlations of Δ from pre to post of Δ steps per min, Δ METS-min per week, and Δ sitting time in control and intervention groups**

<table>
<thead>
<tr>
<th></th>
<th>ΔSteps per min (min)</th>
<th>ΔMET-min per week (METS)</th>
<th>ΔSitting Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
</tr>
<tr>
<td>ΔIntrinsic Regulation</td>
<td>r = -0.3, p = 0.2</td>
<td>r = -0.1, p = 1.0</td>
<td>r = 0.4, p = 0.1</td>
</tr>
<tr>
<td>ΔAutonomy</td>
<td>r = 0.2, p = 0.3</td>
<td>r = 0.0, p = 1.0</td>
<td>r = -1.0, p = 0.7</td>
</tr>
<tr>
<td>ΔCompetence</td>
<td>r = 0.4, p = 0.09</td>
<td>r = 0.2, p = 0.3</td>
<td>r = 0.3, p = 0.2</td>
</tr>
<tr>
<td>ΔRelatedness</td>
<td>r = 0.5, p = 0.04*</td>
<td>r = 0.2, p = 0.1</td>
<td>r = 0.2, p = 0.5</td>
</tr>
<tr>
<td>ΔIntrinsic Health</td>
<td>r = 0.3, p = 0.3</td>
<td>r = -0.0, p = 0.8</td>
<td>r = -0.5, p = 0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔIntrinsic Social</td>
<td>r = -0.8, p = 0.8</td>
<td>r = 0.0, p = 0.9</td>
<td>r = 0.2, p = 0.5</td>
</tr>
<tr>
<td>ΔIntrinsic Skill</td>
<td>r = 0.5, p = 0.08</td>
<td>r = 0.0, p = 0.8</td>
<td>r = -0.1, p = 0.7</td>
</tr>
<tr>
<td>ΔExtrinsic Image</td>
<td>r = 0.8, p = 0.8</td>
<td>r = 0.0, p = 0.8</td>
<td>r = -0.8, p = 0.8</td>
</tr>
<tr>
<td>ΔExtrinsic Social</td>
<td>r = -0.0, p = 1.0</td>
<td>r = 0.3, p = 0.03*</td>
<td>r = 0.2, p = 0.6</td>
</tr>
</tbody>
</table>

*Significant relationship p ≤ 0.05
improve exercise habits for health reasons. For the ΔIPAQ sedentary time in the Intervention group, there was a positive \( r = 0.3, p = 0.05 \) association between ΔBREQ-3 Introjected. This means the positive change in sedentary behavior was predictive of the positive change in not desiring to improve fitness and health. ΔIPAQ sedentary time was inversely \( r = -0.3, p = 0.04 \) associated with ΔBREQ-3 Intrinsic Regulation. This means a positive change of increasing sedentary time was predictive of a negative change in seeking out exercise behavior to feel internally fulfilled (Table 8).

**Discussion**

The purpose of this study was to examine the changes over time of physical activity, sedentary behavior, and psychometric variables during a voluntary 16-week faculty and staff exercise program and to compare with a group of employees not participating in the program. Additionally, we assessed the relationship between changes in objective physical activity, subjective physical activity, sedentary behavior, and changes in fitness-related variables, with changes in personality, self-efficacy for physical activity, and self-determination for physical activity.

**Differences and Changes in the Intervention and Control Groups**

Presently neither the Intervention nor Control groups altered total objectively measured physical activity behavior over the course of the study and there was no difference between the groups. The step count for the Intervention and Control groups averaged 12.1 and 10.8 steps per minute. These step counts are sufficient at meeting physical activity guidelines (Spence, Adamo, Colley, & Tudor-Locke, 2012; C Tudor-Locke, 2014). Before quantifying these steps into steps per minute the average steps per
day were 10,190 and 9,437 for the Intervention and Control group, respectively. It is suggested to reach a minimum of 8,000 daily steps; hence, being in either group resulted in reaching the recommended physical activity behavior. The objectively measured physical activity was not altered; however, there were significant increases in weekly exercise intensity (METS) in both groups. The Intervention group increased push-ups repetitions and reduced sedentary behavior throughout the 16-weeks. Furthermore, there were improvements in the following fitness variables for both groups (Intervention, Control) over the course of the study: cardiorespiratory fitness (cooper test) and musculoskeletal endurance as assessed via abdominal curl-ups. In addition to these changes in physical activity intensity and fitness in both groups, there were improvements in the following psychometric variables: greater self-efficacy for making time for exercise and greater exercise competence, which are consistent predictors of physical activity in adults (Bauman et al., 2012). Taken together these results suggest that there was increased confidence in the ability to make time for exercise and feeling more skilled in regards to physical activity and exercise. However, there was also a decrease in exercising for intrinsic health benefits such as cardiovascular improvements, which is an intrinsic motivation (Deci & Ryan, 1985b, 2000). Therefore, while subjects were more skilled and more confident in their exercise abilities, the desire to exercise for intrinsic health reasons decreased. This result suggests that participating in both groups (Control, Intervention) did not lead to building intrinsic motivation for health benefits. The motivation of these individuals to participate in the exercise program, physical activity, and fitness testing may be for reasons such as strong personal values of exercise.
and to develop meaningful relationships with others. An additional possible explanation is participants lacked knowledge of the health benefits associated with exercise and physical activity, which is a determinant of participating in physical activity and exercise for health benefits (Bauman et al., 2012).

**Changes in the Control Group**

While we hypothesized behavioral, fitness and psychological improvements in the Intervention group, as we have outlined in previous sections, we noted several of these improvements in the Control group as well. Prior findings have demonstrated the efficacy of workplace exercise programs for increasing physical activity and fitness and these current findings do not refute those previous (Freak-Poli et al., 2011; Gazmararian et al., 2013; Goetzel et al., 2014; Rebold, Kobak, et al., 2015; von Thiele Schwarz et al., 2008). However, because the Control group had similar improvements in the previously outlined variables (increased MET-min per week, increased curl-ups repetitions, increased self-efficacy making time, and increased competence), this suggests the Control group comprised of previously sedentary and physically active individuals maintained their physical activity behavior and achieved improvements of health-related variables without the help of the program, or that our battery of fitness testing may have also positively affected exercise behavior resulting in changes in certain health and psychological variables. The Control group participated in high levels of physical activity at baseline and demonstrated fitness levels which matched or exceeded the Intervention group at the beginning of the 16-weeks. Thus, this Control group was an active control group, as the American College of Sports Medicine warrants the use of
physically active controls (F. W. Booth & Lees, 2006), and maintained their activity over the 16-weeks. Additionally, there is evidence regarding the ability of regular exercise assessments increasing physical activity behavior (von Thiele Schwarz et al., 2008), due to competition with others, reaching personal goals, and/or comparing performance with a predetermined standard (Morrow Jr, Mood, Disch, & Kang, 2015; Pescatello, 2014).

Furthermore, in the present study, participants wore a physical activity monitor that provided visual feedback (reported daily steps, miles, and activity counts or “moves”). There is also evidence that wearing an activity monitor which provides visual feedback of daily physical activity may have a positive effect on physical activity behavior as the role of feedback may reinforce motivation to engage in a behavior (Patterson, 2001). Evidence suggests that feedback about physical activity may increase awareness of physical activity (Proper, Van der Beek, Hildebrandt, Twisk, & Van Mechelen, 2003) and lead to increases in physical activity (Bravata et al., 2007). Therefore, while workplace exercise programs may not be feasible for some companies, offering employees physical activity monitors that provide feedback and making regular assessments of employee’s physical fitness and exercise habits and attitudes may yield several similar benefits of these difficult-to-implement interventions.

**Changes in the Intervention Group**

There were similar improvements in these aforementioned variables in both the Intervention and Control groups over the 16-weeks, which brings reason it is reasonable to ask if there is a benefit to a workplace exercise program beyond what may be achieved with regular fitness testing. First, because participants self-selected into the Control or
Intervention groups we do not know if those in the Intervention would have similarly benefited from assessment only or if they had some personality trait that better suited them for the intervention. For example, the Intervention group reported greater feelings of relatedness or a need to feel comradery with others in an exercise setting and greater intrinsic social motivation, or the need to connect with others in an exercise setting. Such individuals may significantly benefit from a group exercise setting. For self-efficacy, making time was also greater in the Intervention group than the Control, which suggests these individuals made exercise more of a priority. Second, while both groups exhibited similar improvements for several fitness-related variables, there were some important group by time interactions. The Intervention group significantly increased upper body muscular endurance (measured via the push-up test) whereas the Control group did not. This is important as maintaining musculoskeletal fitness as a person ages is a significant predictor of quality of life and independence in later years (Brill et al., 2000; Hunter, McCarthy, & Bamman, 2004; Jurca et al., 2005). Third, and perhaps most importantly, the Intervention group significantly reduced sedentary behavior over the course of the intervention whereas the Control group did not. This is important as sedentary behavior is an independent risk factor for cardio-metabolic disorders and there is evidence that high sedentary behavior has negative health effects even in individuals who are meeting physical activity guidelines (Lee et al., 2012; Owen et al., 2010; Van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). The term “active couch potato” is used to describe someone who is highly sedentary yet meeting the physical activity guidelines (Healy, Wijndaele, et al., 2008). Female “active couch potatoes” have been shown to have
greater waist circumference, systolic blood pressure, glucose, triglycerides, and high density lipoprotein cholesterol (Healy, Dunstan, Salmon, Shaw, et al., 2008) and, likewise, taking breaks from sitting to be physically active results in reducing metabolic risk (Healy, Dunstan, Salmon, Cerin, et al., 2008; Van der Ploeg et al., 2012), regardless of biological sex. Because both the Control and Intervention groups were equally physically active and only the Intervention group reduced sedentary behavior, it is possible that there was a greater risk for being an “active couch potato” in the Control group.

**Relationships between Changes in Psychometrics and Changes in Health-related Variables**

In addition to assessing changes in physical activity, fitness and psychometric variables in these two groups over the course of the Intervention or Control condition we also assessed the relationships between the changes in physical activity and sedentary behavior to changes in fitness and psychometrics. Greater positive changes in steps per day were associated with greater positive changes in cardiorespiratory fitness, greater musculoskeletal endurance (via the push-up test), greater relatedness (i.e., relating to peers during exercise), greater openness, greater agreeableness, and reduced neuroticism. Negative changes in sedentary behavior (reduced sedentary behavior) were associated with greater positive changes in cardiorespiratory fitness, autonomy and intrinsic health (i.e., desire to internally improve), and decreased self-approval (i.e., desire to prove to self). These findings provide a potential mechanistic explanation (i.e., increased physical activity and decreased sedentary behavior) behind the improvements seen in participants
in the present study. They also provide additional evidence of the positive outcomes that are associated with increasing physical activity and decreasing sedentary behavior.

**Limitations and Future Directions**

While we feel the present study provides useful insights into the efficacy of workplace exercise interventions and health monitoring programs, it is not without limitations. First, the sample size was small. This is especially true for the analyses separating the intervention groups into smaller subgroups. Second, only 21% of the participants were male, which limits the ability to generalize the results of this study. Additionally, these participants were employees of a large, public university, which limits the ability to generalize to other work environments and individuals of different social economic statuses. The exercise program was only offered at certain times and days of the week, which may deter the participation of individuals with schedules which are not convenient with these times. Future research could compare different types of exercise programs, including the current design, with planned fitness testing of different populations including: previously sedentary, ethnic groups, different types of jobs, different regions, and a greater proportion of males, which may have differing results than this report. Since there was an increase in making time to exercise and competence for exercise in both groups, future interventions should focus on strategies which will improve these variables. Additionally, since the Intervention group increased relatedness and personal value of exercise, it may be beneficial for future interventions to focus on building group comradery in exercise programs and to guide individuals to developing exercise into a personal core value.
Conclusion

This study examined the effects of a worksite exercise program versus a control group who participated in fitness testing on healthy behavior, fitness, and changes in psychometric variables associated with health. Overall, physical activity behavior met physical activity recommendations in both groups. Fitness-related variables such as cardiorespiratory fitness, and curl-ups improved in both groups, with the Intervention group increasing push-ups to a greater quantity than the Control group. Sedentary behavior decreased in the Intervention group but not the Control group. The change scores of decreasing sedentary behavior was associated with the change of increasing cardiorespiratory fitness, autonomy, intrinsic motivation and desiring to improve fitness and health and feel internally fulfilled. These suggest that since the Intervention reduced sedentary behavior, these psychometric traits may have contributed to the reduced sitting. Other psychometric traits associated with healthy behavior (making time and self-determination for exercise) demonstrated that participating in the Intervention and Control group may have been effective at improving positive psychometrics of health behavior, but the Intervention group revealed greater changes towards health behavior. Overall, these results suggest that both a worksite exercise program and possibly an assessment-only control in addition to wearing a visual feedback activity monitor are effective in the improvement of health-related variables and psychometric traits associated with healthy behavior. There may be a larger benefit to health improvements in worksite exercise programs.
CHAPTER V
THE RELATIONSHIP BETWEEN CELL PHONE USE, PHYSICAL ACTIVITY, AND SEDENTARY BEHAVIOR IN ADULTS ABOVE THE COLLEGE AGE

Abstract
The modern cellular telephone or “smartphone” (henceforth cell phone) provides access to activities (e.g., internet surfing, watching videos) traditionally associated with sedentary behavior. However, cell phones are portable and provide access to functions that may promote physical activity (e.g., physical activity monitors, applications for physical activity). Previous research in individuals 18-29 years old has found a positive relationship between cell phone use and sedentary behavior, but no relationship with physical activity. This has not been tested in individual’s ≥30 years old; hence the purpose of this study was to assess these relationships in adults that were past college age. A sample of university employees aged 30-63 years ($N = 69$, $50.5 \pm 8.2$ years old) wore an accelerometer for seven days and completed validated surveys assessing daily cell phone use, physical activity, and sedentary behavior. Mean cell phone use was $125.2 \pm 146.8$ minutes per day and this use was inversely associated with age ($r = -0.3$, $p = 0.005$). Correlation analyses revealed cell phone use was not associated with objective physical activity ($r \leq 0.1$, $p \geq 0.3$ for both), subjective physical activity, ($r \leq 0.1$, $p \geq 0.3$ for all), or sedentary behavior ($r = -0.11$, $p = 0.4$). Tertile splits of low, moderate, and high cell phone users revealed no significant ($F \leq 2.0$, $p \geq 0.12$ for all) differences in subjective or objective physical activity or sedentary behavior between groups. Among adults ≥30 years old, cell phone use was not associated with sedentary behavior.
Introduction

Cellular telephone (i.e., cell phone) use has become increasingly common in the last decade. According to the most recent data, 91% of United States adults report owning a cell phone with 64% possessing internet-connected cell phones (i.e., smartphones) which allow for access to a wide array of screen-based activities including: streaming videos, searching the internet, playing video games and updating social media sites (Pew-Research-Center, 2014). These screen-based activities have traditionally been considered sedentary activities (AC King, Goldberg, & Salmon, 2010; Rosenberg et al., 2010). However, because modern smartphones are portable and provide the user access to physical activity monitoring software, software applications (i.e., “apps”) designed to promote physical activity, and because these devices can be used effectively as part of interventions to prompt participants to increase physical activity, smartphone use does not have to be a sedentary activity (Consolvo, Klasnja, et al., 2008; Consolvo, McDonald, et al., 2008; Fjeldsoe, Miller, & Marshall, 2010; Hurling et al., 2007; A King et al., 2013; Kwapisz, Weiss, & Moore, 2011; Lyons, Lewis, Mayrsohn, & Rowland, 2014; Toscos, Faber, Connelly, & Upoma, 2008).

Excessive sedentary (i.e., sitting) behavior and physical inactivity are of concern as both are independently associated with an increased risk of a multitude of health problems including the metabolic syndrome, cardiovascular disease, and type 2 diabetes (Ford et al., 2005; Lee et al., 2012; Owen et al., 2010). Currently an estimated 3.2 million people around the world may die each year due to the negative health effects related to excessive sedentary behavior (Pratt et al., 2014). Conversely, physical activity
includes many positive health benefits including improved functional and cognitive health, reduced risk of falls, decreased risk of premature mortality, and prevention of diseases such as cardiovascular disease/coronary artery disease, hypertension, stroke, osteoporosis, type 2 diabetes mellitus, metabolic syndrome, obesity, colon cancer, breast cancer, and depression (Garber et al., 2011; Physical-Activity-Guidelines-Committee, 2008; Vogel et al., 2009). Despite this widely available information, there remains a high degree of prevalence of inadequate physical activity (American-College-Health-Association, 2012; Centers-for-Disease-Control-Prevention, 2013; Garber et al., 2011; Haskell et al., 2007; Troiano et al., 2008) and excessive sedentary behavior in American adults.

Because many adults are overly sedentary and participate in inadequate amounts of physical activity, an understanding of what contributes to sedentary behavior and physical activity may provide targets for interventions designed for disease prevention and control. Much of adults’ sedentary time has been contributed to electronic screen use, such as watching television or videos or using a computer (Ford et al., 2005; Mansoubi, Pearson, Biddle, & Clemes, 2014). The modern smartphone provides the users with access to these historically sedentary behaviors, in virtually any setting and at any time. While certain smartphone functions (e.g., activity monitors, fitness “apps”) have the potential to promote physical activity, there is evidence in college-aged individuals that total cell phone use is positively associated with sedentary behavior, negatively related to cardiorespiratory fitness, and may reduce intensity if used during exercise or free-living walking for active transport (Barkley & Lepp, 2016a, 2016b;
Evidence from the prior studies indicated that 18-29 year old American undergraduate college students exhibited positive relationships between cell phone use and sedentary behavior and among these college students, high cell phone users engaged in significantly more (78-145 more minutes per day) sedentary behavior per day than low and moderate use peers (Barkley & Lepp, 2016b; Barkley et al., 2015; Lepp et al., 2013). These findings support the notion of the modern smartphone as a sedentary device in college-aged adults. However, while these previous studies report that cell phone use was related to sedentary behavior and may interfere with exercise, resulting in reduced intensity, there is no evidence of a link between cell phone use and total physical activity behavior. Furthermore, these assessments are limited to only college students.

While these previous reports outline the potential of the modern smartphone as a sedentary device in college students, there is evidence of an inverse relationship between cell phone use and age (Barkley & Lepp, 2016b; Pew-Research-Center, 2014). Considering this, it is then possible that examining older adults (i.e., >30 years old) may yield different outcomes than these previous findings. Additionally, these previous studies are limited to using subjective measures to assess physical activity which may be inferior to objective measures to assess physical activity behavior (Centers-for-Disease-Control-Prevention, 2013; Leenders et al., 2000; Shephard, 2003; Tucker et al., 2011). Therefore, the purpose of this investigation was to assess the relationship between cell phone use, physical activity, and sedentary behavior using validated objective physical activity monitors (i.e., accelerometers) and subjective measurements in adults between
the ages of 30-65 years old. Since previous research with college-aged individuals found cell phone use to be positively associated with sedentary behavior and not related to physical activity, our hypothesis was there would be a similar positive relationship between cell phone use and sedentary behavior, but not physical activity.

Methods

Participants

A sample of 69 employees (51 ± 8 years old, n = 54 women) at a large, public university in the Midwestern United States were recruited to participate in the current investigation via advertisement through e-mail and a website. Prior to data collection, all participants were familiarized with the protocol, including instruction on the benefits and risks of the study, and provided written consent. Medical history forms were completed prior to participation. Participants were excluded if they reported a history of medical disorders for issues such as orthopedic injuries, cardiovascular disorder, etc. that would preclude them for participating in regular physical activity.

Procedures

The participants reported to the exercise physiology laboratory on two separate occasions, separated by one week. During the first visit, participants were given a validated accelerometer (Movband, Movable, Cleveland, OH) to wear around the wrist of their dominant hand as much as possible (a minimum of ≥ 10 hours per day) during waking hours for a one week period (Barkley et al., 2014). Participants were given an activity monitor report to complete each night which assesses when the Movband accelerometer was worn that day. Participants’ data were excluded if they did not wear
the accelerometer for a minimum of ≥ 10 hours per day. Each participant completed a questionnaire assessing age and sex. The subjects also self-reported physical activity and sedentary behavior using the International Physical Activity Questionnaire (IPAQ) (M. L. Booth et al., 2003). Finally, self-reported cell phone use was assessed via a validated survey (Lepp et al., 2014, 2015; Lepp et al., 2013). Participants were given instructions to complete the IPAQ and cell phone use survey for the upcoming week in which they wore the Movband accelerometer. After one week, participants returned to the laboratory to return the questionnaire. The University Institutional Review Board approved all procedures.

**Measurements**

**Objective physical activity measurement.** Physical activity behavior was measured objectively via the Movband (Movable, Cleveland, OH) accelerometer, which has been validated against the Actigraph (Actigraph Corporation, Pensacola, FL) accelerometer and indirect calorimetry (Barkley et al., 2014). The Movband is a three-plane accelerometer that measures acceleration to quantify an accurate estimate of physical activity. Physical activity is recorded as “moves” and a built-in algorithm is used to convert the movement data from “moves” to steps and miles, and these data are downloadable with free software provided by the manufacturer [http://www.movable.com/](http://www.movable.com/). All participants were instructed to wear the Movband a minimum of ≥ 10 hours per day for seven days during waking hours. Participants were asked to complete a daily self-reported questionnaire which assesses how often they wore the Movband. This was done to quantify the amount of minutes the participant wore the
Movband. That information was then used to calculate “moves” per minute (“moves” per minute = total “moves” ÷ time worn).

**Self-reported physical activity and sedentary behavior measurement.** The IPAQ instrument is a validated self-reported measure of physical activity and sedentary behavior. The IPAQ has been validated in studies carried out by a number of countries (Craig et al., 2003). Physical activity is assessed as behaviors performed for at least 10 minutes and time spent performing three intensities of activity: walking (low intensity), moderate, and vigorous. Sitting time was also expressed in two forms: weekday and weekend day. The measures of physical activity are summed to estimate the total amount of time spent doing physical activity per week. Total daily physical activity was calculated into Metabolic Equivalent of Task-minutes per day (MET minutes per day). The Metabolic Equivalent of Task was estimated using the product of reported time in three intensities by a Metabolic Equivalent of Task value specific to each intensity of physical activity. Then, it was expressed as a daily average Metabolic Equivalent of Task score (MET minutes per day) according to the IPAQ scoring protocol. Vigorous-intensity physical activity receives 8 Metabolic Equivalent of Tasks, moderate-intensity activity to 4 Metabolic Equivalent of Tasks, and walking to 3.3 Metabolic Equivalent of Tasks. Users are given a “Categorical score” (1-3 scale) and a “Continuous score” (Metabolic Equivalent of Task for the week). The measures used for analysis in this study included the Categorical score (IPAQ Categorical), Continuous score (IPAQ METS-min per week), vigorous (IPAQ Vigorous), moderate (IPAQ Moderate), and walking (IPAQ walking).
Cell phone use. The total daily cell phone was assessed as follows: “As accurately as possible, please estimate the total amount of time you spend using your mobile phone each day. Please consider all uses except listening to music. For example, consider calling, texting, Facebook, e-mail, sending photos, gaming, surfing the Internet, watching videos, and all other uses driven by ‘apps’ and software” (Lepp et al., 2014, 2015; Lepp et al., 2013). Participants were then asked to fill in a blank line for hours and minutes of cell phone use per day. An equation to total the minutes used per day was used accordingly: Total Minutes per Day = Hours * 60 + Minutes.

Analytic Plan

Statistical Packages for Social Sciences version 21.0 was used to analyze the data. Significance was set a priori at $p \leq 0.05$. Pearson’s correlation analyses were performed to assess the relationship between cell phone use and the following variables: sex, age, IPAQ Metabolic Equivalent of Task Score, IPAQ Categorical score, IPAQ Walking, IPAQ Moderate activity, IPAQ Vigorous activity, IPAQ sedentary behavior, and miles per minute and steps per minute accelerometer counts as measured via the Movband. To further assess the differences between cell phone use and sedentary behavior, subsequent analyses consisted of splitting the participants into three even tertiles based on total cell phone use: low use (<33rd percentile, $n = 21$), moderate use (33rd to 66th percentile, $n = 29$), and high use (>66th percentile, $n = 19$). This analysis is the same as previous methods used by Barkley et al., (2015) that assessed the relationship between sedentary behavior and cell phone use in college-aged individuals. These tertiles allowed us to quantify the amount of sedentary behavior in which a high cell phone user participates.
compared with lower cell phone users. A multivariate analysis of covariance (MANCOVA) was conducted to determine if there were differences, across the three cell phone use groups (low, moderate, high), in miles per minute, steps per minute, METS, and sedentary behavior assessed via IPAQ. Sex and age were included as covariates because age was significantly related to cell phone use in the current analysis and prior research has shown both factors to be correlates of cell phone use and physical activity (Caspersen et al., 2000; Sánchez-Martínez & Otero, 2009; Zickuhr, 2011). Additionally, to further examine the differences of age on cell phone use, physical activity, and sedentary behavior, a tertile split was conducted based on age: younger age (<33rd percentile, n = 26), middle age (33rd to 66th percentile, n = 24), and older age (>66th percentile, n = 19). A MANCOVA was conducted to determine if there were differences across the three age groups (younger, middle, older) in cell phone use, miles per minute, steps per minute, METS, and sedentary behavior. Sex was included as a covariate.

**Results**

**Physical Characteristics and Descriptive Statistics**

Descriptive statistics are provided in Table 9. Mean cell phone use was 125.2 ± 146.8 minutes per day. Cell phone use was inversely (r = - 0.3, p = 0.005) associated with age. In other words, younger participants reported greater total cell phone usage. Cell phone use was not different (r = - 0.1, p = 0.5) between males and females.
Table 9

Participants descriptive statistics (data are mean ± SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>N = 69 (15 male, 54 female)</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>51 ± 8</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>166.5 ± 8.8</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>83.4 ± 23.3</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.0 ± 7.7</td>
</tr>
<tr>
<td>Steps per minute (steps)</td>
<td>11.5 ± 4.2</td>
</tr>
<tr>
<td>Miles per minute (miles)</td>
<td>0.00618 ± 0.00263</td>
</tr>
<tr>
<td>IPAQ MET-min per week (METS)</td>
<td>1501.9 ± 2048.7</td>
</tr>
<tr>
<td>IPAQ Categorical Score (units)</td>
<td>1.6 ± 0.7</td>
</tr>
<tr>
<td>IPAQ Walking (min)</td>
<td>178.8</td>
</tr>
<tr>
<td>IPAQ Moderate (min)</td>
<td>89.6</td>
</tr>
<tr>
<td>IPAQ Vigorous (min)</td>
<td>78.8</td>
</tr>
<tr>
<td>Sitting minutes per day (min)</td>
<td>431 ± 181</td>
</tr>
<tr>
<td>Total Cell Phone use minutes per day (min)</td>
<td>125.2 ± 146.8</td>
</tr>
</tbody>
</table>

Cell Phone Use and Physical Activity

There were no relationships between cell phone use and physical activity, including IPAQ Categorical score (r = 0.06, p = 0.6), IPAQ Metabolic Equivalent of Task (r = 0.1, p = 0.3), IPAQ Vigorous (r = 0.06, p = 0.6), IPAQ Moderate (r = -0.07, p = 0.6), IPAQ Walking (r = 0.1, p = 0.4), steps per minute (r = 0.06, p = 0.6), or miles per minute
(r = 0.1, p = 0.3). Additionally, total cell phone use was not significantly related to sedentary behavior (r = - 0.11, p = 0.4), (Table 9).

**Tertile Split by Cell Phone Use**

The even tertile split assessing differences in physical activity and sedentary behavior among low, moderate, and high cell phone users (Table 10) (n = 21 low users, n = 29 moderate users, n = 19 high users) illustrates there were no significant differences (F ≤ 1.0 p ≥ 0.4 for both) for the subjective physical activity (Figure 3) or sedentary behavior (Figure 4) variables across the three cell phone use groups (low, moderate, high cell phone users). There were significant differences (F = 5.3, p = 0.007) for the steps per minute such that there were significantly greater (t = 2.5, p = 0.015) steps per minute in the low users (12.5 ± 4.8) than the moderate users (9.7 ± 3.1) and the significantly greater (t = 3.3, p = 0.002) steps per minute in the high users (13.2 ± 4.3) than the moderate users but no differences (t = 0.5, p = 0.6) of steps per minute between the low and high users, (Figure 5).

**Tertile Split by Age**

The even tertile split assessing differences in physical activity and sedentary behavior among three age groups (Table 11) (n = 26 younger group, n = 24 middle group, n = 19 older group) revealed there were no significant differences for physical activity (F ≤ 1.1, p ≥ 0.4 for all) or sedentary behavior (F = 1.0, p = 0.6). Additionally, there was not a significant difference (F = 2.8, p = 0.07) for the three age groups’ cell phone use, although this was trending significance.
Table 10

*Cell phone use tertiles (data are mean ± SD)*

<table>
<thead>
<tr>
<th>Cell Phone Use (min per day)</th>
<th>Low Cell Phone Use (&lt;33%)</th>
<th>Moderate Cell Phone Use (33-66%)</th>
<th>High Cell Phone Use (&gt;66%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n = 21$, $23.1 \pm 16.9$</td>
<td>$n = 29$, $89.0 \pm 27.8$</td>
<td>$n = 19$, $295.3 \pm 190.3$</td>
</tr>
</tbody>
</table>

Table 11

*Age tertiles for cell phone use (data are mean ± SD)*

<table>
<thead>
<tr>
<th>Cell Phone Use (min per day)</th>
<th>Low Age (&lt;49 years old)</th>
<th>Middle Age (49-56 years old)</th>
<th>Older Age (&gt;56 years old)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$170.0 \pm 29.7$</td>
<td>$123.5 \pm 31.7$</td>
<td>$60.3 \pm 36.0$</td>
</tr>
</tbody>
</table>

*Figure 4.* Subjective physical activity in low, moderate, and high cell phone users (mean ± SEM).
Figure 5. Sedentary behavior in low, moderate, and high cell phone users (mean ± SEM).

Figure 6. Steps per minute of low, moderate, and high cell phone users (mean ± SEM).

*Significant difference from moderate users $p \leq 0.05$.

Discussion

The present investigation measured the relationship between cell phone use, age, physical activity, and sedentary behavior in adults (51 ± 8 years old) greater than college age. There was an inverse relationship between cell phone use and age. There was also a trend towards a main effect of group for the tertile split, separated by the age groups.
(younger, middle, older), for differences in cell phone use with younger participants using their device for 47 and 110 more minutes per day than middle- and older-age participants, respectively. The means revealed greater cell phone use as age groups increased. No relationships existed between the measures of cell phone use and physical activity or sedentary behavior. The results of the tertiles, separated by the amount of time participants allocate to using their cell phone (low use, moderate use, and high use), revealed no differences in measures of subjective physical activity or sedentary behavior between the groups, which further indicates cell phone use and sedentary behavior and physical activity were unrelated in the present sample. However, there were significantly greater steps per minute in both low and high cell phone users relative to moderate cell phone users, but no difference between the high and low cell phone users. The rational for these results are unclear and thus further investigation is warranted. This is the first study we are aware of which examined the relationship between cell phone use and physical activity and sedentary behavior, in adults greater than college age (i.e. > 29 years old). This was also the first study we are aware of which examined the relationship between cell phone use and objectively-measured physical activity.

Presently cell phone use was not associated with physical activity in adults 30-65 years old. This is consistent with previous results in college-aged individuals (Barkley et al., 2015; Lepp et al., 2013). However, the lack of a relationship between cell use and sedentary behavior is different from previous research in college students. Previously, cell phone use in college-aged individuals (18-29 years old), was positively associated with sedentary behavior, and high cell phone users participated in significantly more
(495-584 minutes per day) sedentary behavior, compared to moderate (417-491 minutes per day) and low (395-439 minutes per day) users (Barkley & Lepp, 2016b; Barkley et al., 2015). The reason for these disparate findings of the present study and those previous may be differences in how college-age adults and adults beyond college age use their cell phone and select their sedentary activities.

There was an inverse relationship between age and cell phone use in the present study and this is consistent with previous research (Barkley & Lepp, 2016b; Pew-Research-Center, 2014). The presented means from the tertile split by age indicates the younger age group participated in 38% and 180% greater daily cell phone use than the middle and older age groups, respectively. Interestingly, when comparing previous data on college-aged individuals (18-29 years old) with the present sample of adults 30-63 years old, the average cell phone use is drastically different. College-aged individuals have reported using the cell phone for means ranging from 300 to 380 minutes per day (Barkley & Lepp, 2016b; Barkley et al., 2015; Lepp et al., 2013), which is much less than the mean use in the present sample of 125 minutes per day. The difference between the two age groups cell phone use and sedentary behavior may stem from the generation differences; the younger generation is growing up in a digital age which allows constant connection to digital activities (Anderson & Rainie, 2012), where cell phone use has become the hub of a digital lifestyle (Bajarin, 2013). These “digital natives” may function as being constantly connected to people and information through their mobile cellular devices (Palfrey & Gasser, 2013). Because of the traditionally sedentary nature of the functions these devices offer (A King et al., 2013), college-aged individuals may
be spending time with their cell phone while sedentary. Conversely, the above college-age population may be engaging in more traditional forms of sedentary behaviors, such as watching television or videos, reading, and using a desktop or laptop computer. A study showed United States adults spend 7-9 hours of their work day sedentary (Matthews et al., 2008) and the greatest sedentary time activity consisted of television viewing and screen time (Mansoubi et al., 2014). Hence, cell phone use may not be a large contributor to sedentary behavior in individuals above the college-age but it is possible that low cell phone users beyond college age could still be highly sedentary since they may prefer these traditional sedentary behaviors.

**Limitations and Future Directions**

Although this investigation provides novel information regarding the role of modern cell phones as a sedentary device in adults whom are older than college age it is not without limitations. Since this was a nonexperimental study, causal inference cannot be made. A second limitation is the context in which participants were using their cell phones was not captured (e.g. were participants using their cell phones while they were sitting). Additionally, the IPAQ sedentary assessment is a self-report, which limits the reliability of the sedentary behavior due to its subjective nature. Experimental research designs which capture the individual’s physical behavior during cell phone use (e.g. when the cell phone is used does one sit, stand, walk) utilizing objective measures of cell phone use and questions regarding the context of cell phone use would fulfill these two limitations and are suggested for future research. A final limitation includes that these data were collected from a small sample size of individuals from the ages of 30-63, at a
single, large, public university in the Midwestern United States. Additionally, only 21% of the participants were male, which limits the ability to generalize the results of this study. Hence, future research could measure different populations including: ethnic groups, different types of jobs, different regions, and a greater proportion of males, which may have differing results than this report.

Conclusion

This was the first study we are aware of to assess the relationship between cell phone use and physical activity and sedentary behavior in adults greater than the college age. This was also the first examination of these relationships using both subjective and objective measures of physical activity in any age group. Cell phone use was inversely associated with age, as has been shown previously. However, cell phone use was not related to physical activity or sedentary behavior. This is different from a previously-demonstrated positive relationship between cell phone use and sedentary behavior in 18-29 year-old college students. Because younger individuals are “digital natives” who have been raised with near-constant access to cell phones this may be their sedentary activity of choice. Conversely, adults who are older may prefer other, more traditional forms of sedentary activities such as watching television and using a desktop computer.
CHAPTER VI

CONCLUSION AIM 1 AND 2

For this dissertation I set out to examine the effects of individuals participating in a faculty and staff exercise program versus those who are not in the program on health-related outcomes such as physical activity, sedentary behavior, and fitness-related variables. Additionally, to determine how psychometric factors which are associated with healthy behavior would change with changes in physical activity, sedentary behavior, and fitness-related variables. Secondly, we evaluated the relationship between cell phone use and physical activity and sedentary behavior in adults above the age of 30 who were participants of the first study. Overall, the results from these two studies indicate that a worksite exercise program or participating in fitness testing every eight weeks is beneficial in improving healthy behavior and fitness, but the exercise program may add further benefit. Additionally, cell phone use is not related with physical activity or sedentary behavior in adults 30 and older.

The aim of the first study was to measure if a worksite exercise program is beneficial for health behavior over 16-weeks and to compare program participants to a group of controls who complete fitness testing every eight weeks. Participants were given the opportunity to attend 60-minute exercise class three times per week which offered a variety of fitness classes from which they could choose. Both the Intervention and Control groups met recommended physical activity guidelines, increased cardiorespiratory fitness, and improved abdominal curl-ups repetitions. The Intervention group reduced sedentary behavior and increased push-ups. Belief in the abilities to make
time for exercise and exercise competence improved throughout the 16-weeks in both groups. Changes in intrinsic motivation and internal concern for personal health were correlates with physical activity and inversely associated with sedentary behavior. This suggests that both the worksite exercise program and regular fitness testing are beneficial for achieving healthy behavior, but the exercise program may elicit further benefits. Additionally, to improve healthy behavior, future interventions should focus on strategies which develop participant’s ability to make time to exercise, increase exercise skills, intrinsically motivate participants, and promote internal concern for health.

For aim 2, adults 30 years and older wore an activity monitor accelerometer around their wrist for one week and recorded the times the accelerometer was worn. After one week, participants completed a questionnaire assessing their cell phone use, sedentary behavior, and physical activity. As expected, results revealed cell phone use was inversely associated with age. There were no relationships between cell phone use and physical activity or sedentary behavior. In college-aged individuals (18-25 years old) high cell phone use is associated with sedentary behavior. It seems that above this age group, the cell phone is not a primary activity which contributes to sedentary behavior, suggesting that other activities may be involved with the sedentary behavior.

Overall, these two studies intended to examine strategies to improve physical activity and decrease sedentary behavior by involvement in an exercise program, and to determine if the cell phone adds to sedentary behavior. The results demonstrate the benefits of a worksite exercise program and regular fitness testing, and that cell phone use may not be an activity adults above the college-age participate in which largely
contributes to their sedentary time. Therefore, by conducting studies like these we
develop strategies for future interventions to improve health so that physical activity can
be increased and sedentary behavior can be reduced.
APPENDICES
APPENDIX A

SPECIFIC AIM #1: RECRUITMENT FLYER
Appendix A

Specific Aim #1: Controls Email Recruitment Flyer

Hello,

You are being invited to participate in a research study titled: University faculty and staff exercise intervention using objectively measured physical activity on personality, self-efficacy, motivation, and cell phone use.

While the benefits of exercise are abundantly clear, a large majority of adults are still sedentary. Therefore, it is important to understand successful methods of increasing physical activity. To accomplish this, research examining traits which are associated with participation in physical activity and improving health-related variables is needed.

The purpose of this study is to examine potential relationships of personality, self-efficacy for physical activity, motivation for physical activity, and electronic media use (cell phone), with changes in fitness, attendance to a work-site exercise program, and physical activity behavior over the course of a 16-week period.

We would like you to take part in this project, which is a 16 week period of wearing a physical activity tracker as a wrist watch (the Movband accelerometer) and completing a series of physical and perceptual testing over three time periods (week 0, week 8, and week 16).

Upon enrollment, you will be familiarized with the 16 week protocol, including instruction on the benefits and risks of the exercise program, and given the Institutional Review Board consent to read and sign. A health history questionnaire and physician’s consent will also be completed prior to participation to ensure you are healthy enough to exercise. Exclusion criteria include reporting a history of medical disorders and not receiving clearance from the physician beforehand for such issues as orthopedic injuries, and cardiovascular disorders.

The testing consist of height, weight, body composition (using a hand held caliper to measure your skin thickness at 7 locations on your body), resting blood pressure, resting heart rate, push-ups, partial curl-ups (sit-ups), 12-minute run/walk test to measure your aerobic capacity, and a series of questionnaires. The questionnaires consist of measurements which will assess personality, constructs of motivation and self-efficacy to participate in physical activity, cell phone use, and work productivity. Specifically, there will be 17 questionnaires which participants will complete.

There will be no follow-up requirement. Total time of participation for the control group will be five hours (pre-, mid-, post-testing).
You will receive a $5 gift card to a local store each time a testing day is completed (three testing days for $15 total). You may gain slight benefits in health and fitness from participating in three physical fitness testing days throughout the 16 week period. This may only be a slight benefit and so this research may not benefit you directly. However, your participation in this study will help us to better understand the differences in why some individuals choose to participate in physical activity and exercise while others do not. Additionally, this will help us to better understand the potential influence of cell phone use on physical activity.

If you are interested in participating in this study, please respond to this e-mail. We thank you for your consideration and your time.
APPENDIX B

SPECIFIC AIM #1: INFORMED CONSENT FORM
Appendix B

Specific Aim #1: Informed Consent Form

Informed Consent to Participate in a Research Study

Title: University faculty and staff exercise intervention using objectively measured physical activity on personality, self-efficacy, motivation, and cell phone use

Principal Investigator: Curtis Fennell, Jacob Barkley PhD, Ellen Glickman PhD, J. Derek Kingsley PhD, Andrew Lepp PhD

You are being invited to participate in a research study. This consent form will provide you with information on the research project, what you will need to do, and the associated risks and benefits of the research. Your participation is voluntary. Please read this form carefully. It is important that you ask questions and fully understand the research in order to make an informed decision. You will receive a copy of this document to take with you.

Purpose:
While the benefits of exercise are abundantly clear, a large majority of adults are still sedentary. Therefore, it is important to understand successful methods of increasing physical activity. To accomplish this, research examining traits which are associated with participation in physical activity is needed. The purpose of the present study is to examine potential relationships of personality, self-efficacy for physical activity, motivation for physical activity, and cell phone use with changes in fitness and physical activity behavior over the course of a 16-week period.

Procedures:
We would like you to take part in this project, which is a 16 week period of wearing an activity monitor on your wrist (Movband accelerometer) and completing a series of physical and perceptual testing over three time periods. Before participating, you will complete a Physician’s Consent Form and Health History Questionnaire to ensure that you are healthy enough to participate in physical activity and exercise. You will be excluded if you report a history of medical disorders or did not receive clearance from your physician beforehand for such issues as orthopedic injuries and cardiovascular disorders.
You will be asked to wear a Movband accelerometer as much as possible for 16 weeks. This is a movement tracking device which is wearable as a wrist watch. It is requested that once per week you charge the Movband and complete a questionnaire assessing how much you wore the Movband. The research team will be monitoring your physical activity over the 16 week period.

You will be asked to complete a series of questionnaires and fitness testing at week 0 (baseline), week 8 (mid-point), and week 16 (final). The questionnaires consist of 17 instruments which will assess personality, locus of control (belief in your ability to control your life), satisfaction with life, depression, anxiety, and stress, social interactions, self-efficacy for physical activity, motivation for physical activity, electronic media use (cell phone), social interactions, and work productivity. You will be asked to complete a series of resting and physically active fitness tests. These tests will be conducted and monitored by the research team who is trained and CPR and First Aid certified.

The fitness testing consists of resting and physical tests which are explained below:
- **Height:** Your height will be measured on a scale.
- **Weight:** Your weight will be measured on a scale.
- **Body composition:** Using a hand caliper, 7 areas of your skin will be measured to estimate body fat percent.
- **Resting blood pressure:** An automated blood pressure will be placed around your brachial artery for about 35 seconds to measure the pressure of your blood against the brachial artery.
- **Resting heart rate:** A heart rate monitor will be placed just below your chest and a watch associated with the heart rate monitor will measure your resting heart rate.
- **Push-ups:** You will be asked to complete as many push-ups as possible.
- **Curl-ups:** You will be asked to complete as many curl-ups as possible in 60 seconds.
- **12-minute run/walk test:** You will be asked to run and/or walk around a gymnasium and try to cover as far of distance as you can in 12 minutes.
- **Flexibility test:** You will be asked to sit on the floor with your feet resting on a box. You will then be asked to place one hand over the other and reach as far as you can.

If you are participating in the Fit for Life workshop, your attendance to the class sessions will be recorded.

There will be no follow-up requirement. Total time of participation will be about 12.5 hours. This includes the questionnaire and fitness testing (1.5 hours at three time points, totaling to 4.5 hours) and charging the Movband as well as completing the questionnaire assessing how much you wore the Movband (30 minutes per week for 16 weeks, totaling to 8 hours). The approximate number of subjects in this study will be 80.
Audio and Video Recording and Photography
There will be no audio and video recording or photography.

Benefits
Your participation in this research study may not benefit you directly. However, your participation in this study will help us to better understand the differences in why some individuals choose to participate in physical activity and exercise while others do not. Additionally, this will help us to better understand the potential influence of cell phone use on physical activity.

Risks and Discomforts
The fitness tests include portions of participating in physical activity. With physical activity, there are minimal expected risks and harms. These risks may include fatigue, shortness of breath, muscle soreness or dizziness. Possible adverse events consists of orthopedic injuries, cardiovascular strain and incident of a cardiovascular event, exercise induced asthma, and fatigue. The likelihood of these occurrences is very minimal. Additionally, the individuals in the intervention group will be participating in the Fit for Life workshop. This study is asking the individuals who have elected into the Fit for Life workshop to participate in data collection. So the physical activity subject’s participation in the Fit for Life workshop is pseudo-independent of this study. 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.
Some of the questions that you will be asked are of a personal nature and may cause you embarrassment or stress. You may ask to see the questions before deciding whether or not to participate in the study. If you do not wish to answer a question, you may skip it and go on to the next question.

Privacy and Confidentiality
Your study related information will be kept confidential within the limits of the law. Any identifying information will be kept in a locked file cabinet and only the researchers will have access to the data. Research participants will not be identified in any publication or presentation of research results; only aggregate data will be used. This data will include both measures of physical health and cognitive health. All forms and questionnaires with participant information will be kept in a secure file cabinet that will be locked to which the primary investigators will have access. The data from the Movband will be uploaded to the Movable website and is kept confidential as only the researchers will have access.
No data from participants from other studies will be included in the locked cabinets. Your data will not be shared with anyone but the researchers. There will be coding of participant’s folders so that their name is not on the folder in which is their data. If you agree to participate in this research project, health information that may identify you will be collected. We will only collect information that is needed for the research and described in this consent form. By signing this consent form, you are authorizing the study investigators to access your medical record and health information as described in the consent document.

**Compensation**
The compensation will include receiving a free Movband accelerometer. Additionally, you will receive a $5.00 gift card to a local gas station for each of the three testing days you attend ($15.00 total).

**Voluntary Participation**
Taking part in this research study is entirely up to you. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information that may affect your health, welfare, or willingness to continue your study participation.

**Contact Information**
If you have any questions or concerns about this research, you may contact Curtis Fennell at cfennel1@kent.edu, Ellen Glickman at 330-672-2930 or eglickma@kent.edu, or Jacob Barkley at 330-672-2857 or jbarkle1@kent.edu. This project has been approved by the Kent State University Institutional Review Board. If you have any questions about your rights as a research participant or complaints about the research, you may call the IRB at 330.672.2704.

**Consent Statement and Signature**
I have read this consent form and have had the opportunity to have my questions answered to my satisfaction. I voluntarily agree to participate in this study. I understand that a copy of this consent will be provided to me for future reference.

________________________________
Participant Signature

________________________________
Date
APPENDIX C

SPECIFIC AIM #1: HEALTH HISTORY QUESTIONNAIRE
Appendix C

Specific Aim #1: Health History Questionnaire

KENT STATE UNIVERSITY
APPLIED PHYSIOLOGY RESEARCH LAB

HEALTH HISTORY

Thank you for volunteering to be a participant for a study to be conducted in the Applied Physiology Research Laboratory. You may be asked to perform a test that requires you to exercise at or near your maximum capability. 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 the tests dangerous for you. Please complete the health history as accurately as you can. This medical history is confidential and will only be seen by researchers to determine your qualifications for this study.

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
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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__________________
REASON FOR TAKING THIS

MEDICATION__________________
REASON FOR TAKING THIS

MEDICATION__________________
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
PROBLEMS AND SYMPTOMS, continued

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

Explain any items checked (when, severity, treatment)
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

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 research study? YES NO

Do you currently smoke cigarettes? YES NO

Do you currently use any smokeless tobacco products? YES NO
APPENDIX D

SPECIFIC AIM #1: PHYSICIAN CLEARANCE FORM
Appendix D

Specific Aim #1: Physician Clearance Form

PHYSICIAN’S CLEARANCE FOR EXERCISE PARTICIPATION
Kent State University- Dept. of Exercise Physiology

Patient’s name:
Address:
Telephone number:

Dear Doctor,

Your patient, ____________, has expressed an interest in participating in a study requiring fitness testing (KSU IRB approval #15-645). The object of this project is to compare physical activity, fitness, psychometric variables, and cell phone use in a group of individuals participating in a worksite exercise program and a group of inactive individuals who are not participating in the worksite exercise program.

On three separate occasions over 16 weeks (week 0, week 8, week 16), this patient will be completing a series of fitness tests. These tests include height, weight, resting heart rate, resting blood pressure, 7-site skinfold testing, hip and waist circumference measurements, 12-minute run/walk test, push-ups to failure, 60-second sit-ups, sit-and-reach flexibility test. This individual needs to be healthy enough to be able to participate in these fitness tests.

Exclusion Criteria:
- Age below 30 or above 65
- Orthopedic injury (ACL or MCL tear, rotator cuff tear, broken bone).
- Cardiovascular disease (heart attack, heart surgery, angioplasty, pacemaker, rhythm disturbance, heart valve disease, heart failure, heart transplantation and congenital heart disease), stroke, and any surgical procedures.

Below is a clearance form to be filled out and signed by you and returned via fax: 330-672-2250 or e-mail: cfennell1@kent.edu.

Physician’s recommendation (check the appropriate line)

a._________ There is no contraindication for participation in this exercise research project.
b._________ Participation in this exercise research program is inadvisable.

Physician’s name: _____________________________________________
Signature: _____________________________________________________
Date: _________________________________________________________

Address: _____________________________________________________
Telephone: ____________________________________________________
Fax: __________________________________________________________

Please return completed form to:
Curtis Fennell, M.S., Graduate Assistant
E-mail: cfennell1@kent.edu
Fax: 330-672-2250
Phone: 586-255-0432
APPENDIX E

SPECIFIC AIM #1: MOVBAND ACCELEROMETER
Appendix E

Specific Aim #1: Movband Accelerometer
APPENDIX F

SPECIFIC AIM #1: ACTIVITY MONITOR REPORT FORM
Appendix F

Specific Aim #1: Activity Monitor Report

Name: ______________________

Activity monitor report
Wear the monitor as much as you can throughout the week. Only take it off when you go to bed at night. **Do not record when you are sleeping.** Do not get it wet.

1. Please circle/highlight the days below that you wore the activity monitor.
2. Fill in the date.
3. List the times that you had the monitor on in the space provided.
4. Indicate if and when you removed the monitor.
5. Specify why the monitor was removed.

See the example below:

**Monday**  **Date:** 1/25/16

**Times worn:** 9am-2pm (took it off to take a shower), 3pm – 10pm (went to bed at 10pm)

**Monday**  **Date:** 1-25-16________

**Times worn:**

**Tuesday**  **Date:** ________

**Times worn:**

**Wednesday**  **Date:** ________

**Times worn:**

**Thursday**  **Date:** ________

**Times worn:**

**Friday**  **Date:** ________

**Times worn:**

**Saturday**  **Date:** ________

**Times worn:**

**Sunday**  **Date:** ________

**Times worn:**
APPENDIX G

SPECIFIC AIM #1: FITNESS TESTING FORM
# Appendix G

Specific Aim #1: Fitness Testing Form

Date (Base): _____ Date (Mid): _____ Date (Post): _____
Age: _____ Age: _____ Age: _____

<table>
<thead>
<tr>
<th>Cardiovascular Parameters:</th>
<th>Baseline</th>
<th>Mid-point</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resting Heart Rate (bpm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resting Blood Pressure (mmHg)</td>
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<table>
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<th>Body Composition:</th>
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<th>Chest</th>
<th>Triceps</th>
<th>Midaxillary</th>
<th>Supriliac</th>
<th>Abdominal</th>
<th>Thigh</th>
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</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Weight (lbs)</td>
<td></td>
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<tr>
<td>BMI</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Waist (cm)</td>
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<td></td>
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<table>
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<tr>
<th>7-Site Skinfolds</th>
<th>Baseline</th>
<th>Mid-point</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscapula</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triceps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midaxillary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supriliac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thigh</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>Baseline</th>
<th>Mid-point</th>
<th>Post</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Body Fat %</th>
<th>Baseline</th>
<th>Mid-point</th>
<th>Post</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cardiorespiratory Endurance:</th>
<th>(half)</th>
<th>(full)</th>
<th>(half)</th>
<th>(full)</th>
<th>(half)</th>
<th>(full)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper 12 Minute Test (laps.cones)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Calculated Distance (m)</th>
<th>Baseline</th>
<th>Mid-point</th>
<th>Post</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Muscular Endurance:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Push-Up (maximum number)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Minute Curl-Up (amount in 1 minute)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flexibility:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit-and-Reach (cm - Scale E)</td>
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</tr>
</tbody>
</table>
APPENDIX H

SPECIFIC AIM #1: DEMOGRAPHIC INFORMATION FORM
Appendix H

Specific Aim #1: Demographic Information Form

Part I: Demographics and General Questions

The following contains items pertaining to your demographic and background information. For each item, please respond with the appropriate information.

1. What is your sex (circle appropriate response)?
   o Male
   o Female

2. How old are you? _____

3. Are you Hispanic or Latino?
   o Yes
   o No

4. What is your race?
   o American Indian or Alaska Native
   o Asian
   o Black or African American
   o Native Hawaiian or Other Pacific Islander
   o White

5. What is your current occupation title?
   __________________________________________________________

6. What is your job status (Check one)?
   o Full-time
   o Part-time

7. How many hours of paid employment do you work each week? __________

8. What is your relationship status? (Check one)
   o Single
   o In a relationship
   o Engaged
   o Married

9. Do you have any children? ____ If yes, how many? ____
10. What is the highest degree or level of school you have completed?
   o No schooling
   o Nursery school to 8th grade
   o 9th, 10th or 11th grade
   o 12th grade, no diploma
   o High school graduate - high school diploma or the equivalent (for example: GED)
   o Some college credit, but less than 1 year
   o One or more years of college, no degree
   o Associate degree (for example: AA, AS)
   o Bachelor's degree (for example: BA, AB, BS)
   o Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)
   o Professional degree (for example: MD, DDS, DVM, LLB, JD)
   o Doctorate degree (for example: PhD, EdD)
APPENDIX I

SPECIFIC AIM #1: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE
Appendix I

Specific Aim #1: International Physical Activity Questionnaire

Part IV: Physical Activity Questionnaire (IPAQ)
We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

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

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?
   _____ days per week
   □ No vigorous physical activities ➔ Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?
   _____ hours per day
   _____ minutes per day
   □ Don’t know/Not sure

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

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
   _____ days per week
   □ No moderate physical activities ➔ Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?
   _____ hours per day
   _____ minutes per day
   □ Don’t know/Not sure
Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

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

   □ No walking  ➔ Skip to question 7

6. How much time did you usually spend walking on one of those days?
   ___________ hours per day
   ___________ minutes per day

   □ Don’t know/Not sure

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

7. During the last 7 days, how much time did you spend sitting on a week day?
   ___________ hours per day
   ___________ minutes per day

   □ Don’t know/Not sure

8. During the last 7 days, how much time did you spend sitting on a weekend day?
   ___________ hours per day
   ___________ minutes per day

   □ Don’t know/Not sure
APPENDIX J

SPECIFIC AIM #1: INTERNATIONAL PERSONALITY ITEM POOL FORM
Appendix J

Specific Aim #1: International Personality Item Pool Form

Questionnaire

Participant Number: ______________

Below are phrases describing people’s behaviors. Please use the rating scale to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then write in the number that corresponds to the number on the scale.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Inaccurate</td>
<td>Moderately inaccurate</td>
<td>Neither Inaccurate or nor accurate</td>
<td>Moderately Accurate</td>
<td>Very Accurate</td>
</tr>
</tbody>
</table>

1. __ Am the life of the party.
2. __ Like order.
3. __ Make a mess of things.
4. __ Often feel blue.
5. __ Feel comfortable around people.
6. __ Keep in the background.
7. __ Am full of ideas.
8. __ Seldom feel blue.
9. __ Have difficulty understanding abstract ideas.
10. __ Don’t mind being the center of attention.
11. __ Have little to say.
12. __ Often forget to put things back in their proper place.
13. __ Am exacting in my work.
14. __ Feel others’ emotions.
15. __ Use difficult words.
16. __ Get chores done right away.
17. __ Pay attention to details.
18. __ Change my mood a lot.
19. __ Get irritated easily.
20. __ Don’t like to draw attention to myself.
21. __ Sympathize with others’ feelings.
22. __ Am quick to understand things.
23. __ Am not interested in abstract ideas.
24. __ Am always prepared.
25. __ Am not interested in other people’s problems.
26. __ Have a rich vocabulary.
27. __ Am quiet around strangers.
28. __ Worry about things.
29. __ Leave my belongings around.
30. __ Take time out for others.
31. __ Follow a schedule.
32. __ Feel little concern for others.
33. __ Get upset easily.
34. __ Do not have a good imagination.
35. __ Have a vivid imagination.
36. __ Don’t talk a lot.
37. __ Make people feel at ease.
38. __ Talk to a lot of different people at parties.
39. __ Shirk my duties.
40. __ Have frequent mood swings.
41. __ Am relaxed most of the time.
42. __ Am interested in people.
43. __ Have a soft heart.
44. __ Start conversations.
45. __ Am not really interested in others.
46. __ Get stressed out easily.
47. __ Insult people.
48. __ Spend time reflecting on things.
49. __ Am easily disturbed.
50. __ Have excellent ideas.
APPENDIX K

SPECIFIC AIM #1: SELF-EFFICACY AND EXERCISE HABITS SURVEY
## Appendix K

### Specific Aim #1: Self-Efficacy and Exercise Habits Survey

**Exercise Confidence Survey**

Below is a list of things people might do while trying to increase or continue regular exercise. We are interested in exercises like running, swimming, brisk walking, bicycle riding, or aerobic classes.

Whether you exercise or not, please rate how confident you are that you could really motivate yourself to do things like those consistently, for at least six months.

Please circle one number for each question. How sure are you that you can do these things?

<table>
<thead>
<tr>
<th>Question</th>
<th>I know I cannot</th>
<th>Maybe I can</th>
<th>I know I can</th>
<th>Do not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>21. Get up early, even on weekends, to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>22. Stick to your exercise program after a long, tiring day at work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>23. Exercise even though you are feeling depressed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>24. Set aside time for a physical activity program; that is, walking, jogging, swimming, biking, or other continuous activities for at least 30 minutes, 3 times per week.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>25. Continue to exercise with others even though they seem too fast or too slow for you.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>26. Stick to your exercise program when undergoing a stressful life change (e.g., divorce, death in the family, moving).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>27. Attend a party only after exercising.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>28. Stick to your exercise program when your family is demanding more time from you.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>29. Stick to your exercise program when you have household chores to attend to.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>30. Stick to your exercise program even when you have excessive demands at work.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>31. Stick to your exercise program when social obligations are very time consuming.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>32. Stay or study late in order to exercise more.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
APPENDIX L

SPECIFIC AIM #1: BEHAVIORAL REGULATIONS IN EXERCISE

QUESTIONNAIRE-3
### Appendix L

Specific Aim #1: Behavioral Regulations in Exercise Questionnaire-3

**EXERCISE REGULATIONS QUESTIONNAIRE (BREQ-3)**

**Age:** _______ years  
**Sex:** male  
female (please circle)

**WHY DO YOU ENGAGE IN EXERCISE?**

We are interested in the reasons underlying peoples’ decisions to engage or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

<table>
<thead>
<tr>
<th></th>
<th>Not true for me</th>
<th>Sometimes true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It’s important to me to exercise regularly</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>I don’t see why I should have to exercise</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>I exercise because it’s fun</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>I feel guilty when I don’t exercise</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>I exercise because it is consistent with my life goals</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>I exercise because other people say I should</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>I value the benefits of exercise</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>I can’t see why I should bother exercising</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>I enjoy my exercise sessions</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>I feel ashamed when I miss an exercise session</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>I consider exercise part of my identity</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>I take part in exercise because my friends/family/partner say I should</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>I think it is important to make the effort to exercise regularly</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>I don’t see the point in exercising</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Statement</td>
<td>Score</td>
<td></td>
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<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I find exercise a pleasurable activity</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>I feel like a failure when I haven’t exercised in a while</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>I consider exercise a fundamental part of who I am</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>I exercise because others will not be pleased with me if I don’t</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I get restless if I don’t exercise regularly</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>I think exercising is a waste of time</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I get pleasure and satisfaction from participating in exercise</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>I would feel bad about myself if I was not making time to exercise</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I consider exercise consistent with my values</td>
<td>0-4</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>I feel under pressure from my friends/family to exercise</td>
<td>0-4</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX M

SPECIFIC AIM #1: GOAL CONTENT FOR EXERCISE QUESTIONNAIRE
Appendix M

Specific Aim #1: Goal Content for Exercise Questionnaire

The Goal Content for Exercise Questionnaire
(GCEQ: Sebire et al., 2008)

People have a number of different goals that they endorse when engaging in physical activity. We would like to know a little more about YOUR physical activity goals. Please indicate on the scale provided how important each goal is for you with reference to physical activity.

<table>
<thead>
<tr>
<th>Goal</th>
<th>Not at all important</th>
<th>Moderately important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>…to connect with others in a meaningful manner</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to improve the look of my overall body shape</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to increase my resistance to illness and disease</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to be well thought of by others</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to acquire new physical activity skills</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to share my physical experiences with people that care for me</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to improve my appearance</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to increase my energy level</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to gain favorable approval from others</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to learn and exercise new techniques</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to develop close friendships</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to be slim so to look attractive to others</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to improve my overall health</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to be socially respected by others</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to become skilled at a certain physical activity</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to form close bonds with others</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…to change my appearance by altering a specific area of my body</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
…to improve my endurance, stamina
...so that others recognize me as a physically active person
...to develop my physical activity skills
APPENDIX N

SPECIFIC AIM #1: PSYCHOLOGICAL NEED SATISFACTION IN EXERCISE QUESTIONNAIRE
Appendix N

Specific Aim #1: Psychological Need Satisfaction in Exercise Questionnaire

1 - strongly disagree to 6 - strongly agree

Perceived Competence

- I feel that I am able to complete exercises that are personally challenging
- I feel confident I can do even the most challenging exercises
- I feel confident in my ability to perform exercises that personally challenge me
- I feel capable to completing exercises that are challenging to me
- I feel like I am capable of doing even the most challenging exercises
- I feel good about the way I am able to complete challenging exercises

Perceived Autonomy

- I feel free to exercise in my own way
- I feel free to make my own exercise program decisions
- I feel like I am in charge of my exercise program decisions
- I feel like I have a say in choosing the exercises that I do
- I feel free to choose which exercises I participate in
- I feel like I am the one who decides what exercises I do

Perceived Relatedness

- I feel attached to my exercise companions because they accept me for who I am
- I feel like I share a common bond with people who are important to me when we exercise together
- I feel a sense of camaraderie with my exercise companions because we exercise for the same results
- I feel close to my exercise companions who appreciate how difficult exercise can be
• I feel connected to the people who I interact with while we exercise together

• I feel like I get along well with other people who I interact with we exercise together
APPENDIX O

SPECIFIC AIM #2: RECRUITMENT FLYER
Appendix O

Specific Aim #2: Recruitment Flyer

Hello,

You are being invited to participate in a research study titled: University faculty and staff exercise intervention using objectively measured physical activity on personality, self-efficacy, motivation, and cell phone use.

While the benefits of physical activity are abundantly clear, a large majority of adults are still sedentary. Therefore, it is important to understand what contributes to these behaviors. To accomplish this, research examining factors contributing to physical activity and sedentary behaviors are is warranted.

The purpose of this study is to examine potential relationships of personality, self-efficacy for physical activity, motivation for physical activity, and electronic media use (cell phone), with changes in fitness, attendance to a work-site exercise program, and physical activity behavior over the course of a 16-week period

We would like you to take part in this project, which is a 1 week period of wearing a physical activity tracker as a wrist watch (the Movband accelerometer) and completing a series of physical and perceptual testing.

Upon enrollment, you will be familiarized with the protocol, including instruction on the benefits and risks, and given the Institutional Review Board consent to read and sign. A health history questionnaire will also be completed prior to participation. Exclusion criteria include reporting a history of medical disorders.

The testing consist of a series of questionnaires. The questionnaires consist of measurements which will assess physical activity, sedentary behavior, and cell phone use.

There will be no follow-up requirement. Total time of participation will be one week.

You will receive a $5 gift card to a local store after the week is completed. You may gain slight benefits from wearing a visual activity monitor. This may only be a slight benefit and so this research may not benefit you directly. However, your participation in this study will help us to better understand the potential influence of cell phone use on physical activity and sedentary behavior.

If you are interested in participating in this study, please respond to this e-mail. We thank you for your consideration and your time.
APPENDIX P

SPECIFIC AIM #2: INFORMED CONSENT FORM
Appendix P

Specific Aim #2: Informed Consent Form

Informed Consent to Participate in a Research Study

Title: University faculty and staff exercise intervention using objectively measured physical activity on personality, self-efficacy, motivation, and cell phone use

Principal Investigator: Curtis Fennell, Jacob Barkley PhD, Ellen Glickman PhD, J. Derek Kingsley PhD, Andrew Lepp PhD

You are being invited to participate in a research study. This consent form will provide you with information on the research project, what you will need to do, and the associated risks and benefits of the research. Your participation is voluntary. Please read this form carefully. It is important that you ask questions and fully understand the research in order to make an informed decision. You will receive a copy of this document to take with you.

Purpose:
While the benefits of exercise are abundantly clear, a large majority of adults are still sedentary. Therefore, it is important to understand successful methods of increasing physical activity. To accomplish this, research examining traits which are associated with participation in physical activity is needed. The purpose of the present study is to examine potential relationships of personality, self-efficacy for physical activity, motivation for physical activity, and cell phone use with changes in fitness and physical activity behavior over the course of a 16-week period.

Procedures:
We would like you to take part in this project, which is a 16 week period of wearing an activity monitor on your wrist (Movband accelerometer) and completing a series of physical and perceptual testing over three time periods. Before participating, you will complete a Physician’s Consent Form and Health History Questionnaire to ensure that you are healthy enough to participate in physical activity and exercise. You will be excluded if you report a history of medical disorders or did not receive clearance from
your physician beforehand for such issues as orthopedic injuries and cardiovascular disorders.
You will be asked to wear a Movband accelerometer as much as possible for 16 weeks. This is a movement tracking device which is wearable as a wrist watch. It is requested that once per week you charge the Movband and complete a questionnaire assessing how much you wore the Movband. The research team will be monitoring your physical activity over the 16 week period.
You will be asked to complete a series of questionnaires and fitness testing at week 0 (baseline), week 8 (mid-point), and week 16 (final). The questionnaires consist of 17 instruments which will assess personality, locus of control (belief in your ability to control your life), satisfaction with life, depression, anxiety, and stress, social interactions, self-efficacy for physical activity, motivation for physical activity, electronic media use (cell phone), social interactions, and work productivity. You will be asked to complete a series of resting and physically active fitness tests. These tests will be conducted and monitored by the research team who is trained and CPR and First Aid certified.
The fitness testing consists of resting and physical tests which are explained below:
Height: Your height will be measured on a scale.
Weight: Your weight will be measured on a scale.
Body composition: Using a hand caliper, 7 areas of your skin will be measured to estimate body fat percent.
Resting blood pressure: An automated blood pressure will be placed around your brachial artery for about 35 seconds to measure the pressure of your blood against the brachial artery.
Resting heart rate: A heart rate monitor will be placed just below your chest and a watch associated with the heart rate monitor will measure your resting heart rate.
Push-ups: you will be asked to complete as many push-ups as possible.
Curl-ups: You will be asked to complete as many curl-ups as possible in 60 seconds.
12-minute run/walk test: You will be asked to run and/or walk around a gymnasium and try to cover as far of distance as you can in 12 minutes.
Flexibility test: You will be asked to sit on the floor with your feet resting on a box. You will then be asked to place one hand over the other and reach as far as you can.
If you are participating in the Fit for Life workshop, your attendance to the class sessions will be recorded.
There will be no follow-up requirement. Total time of participation will be about 12.5 hours. This includes the questionnaire and fitness testing (1.5 hours at three time points, totaling to 4.5 hours) and charging the Movband as well as completing the questionnaire assessing how much you wore the Movband (30 minutes per week for 16
weeks, totaling to 8 hours). The approximate number of subjects in this study will be 80.

**Audio and Video Recording and Photography**

There will be no audio and video recording or photography.

**Benefits**

Your participation in this research study may not benefit you directly. However, your participation in this study will help us to better understand the differences in why some individuals choose to participate in physical activity and exercise while others do not. Additionally, this will help us to better understand the potential influence of cell phone use on physical activity.

**Risks and Discomforts**

The fitness tests include portions of participating in physical activity. With physical activity, there are minimal expected risks and harms. These risks may include fatigue, shortness of breath, muscle soreness or dizziness. Possible adverse events consists of orthopedic injuries, cardiovascular strain and incident of a cardiovascular event, exercise induced asthma, and fatigue. The likelihood of these occurrences is very minimal. Additionally, the individuals in the intervention group will be participating in the Fit for Life workshop. This study is asking the individuals who have elected into the Fit for Life workshop to participate in data collection. So the physical activity subject’s participation in the Fit for Life workshop is pseudo-independent of this study. 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.

Some of the questions that you will be asked are of a personal nature and may cause you embarrassment or stress. You may ask to see the questions before deciding whether or not to participate in the study. If you do not wish to answer a question, you may skip it and go on to the next question.

**Privacy and Confidentiality**

Your study related information will be kept confidential within the limits of the law. Any identifying information will be kept in a locked file cabinet and only the researchers will have access to the data. Research participants will not be identified in any publication or presentation of research results; only aggregate data will be used. This data will include
both measures of physical health and cognitive health. All forms and questionnaires with participant information will be kept in a secure file cabinet that will be locked to which the primary investigators will have access. The data from the Movband will be uploaded to the Movable website and is kept confidential as only the researchers will have access. No data from participants from other studies will be included in the locked cabinets. Your data will not be shared with anyone but the researchers. There will be coding of participant’s folders so that their name is not on the folder in which is their data. If you agree to participate in this research project, health information that may identify you will be collected. We will only collect information that is needed for the research and described in this consent form. By signing this consent form, you are authorizing the study investigators to access your medical record and health information as described in the consent document.

**Compensation**

The compensation will include receiving a free Movband accelerometer. Additionally, you will receive a $5.00 gift card to a local gas station for each of the three testing days you attend ($15.00 total).

**Voluntary Participation**

Taking part in this research study is entirely up to you. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information that may affect your health, welfare, or willingness to continue your study participation.

**Contact Information**

If you have any questions or concerns about this research, you may contact Curtis Fennell at cfennell@kent.edu, Ellen Glickman at 330-672-2930 or eglickma@kent.edu, or Jacob Barkley at 330-672-2857 or jbarkle1@kent.edu. This project has been approved by the Kent State University Institutional Review Board. If you have any questions about your rights as a research participant or complaints about the research, you may call the IRB at 330.672.2704.

**Consent Statement and Signature**

I have read this consent form and have had the opportunity to have my questions answered to my satisfaction. I voluntarily agree to participate in this study. I understand that a copy of this consent will be provided to me for future reference.
APPENDIX Q

SPECIFIC AIM #2: HEATH HISTORY QUESTIONNAIRE
Appendix Q

Specific Aim #2: Health History Questionnaire

KENT STATE UNIVERSITY
APPLIED PHYSIOLOGY RESEARCH LAB

HEALTH HISTORY

Thank you for volunteering to be a participant for a study to be conducted in the Applied Physiology Research Laboratory. You may be asked to perform a test that requires you to exercise at or near your maximum capability. 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 the tests dangerous for you. Please complete the health history as accurately as you can. This medical history is confidential and will only be seen by researchers to determine your qualifications for this study.

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
________________________________________________________________________
________________________________________________________________________
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:___________________________________________
________________________________________________________________________
________________________________________________________________________

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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________________
REASON FOR TAKING THIS
______________________________________________________________________________
MEDICATION________________
REASON FOR TAKING THIS
______________________________________________________________________________
MEDICATION________________
REASON FOR TAKING THIS
______________________________________________________________________________
MEDICATION________________
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
PROBLEMS AND SYMPTOMS, continued

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

Explain any items checked (when, severity, treatment)
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

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 research study?     YES     NO
Do you currently smoke cigarettes?     YES     NO
Do you currently use any smokeless tobacco products?     YES     NO
APPENDIX R

SPECIFIC AIM #2: MOVBAND ACCELEROMETER
Appendix R

Specific Aim #2: Movband Accelerometer
APPENDIX S

SPECIFIC AIM #2: ACTIVITY MONITOR REPORT FORM
Appendix S

Specific Aim #2: Activity Monitor Report Form

Name: ____________________

Activity monitor report
Wear the monitor as much as you can throughout the week. Only take it off when you go
to bed at night. **Do not record when you are sleeping.** Do not get it wet.

1. Please circle/highlight the days below that you wore the activity monitor.
2. Fill in the date.
3. List the times that you had the monitor on in the space provided.
4. Indicate if and when you removed the monitor.
5. Specify why the monitor was removed.

**See the example below:**

<table>
<thead>
<tr>
<th>Monday</th>
<th>Date: 1/25/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn: 9am-2pm (took it off to take a shower), 3pm – 10pm (went to bed at 10pm)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tuesday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wednesday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thursday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Friday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saturday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times worn:</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX T

SPECIFIC AIM #2: DEMOGRAPHIC INFORMATION FORM
Appendix T

Specific Aim #2: Demographic Information Form

Part I: Demographics and General Questions

The following contains items pertaining to your demographic and background information. For each item, please respond with the appropriate information.

11. What is your sex (circle appropriate response)?
   - Male
   - Female

12. How old are you? ____

13. Are you Hispanic or Latino?
   - Yes
   - No

14. What is your race?
   - American Indian or Alaska Native
   - Asian
   - Black or African American
   - Native Hawaiian or Other Pacific Islander
   - White

15. What is your current occupation title?
   ________________________________________________

16. What is your job status (Check one)?
   - Full-time
   - Part-time

17. How many hours of paid employment do you work each week? _________

18. What is your relationship status? (Check one)
   - Single
   - In a relationship
   - Engaged
   - Married

19. Do you have any children? ____  If yes, how many? ____
20. What is the highest degree or level of school you have completed?
   o No schooling
   o Nursery school to 8th grade
   o 9th, 10th or 11th grade
   o 12th grade, no diploma
   o High school graduate - high school diploma or the equivalent (for example: GED)
   o Some college credit, but less than 1 year
   o One or more years of college, no degree
   o Associate degree (for example: AA, AS)
   o Bachelor's degree (for example: BA, AB, BS)
   o Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)
   o Professional degree (for example: MD, DDS, DVM, LLB, JD)
   o Doctorate degree (for example: PhD, EdD)
APPENDIX U

SPECIFIC AIM #2: INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE
Appendix U

Specific Aim #2: International Physical Activity Questionnaire

Part IV: Physical Activity Questionnaire (IPAQ)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

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

5. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?
   ____ days per week
   □ No vigorous physical activities ➔ Skip to question 3

6. How much time did you usually spend doing vigorous physical activities on one of those days?
   ____ hours per day
   ____ minutes per day
   □ Don’t know/Not sure

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

7. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
   ____ days per week
   □ No moderate physical activities ➔ Skip to question 5

8. How much time did you usually spend doing moderate physical activities on one of those days?
   ____ hours per day
   ____ minutes per day
   □ Don’t know/Not sure
Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?  
   ___ days per week  
   [☐] No walking  
   [□] Skip to question 7

9. How much time did you usually spend walking on one of those days?  
   ___ hours per day  
   ___ minutes per day  
   [☐] Don’t know/Not sure

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

10. During the last 7 days, how much time did you spend sitting on a week day?  
    ___ hours per day  
    ___ minutes per day  
    [☐] Don’t know/Not sure

11. During the last 7 days, how much time did you spend sitting on a weekend day?  
    ___ hours per day  
    ___ minutes per day  
    [☐] Don’t know/Not sure
APPENDIX V

SPECIFIC AIM #2: CELL PHONE USE FORM
Appendix V

Specific Aim #2: Cell Phone Use Form

The following contains items pertaining to your general and specific mobile phone use habits and behaviors. For each item, please respond with the appropriate information.

1. As accurately as possible, please estimate the total amount of time you spend using your mobile phone each day. Please consider all uses except listening to music. For example: consider calling, texting, Facebook, email, sending photos, gaming, surfing the internet, watching videos, and all other uses driven by “apps” and software.

   Hours: _______________ Minutes: _______________

2. As accurately as possible, please estimate a) the total number of text messages that you send and receive each day and b) the total number of calls you make and receive each day.

   a) Number of texts sent: ____________  Number of texts received: ____________
   
   b) Number of calls made: ____________  Number of calls received: ____________
REFERENCES


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