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Does the Use of the FITBIT Accelerometer Increase Physical Activity Levels?

A THESIS

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Table of Contents

List of Tables

Table

List of Figures

Figure

Abstract

Does the Use of the FITBIT Accelerometer Increase Physical Activity Levels?

The purpose of this research was to determine if the FITBIT accelerometer altered physical activity levels in those wearing the accelerometer versus those not wearing the device. There were 21 subjects in this study, recruited from the University of Central Oklahoma's employee wellness program, the kinesiology department faculty, and the wellness center staff. Nine – teen participants completed the Human Activity Profile (HAP) survey to measure physical activity levels pre – and post – experimentation. Ten subjects received a FITBIT accelerometer to wear for six weeks, while the other nine subjects made up the control group and did not use an accelerometer. Results of this study revealed no significant difference between the FITBIT and the control groups HAP maximum activity scores (MAS) ($p = 0.16$), and HAP adjusted activity scores (AAS)($p = 0.0.179$). There was not a significant difference for the main effect for time ($p = 0.367$), main effect for group ($p = 0.98$), or interaction of time by group ($p = 0.389$). Steps did not significantly change across time for the FITBIT group ($p = 0.41$). The FITBIT group did have a smaller effect size than the control group for MAS ($d = 0.325$, $d = 0.587$) and for AAS ($d = 0.054$, $d = 0.565$). In conclusion the FITBIT group did not have significantly different physical activity levels compared to the control group, but the FITBIT group did have lower effect sizes, which meant the physical activity levels decreased less than the control group's activity levels.

CHAPTER ONE: INTRODUCATION

Physical inactivity and motivation is a problem globally that is becoming more prevalent (Dumith, Hallal, Reis, & Kohl, 2011). As people get older and they gain weight they become more inactive (Samir, Mahmud, & Khuwaja, 2010). Motivation and support have been suggested as influences that keep people from being active (Samir et al., 2010). Garber, et al. (2011) state that physical activity can help maintain an individuals weight and reverse or decrease metabolic disease. Another reason physical inactivity should be looked at is because it is related to cardiovascular disease (CVD) death (Reddigan, Arder, Riddel, & Kuk, 2011). Some groups, and ethnicities of people are more prone to be inactive than others such as older individuals, African – Americans, those with sedentary jobs, and women. (Sisson, Camhi, Turdor-Locke, Johnson, Katzmarzyk, 2011).

Therefore, if weight is not being managed through physical activity, then this can lead to obesity, which in turn can cause cardiovascular disease, diabetes, and early death (Preston & Stokes, 2011). It is also important to mention that obesity costs the nation a large sum of medical costs. Chenoweth and Leutzinger (2006) estimated physical inactivity and excess weight to cost the nation 507 billion dollars in 2003 and they estimated it to exceed 708 billion dollars in 2008. This is a large sum of money and could be used to help families that do not have the luxury of having health care. This is the amount of money the country is losing due to medical costs and loss of wages.

Edwards (2007) found that individuals that took public transit instead of using their own vehicle walked on average 8.3 minutes more per day. Using public transit could result in 12.9 (slow), 16.2 (moderate), and 19.5 (brisk) fewer calories stored per day depending on ones pace of walking. Although this is not a large number, obesity rates could be slowed dramatically if individuals decided to use public transportation rather than by their own means (Edwards, 2007). Edwards (2007) also mentioned that by walking this extra amount and reducing obesity, individuals could save up to $5,500 per individual per year for medical expenses. Allison, Zannolli, and Narayan (1999) found that medical costs could be overestimated due to obesity. The over estimation was thought to be because obese individuals have a higher mortality rate (Allison et al., 1999). Even though their argument is about medical costs being overestimated, it is important to mention that it is only because there is a higher death rate for those whom are obese. Therefore, if they do not die sooner due to increased and better medical care, then their medical costs will be higher.

Although life expectancy has increased over the last several years, obesity and weight gain has seemed to increase. Lindstrom, Isacsson, & Merlo (2003) discovered that the prevalence of obese and overweight individuals in Sweden increased from 1986 to 1994, while physical inactivity was also found to be increased. The authors believed that inactivity could be attributed to the increase in obesity. It is possible that busier lifestyles, with higher demands in the home and at work are leading to decreased leisure time activities that are active. These higher demands are leading individuals to more than likely use means that would allow them to take on more tasks (Struber, 2004). For example the utilization of technology and motorized transportation has led people to be much more inactive (Struber, 2004).

Obesity is a problem that has increased in the United States. (Centers for Disease Control and Prevention [CDC], 2013). A large part of this problem is related to the lack of physical activity (Spees, Scott, & Taylor, 2012). This is important because of all the health benefits associated with healthy weight, but quality of life is much lower in those whom are obese compared to those that are normal or overweight (Groessel, Kaplan, Barrett-Conner, & Ganiats

(2004). This study proposed that there was a problem with the lack of, or proper type of motivation for overweight and obese people when encouraged to increase physical activity. A study performed by Nowicki, Murlikiewicz, & Jagodzinska (2010) found that the use of pedometers on hemodialysis patients increased physical activity levels. Therefore, it was assumed that by having a FITBIT on during this study, there would be an increase in physical activity levels because it would heighten awareness of health benefits and possibly increase social motivation (Litt, Iannotti, & Wang, 2011).

The interest of this study was to determine if the use of an accelerometer could be a motivational factor to increase obese individuals physical activity levels. Litt et al. (2011) discovered that external motivations were negatively associated with physical activity and health motivation and social motivation were positively tied to physical activity. It was believed that by telling individuals to exercise, they would be externally motivated. Whereas, if an individual had a tool to monitor their fitness with, like an accelerometer then they would increase their health motivation because they are conscious of what they are doing and the benefits of physical activity. Also, an accelerometer was thought t increase motivation, because it would give individuals a means to compete with others and it give them something to talk about during or after their activity. As stated by Power, Ullrich-French, Steel, Dartha, & Bindler (2011) intrinsic motivation is related to higher physical activity levels. It was thought that the FITBIT could be used to extrinsically motivate obese individuals so that they could eventually make the shift into an intrinsic motivation to become more active.

Purpose

The purpose of this study was to look at the use of a FITBIT (Friedman & Park) accelerometer when measuring physical activity to determine if this device could lead to increases their physical activity levels. Physical activity was measured using a physical activity recall survey to determine any change when using a FITBIT accelerometer versus not using one. The belief was that when the participants monitored their activity levels using the FITBIT they would want to become more active if they were sedentary and maintain their activity level if they were already very active. Bredahl and Singhammer (2011) performed a study in which they found that self-rated health increased physical activity when participants were prescribed exercise.

Several studies have mentioned using accelerometers and pedometers to measure physical activity levels. For example McMinn, Rowe, Stark, and Nicol (2010) used a New Lifestyles NL-1000 Accelerometer to measure physical activity. The authors found that this device was valid in its use in measuring moderate-to-vigorous physical activity in school settings. Silva, Mota, Esliger, & Welk (2010) found that an Actigraph GT1M accelerometer was reliable in counts and steps taken, although there was some variability in detection of initial movement or the threshold of movement. The threshold of movement could potentially affect the results if the participant chose to partake in activities such as basketball, tennis, or lots of short movements around the office. This particular study used the FITBIT (San Francisco, California, USA) because it assumed that using a step-measuring device would increase motivation to elevate levels of physical activity (Nowicki, et al., 2010). Even though the FITBIT was different from the ones mentioned in these validity and reliability studies, it can be assumed that this accelerometer will be able to obtain the data needed for this research (Chen et al., 2003; McMinn, et al., 2010; Silva, et al. 2010).

Limitations

Typically accelerometers measure weight bearing exercise movement. Non-weight bearing exercises would not be picked up as accurately and could affect the results if a subject chose to increase their activity levels performing non – weight bearing activities. The belief was the accelerometer placement would be a potential compliance issue and could have been a limiting factor. The small sample size was also believed to limit the results that would be gathered from this research.

Delimitations

Delimitations of this study included subjects being obese and overweight subjects. This delimitation was changed when the Institutional Review Board deemed this offensive. Therefore, the study was opened up to any weight status. Another delimitation was the subjects were faculty and staff of the University of Central Oklahoma because of the ease of access to these volunteers at the university. There was no age limit set for the subjects, although it may have been interesting to look at the difference in activity levels among age categories and male and female.

Summary

It should be the goal of those in health and fitness careers to help those whom are overweight to have affective associations with physical activity, to motivate and figure out a way that could help those whom are overweight to increase their physical activity levels (Kiviniemi, Voss,-Humke, & Seifert, 2007). This study looked at the effect that a FITBIT accelerometer would have on physical activity. The purpose of this study was to determine if awareness of physical activity by using a FITBIT accelerometer altered physical activity levels. This was important to this study because physical activity needs to be included more in most obese and overweight people’s lifestyle so that the trend in the obesity rate and medical costs can decrease (Flegal, 2005; Chenoweth & Leutzinger, 2006).

Hypothesis

The hypothesis was that the FITBIT accelerometer would lead to increases in physical activity levels and steps taken.

CHAPTER TWO: LITERATURE REVIEW

The purpose of this research was to discover if the use of accelerometers on a population of overweight and obese subjects would help motivate these individuals to increase their physical activity levels. This literature review points to the problem of obesity as it costs individuals and the country a significant amount of money. It points out how physical inactivity is also a problem and how it relates to obesity. Literature will be discussed that describes how taking public transit instead of personal automobile transportation can decrease obesity. Obesity is said to lead to early death. Research shows that by becoming more physically active and decreasing the obesity rate, life expectancy can be increased. This review will also discuss previous research that has used an accelerometer as an intervention to increase physical activity levels. Next, it will tie the research together pointing out why this study is so important. This review will also suggest further research that needs to be done to close any other gaps or inconsistencies. Each of the research articles reviewed here will be analyzed and discussed as they pertain to the topic being supported in this study.

Physical Inactivity & Obesity

Physical inactivity is a major problem that is becoming more prevalent (Dumith et al., 2011). One of the main concerns is discovering why people are inactive and how to get them to be active. Samir et al. (2011) conducted a study in Pakistan in which they looked at how prevalent physical inactivity was in the country and the barriers that obese individuals are faced with. This particular study was conducted at a community health center in Pakistan. Data collectors would interview attendants that were with a patient in the community health center. After an interview was performed the data collectors would take height and weight to determine body mass index (BMI) of the subjects. Those subjects in this study were between the ages of 18 and 69 years of age and had a BMI ≥ 25 kg/m^2. The subject's activity level was then measured using the International Physical Activity Questionnaire. If the obese subjects were found to be inactive then they were interviewed to determine any particular things that keep them from being active. The data collectors interviewed 350 obese attendants and found that 254 were inactive.

The results showed that as age and BMI increased along with being married, so did inactivity ($p \leq 0.01$, $p \leq 0.01$, $p \leq 0.05$ respectively). The authors found that if a subject was over the age of 33 then they were twice as likely to be inactive than those that were younger. They also found that when the BMI of a subject was ≥ 33 kg/m^2 they were more likely to be inactive than those with ≤ 33kg/m^2. Also, those that had a family history of obesity were 3.5 times more likely to be inactive.

From this information Samir et al. (2011) continued to look for factors that act as barriers to keep these individuals from exercising. They gathered that 25% of the obese inactive participants had been given information about physical activity benefits and importance. Fifty percent of the subjects said they were not motivated to be active, and 75% of the subjects stated they were not adequately skilled to be physically active. Half of the subjects said there was no support from home, while counseling, access, cost, and time seemed to be a few of the other factors that resulted in inactivity seen in this obese population.

The study by Samir et al. (2011) was important because it showed how prevalent physical inactivity has been in the obese population. It also pointed out the some documented barriers that obese individuals may face.

Garber et al. (2011) pointed out in the American College of Sports Medicine (ACSM) position statement for prescribing exercise that physical activity can help with weight management and metabolic diseases. Becoming physically active is important to keep from becoming overweight and or obese. Obesity is known to cause cardiovascular disease, diabetes, and early death (Preston & Stokes, 2011). Preston and Stokes (2011) demonstrated that early death can follow after cardiovascular disease and metabolic diseases for obese individuals These authors looked at how years of life were affected by obesity levels in a particular population. Their argument was that obesity caused more deaths or earlier deaths. Because the United States has a higher obesity rate than all of Europe, East Asia, and North America they believe this was why the United States showed a lower life expectancy. The subjects of this study were between the ages of 50-89 and had participated in previous health examination studies. Subjects were from 16 different countries. BMI was used to determine obesity in individuals of that country. Some of the countries used self-reported data, and some used measured data. The authors corrected for any errors that were possible from any of the self-reports.

The results of Preston & Stokes, (2011) demonstrated that the United States had a greater body mass index (BMI) compared to other countries' BMI. Canada and England were the next most prevalent countries for each class of obesity, but they were still a fraction of what the United States was in obesity rates. In the United States there was 0.20 deaths caused by obesity compared to 0.10 seen in other countries. Women aged 60 to 69 and men aged 50-59 were the age ranges most affected by obesity and death. The authors discovered that women in the United States with a BMI in the lowest risk BMI category lived an extra 1.28 years and men lived an extra 1.61 years. Whereas, women of other countries would gain 0.73 years and the men would gain 0.98 years. This study found that obesity lead to earlier death in all countries, but was most prevalent in the United States.

The importance of this study was that it showed how obesity causes earlier death in all countries, but especially the United States. If obesity were to be eliminated in the United States, the life expectancy would be 25% - 40% higher than the next two most obese countries, England and Canada. The strengths of this study as pointed out by the authors were that they used information from studies for 16 different countries that had larger incomes. They looked at obesity in age groups after the age of 50 and looked at varying BMI categories for both male and female. The authors also corrected for some uncertainty and sensitivity. Possible limitations were that some countries self-reported their BMI values. In the research the authors point out that they thought mortality risks were similar between countries, when they may not have been.

Because, physical inactivity can cause many health complications and obesity can decrease life expectancy it is important to discuss the health care costs that are attributed to obesity. Chenoweth & Leutzinger (2006) looked at the health care costs of obesity and physical inactivity. The authors looked at the prevalence of physical inactivity and obesity in seven different states in the United States (US) and argued that these two factors led to additional increased health risk factors. The seven different states were California, Massachusetts, Michigan, New York, North Carolina, Texas and Washington. These seven states were said to represent one third of the population of the United States and are demographically spread out throughout the country to give a good representation of the population. They found that all seven states' had almost half their population if not more being physically inactive. Physically activity was reported if it met the 30 minutes of moderate activity most days during the week. On the other hand, all seven states had a population with more than half their population having excess weight. Excess weight was defined in this research as having a BMI of over 25 kg/m^2. A Proportionate Risk Factor Cost Appraisal (PRFCA) helped determine costs of particular medical conditions whether that was due to excess weight or inactivity. Medical care, workers' compensation, and productivity were used to assess charges due to the medical conditions associated with these factors. The authors then calculated not only what the medical cost would be, but also, what loss of productivity would cost. The authors stated that physical inactivity and excess weight cost the country about 507 billion dollars in 2003. If obesity and physical inactivity continued to rise from when this paper was written to 2008 the authors estimated the cost of these two factors to be 709 billion dollars. This is a substantial amount of money and the authors state that if there was a five percent decrease in excess weight and physical inactivity then the current costs could be reduced.

Research by Chenoweth & Leutzinger (2006) was important because it demonstrated roughly how much excess weight and physical inactivity affected the country not only due to health risks, but also the huge financial burden. Limitations of this study were that they were unable to separate those costs that were attributed to excess weight and being sedentary. There was no validity in data collection from the PRFCA because data came from several varying sources. The authors also stated that there was a strong correlation between the risk factors, excess weight and physical inactivity, but there was not as strong of one between these two factors and the workplace costs. Strengths of this study were that it gave an estimated cost for both physical inactivity and excess weight. The study gave projected costs if the country were to continue in the same direction and it gave realistic goals for the country to reduce these costs.

Edwards (2007) also looked at the medical costs, as they relate to obesity and public transportation, but more in the sense of how these costs can be reduced by walking more. By using public transportation, this would require more walking to and from the transit location. The question that Edwards was interested in answering was, whether obesity and medical costs are attributed to obesity decrease, similar to what the previous article just mentioned, by taking more steps to get to the public transportation than utilizing their own transportation. The methods of this study included Edwards using information from a previous study in which data was collected from a sample of people in New York City. Each of these people used pedometers to count total steps and then were grouped into public transportation users and drivers. He then calculated total walk time from the 2001 National Household Travel Survey and compared the estimates to the objective measures that were previously collected in the other study. Then Edwards (2007) determined how much obesity rates would change by the total time walked and how prevalent obesity would be if more individuals utilized these walking times. He then calculated out how much medical costs could be decreased by utilizing walking to and from public transportation.

The author found that by taking public transportation instead of driving, a person walks 8.3 more minutes than someone who does not. It is reported that walking could burn 25.7 to 39 more calories and 12.9 to 19.5 less calories could be stored because of the body's efficiency. As Edwards (2007) reported from another study weight gain could be eliminated in a large percentage of the population. Obesity prevalence as stated in this article is supposed to increase at half a percent per year. With an additional 8.3 minutes per day walked this increase could be lessened to a 0.29% to 0.20% depending on how brisk the walk is. Medical savings were estimated to be between $4,800 to $6,600 dollars per individual depending also on intensity. This paper was important in that it showed that being slightly more active, even 8.3 more minutes, a day could help reduce the risks and costs of obesity. In conclusion Edwards (2007) said that this amount of time may not stop obesity, but it could definitely decrease it.

Limitations of the Edwards (2007) study were the use of data from self – reports of walking time. This data does not include exercise that was not walking or bicycling to public transportation. Also, data was used for only one travel day and some days may not have given a good representation for some people's travel on those days.

On the contrary to the previous study, Allison et al. (1999) did a study stating that health care costs were over estimated for obese individuals. It was important to take note of their conclusion. In this study Allison et al wanted to determine if health care costs were affected by mortality rates of obese individuals making the costs less than predicted. The age range of subjects used in this study was 20 to 85 years of age. The methods of this study were to figure the costs that an obese individual would accrue during their particular lifespan. Obesity in this study was defined as a person having a BMI of 29 kg/m^2. Data from the National Health and Nutrition Examination Survey (NHANES III) was used to determine prevalence of obesity. Base rate of death was reported from the Vital Statistics of the United States. Also, the obese individuals risk of death was found from a previous study and calculated for the ages 20 to 85 years. Then the authors figured the costs by age that obesity costs.

Allison et al. (1999) found that lifetime costs of being obese were 4.32% of the medical costs compared to 5.7% reported by a previous study. Therefore the results indicated that obesity has been found to lead to earlier death therefore causing less direct health care costs than previously reported. Although this may have been the case, the authors pointed out the possible increased indirect costs associated with the loss of productivity due to earlier death. This study is important to the current research being done using the accelerometer as a motivation device because even though health care costs may be overestimated it was important to note that it was because the obese are dying sooner, along with increased indirect costs.

Limitations of the Groessl et al. (2004) study as mentioned by the authors were that there was some uncertainty in the risks of death caused by obesity. The authors also mention that due to some uncertainty health care costs could be even lower than mentioned, but they were still positive, meaning they were still costing the country quite a bit of money. Strengths of this study were that this study looked at subjects with an age range of 20 to 85 years of age. The study determines base death rates and health care costs at each individual age range so that values could be determined before death happened.

A study performed by Groessl et al. (2004) looked at how quality of life was lost or was a lot lower when a person was or is obese. The purpose of this study was to determine how health related quality of life was affected by obesity status in older adults. There were 1326 older adults, with an average age of 72 years and mostly Caucasian, that participated in this study and were split into four groups depending on their obesity status, (BMI < 20kg/m^2, 20 – 24 kg/m^2, 25 – 29.9 kg/m^2, > 30 kg/m^2). Participants were used from a separate study performed in 1995 for osteoporosis. Quality of well being (QWB) data was collected over a phone interview one week after each of the participants had been measured for height and weight. An ANOVA and ANCOVA were run to find any differences by obesity status. The average BMI was 25.4 ± 4.0 kg/m^2. The mean QWB was 0.698 ± 0.102. The QWB results were much lower in the obese group than the normal and overweight group. Those that were obese had a mean difference or loss in quality of adjusted-life years (QALYs) of 0.046 per year. The obese group had a significantly greater loss of QALYs compared to the normal and overweight groups ($p \leq 0.001$). The authors suggested that this loss of QALYs was not a large number, but it was affecting so many people that it became an important factor. Therefore being obese affected the QALYs more than being at normal and overweight status. This study relates to the current research in that it shows another reason why being obese is such a negative thing. Limitations of this study include the use of BMI to measure obesity status. The participants used were educated, white, and mostly middle and upper class, not accurately depicting the population. The QALY data did not include mortality rates and this study was cross-sectional so it did not reveal the exact effects that obesity had on quality of life.

Risks associated with being inactive and having excess weight gain have now been mentioned. The financial costs brought on by having excess weight has also been discussed. This is not to mention that quality of life is more than likely lost because of obesity (not discussed). Although the severity of being obese and inactive is widely known, the obesity rates have continued to climb (CDC, 2013). Lindstrom et al. (2003) discussed the prevalence of obesity and physical inactivity and how it has to increase. The authors of this study proposed that being obese and overweight were associated with a decrease in leisure activity. The purpose was to determine whether obesity, overweight, and physical activity was increasing or decreasing from 1986 to 1994. The participants of this study included 5422 people. In 1994 participants in Malmo, Sweden were chosen that were born in 1913, 1923, 1933, 1943, 1953, 1963, 1968, and 1973. Previous data from another study had been collected in 1986 for those born in 1910, 1915, 1925, 1935, 1945, 1960, and 1965. Obesity in this study was someone with a BMI of 30 kg/m^2. Overweight was someone with a BMI between 25kgm^2 to 29.9kg/m^2. Leisure activity was determined by a four-question survey. The first category was no physical activity. The second was four hours a week of walking, bicycling, or something equivalent. The third answer was someone who exercised regularly, while the fourth was someone who exercised at an extreme level. Those that were born outside of Sweden were given their own category, and education was also measured according to how long the participants were in school. Multivariate analyses, chi-squared tests, and correlations were run to determine differences of obesity status with education, obesity rates between 1986 to 1994, and how obesity, being overweight and physical activity related to each other, respectively.

Results of Lindstrom et al. (2003) showed that the prevalence of obesity and being overweight increased from 1986 to 1994. The sedentary lifestyle went from 14.7% to 18.1% in men and 19.4% to 26.7% in 1994. Sedentary lifestyle increased for every group of people, independent of their age, educational status, and country of origin. Those born from other countries had even higher rates of being sedentary than those born in Sweden. As BMI increased so did the proportion of sedentary lifestyle. In conclusion the authors stated that obesity had increased during this time period, most likely because there was less leisure physical activity for fun.

This study was important, even though it was performed outside of the United States, because it makes a connection between obesity and physical activity levels. This is important to the community and to current research in determining ways to increase physical activity for those who are overweight or obese. Limitations of this study were BMI was self-reported except in 1986 and 1994. Leisure-time physical activity was self reported, which could have affected the results if the subjects did not understand the survey properly. Also, the population in this study was not representative of the population census.

Another study performed by Spees et al. (2012) looked at the amounts of physical activity by obesity status. The purpose of this study was to verify how many adults by weight status were actually meeting the physical activity guidelines. In addition the authors wanted to reveal what activities where being performed most by weight status and also the frequency and duration of physical activity. Data from 1999 to 2006 NHANES survey was used in this study. There were 7695 subjects between the ages of 18 to 50 years. Obesity status was defined as underweight (<18.5 kg/m^2), normal weight (18.5 – 24.9 kg/m^2), overweight (25 – 29.9 kg/m^2), and obese as (>30 kg/m^2). Physical activity was self-reported and was classified as being either vigorous or moderate. Times and duration of activities were also reported. Chi-square analyses were run to determine any differences between physical activity levels met and recommended. ANCOVA was run to find any differences in the frequencies and durations of both physical activity intensities.

Obesity status showed no difference in the amount of moderate physical activity accomplished. Obese individuals were found to exercise much less overall *($p \leq 0.001$)* and less at the vigorous intensity ($p \leq 0.001$). Normal weight subjects spent more time exercising vigorously whereas overweight and obese people spent more time at the moderate level. Overweight individuals were found to be anywhere from 70% to 89% less likely to meet the physical activity guidelines of the 2007 American College of Sports Medicine and the 2008 Physical Activity Guidelines for Americans. Stretching walking, dance, and weight lifting were the moderate physical activities most commonly participated in by all the obesity statuses. Running, cycling, and walking were the vigorous activities that were participated in most by normal weight subjects, whereas obese subjects did yard work and stair climbing for their vigorous activity more than normal weight subjects. Therefore, obesity status revealed differences in frequency and duration of physical activity. Almost half of obese people are meeting physical activity guidelines, but this paper points out that these durations and frequencies are not helping these individuals get to a normal weight. More attention needs to be placed on guidelines of physical activity levels and durations.

Limitations to this study were that it was cross-sectional and it only represented data that was self-reported for a 30-day recall, and not measured for an extended period of time. A strength of this study was that it had a large sample size and could be generalized to the public population. This study related to the current research because it showed that obese individuals are potentially not exercising enough to obtain a healthy weight status.

Reddigan et al. (2011) conducted a study on how cardiovascular disease mortality and physical activity relate. The purpose of this study was to determine if cardiometabolic risk factors affect the relationship between physical activity and cardiovascular disease (CVD) death. Secondly the effect that physical activity has on CVD death in subjects that were healthy and those that were at risk of CVD death. The NHANES III was utilized in this study and data from 1988 to 1994 was obtained. There were 10, 261 subjects that were between 20 and 90 years of age. The National Death Index was used to determine deaths. Two different statistical classifications of deaths were used to find the cause of deaths or rates of causes of deaths during the time period. A physical activity questionnaire about leisure time activity, with time and type of activity was completed. Age, gender, and income were determined by completing another questionnaire. Blood draws were used to assess cardiometabolic risk factors. The American College of Sports Medicine guidelines were outlined in this paper as to what vigorous activity meant.

Results of this study indicated that those that were younger, did not smoke, had more income, and had a better metabolic profile were more active than the alternative. There were 42.1% that participated in light physical activity. There were 35.7% that participated in moderate/vigorous activity. There were 1095 out of 2433 total deaths that were contributed to cardiovascular effects. For every 1000 person years there were 13.2 deaths for those that were inactive, 6.2 for those that had light physical activity, and 7.6 for those that had moderate/vigorous physical activity. The more cardiometabolic risk factors a person had, the more mortality that was also present. This study found that obesity by itself did not show a significant relationship to CVD death. In conclusion the authors mentioned that it is important to participate in any physical activity to help decrease CVD death and improve metabolic risk factors. It was found that it was better for a person to be active with the risk factors than inactive with the risk factors.

A limitation of the Reddigan et al. (2011) study was that physical activity levels were only assessed at the beginning of the study meaning some individuals may have changed over time. Time of physical activity and levels of physical activity were all self-reported which could have misclassified some of the individuals. Any unknown deaths were not mentioned in this study, which could have increased CVD numbers if some of the unknowns were related. Strengths of this study were that it included a large sample size that could be representative of the U.S. population. There was also roughly a 13-year follow up, and the number of deaths was large, which helped the strength of the data.

Motivation

The assumption of the current research was that there was some type of problem with motivation and how people respond to physical activity. Litt, et al. (2011) did a study in which they looked at how different motivations affected adolescent physical activity. The purpose of this study was to determine motivations for physical activity in adolescents. The methods of this study included 9011 students in sixth grade through tenth grade filling out the Health Behavior in School-aged Children (HBSC) survey during the school year 2005 to 2006. These students represented a national sample. Using a three-part survey physical activity was assessed. The first part asked how often the adolescent had been physically active in the last week and was scaled from zero to seven. The second part asked how many times a week they had exercised and the third part asked the hours that the adolescents had exercised. The second part was responded to as "*never, less than once a month, once a month, once a week, two to three times per week, four to six times per week, or every day*." The third part was responded to as, 1(*not important) 2(fairly important), 3(very important).* The HBSC was used to measure motivational reasons for why the subject exercised. A confirmatory factor analysis model and a structural equation model were used to look at the relationships between the three motivational factors, reward, social, and health, to physical activity.

Results indicated that health motivation had the highest correlation to physical activity levels. The correlation was 0.31 for boys and 0.24 for girls. The correlation between social motivation and physical activity was strong in females. In the beginning of this study the researchers discussed how intrinsic motivations are associated with physical activity, whereas extrinsic motivations are not. For the purpose of this study with adolescents internal versus external motivations were used. The health motivation was said to be on the internal side of the external motivation spectrum. Social motivation was said to be an internal motivation and the reward motivation was external. Both the health social motivation showed positive relationships between them and physical activity levels. The authors concluded that the adolescents saw the importance of health and that helped motivate them. Since social motivation was positively correlated to physical activity in females, it may be a factor that may be important in motivating females to become more active.

A strength of this study was the large sample size from the NHANES data. A limitation would be that it was self-reported data. Even though this article looked at motivations in adolescents the authors argued that adolescent motivation and physical activity levels relate to how active they will be as adults. This study was important to current research in that accelerometers may act as a tool to make individuals more health conscious, therefore leading them to be more active. Also, using an accelerometer may be a tool to increase social motivation because it will give women a reason to discuss goals and work together.

Power et al. (2011) also conducted a study looking at the motivations and their associations with physical activity in adolescents. The purpose of this study was to look at four different types of motivation to be physically active, extrinsic, introjected, and intrinsic. These motivations were then identified to see how they each relate to being obese or not. Motivation was measured in those adolescents that were physically active so that those that were not active did not affect the results. The subjects used in this study were 82 middle school students that had been part of the Teen Eating and Activity Mentoring in Schools study. The subjects were selected as being active if they answered yes to participating in moderate to vigorous physical activity for 30 minutes at a time. The 82 subjects also had BMI values available by obtaining height and weight for each of them. The "Motivation for Exercise" questionnaire was filled out to assess what motivated each subject to be physically active. The Progressive Aerobic Cardiovascular Endurance Run was also used to determine each of the subjects' fitness level. A two by two ANOVA was run to find any differences between each of the four types of motivation being assessed and physical activity.

The results indicated that 57% of the 82 subjects were normal weight according to the BMI calculated for each individual. There were 16% that were overweight and 27% that were obese. The overweight and obese groups were put into one group, the obese group and the normal weight group was put into the non-obese group. The motivational factors intrinsic and identified were correlated with a value of $r = 0.70$. The correlation between external and introjected was $r = 0.73$, and introjected was correlated with identified $r = 0.24$ ($p \leq 0.05$). The results indicated that individuals that were not obese were much more intrinsically motivated.

Intrinsic motivation and weight status were correlated at $r = -0.21$ ($p \leq 0.06$). The authors said this was significant. The correlation between intrinsic motivation and cardiovascular fitness was $r = 0.27$ ($p \leq 0.05$). Correlation between cardiovascular fitness and weight status was $r = -0.51$ ($p \leq 0.001$). Therefore, individuals who were not obese according to BMI status were more likely to be intrinsically motivated to be physically active and had a higher cardiovascular fitness level.

A strength of this study was that it used middle school students from different schools. A limitation of this study was the use of BMI in middle school students. Some students develop faster and so BMI may not represent body composition. This study was important, because it stated that those who exercise, because they enjoy it, tend not to be overweight. This was important to the current research because it was a goal to get those who are overweight to enjoy being active. A proposed thought was that the FITBIT accelerometer would help with the enjoyment factor. The thought was that the FITBIT may be able to act as a tool to get someone to be active and then eventually they would begin to look forward to being active.

Another study conducted by Conroy, Hyde, Doerksen, and Ribeiro (2010) looked at another type of motivation and how it affected physical activity. The purpose of this study was to see how implicit attitudes affected what was known as unintentional physical activity by controlling for intentional physical activity, which was motivated explicitly. It was stated in this article that implicit attitudes were more habitual by nature and not so much planned out and intentional. The authors believed that implicit attitudes could suggest higher physical activity levels. This study included 201 undergraduate subjects with a mean age of 19.2 years. Motivation was figured using MediaLab and DirectRT software. After this data was collected the subjects were given pedometers to measure steps. The goal was to collect seven days worth of step data. Self-efficacy beliefs, outcome expectations, perceived behavioral control and behavioral intention, were collected using the respective surveys and scales. A Single-Category Implicit Association Test measured the implicit motivations. A multiple regression was used to determine if implicit attitudes meant more daily steps.

From this study the authors found that the daily steps taken were related to implicit attitudes about physical activity. Conroy et al. (2010) said that explicit motivation was still an important factor and was not any less significant than implicit attitudes ($p < 0.01$). It was mentioned that implicit attitudes might be a new target to go after when trying to promote physical activity. Making physical activity habitual through daily living could be an important promotional factor because the authors argue that our genome already desires to be active from pre-historic times. The use of the FITBIT accelerometer in the current research could be important because it was thought that it might be able to help those using it to see the daily steps taken increase when they chose to park further or take the stairs.

Limitations of this study were it used college students and the results from this population may not be as accurate when applied to the general population. Unintentional motivated physical activity was estimated and not measured. Also the seven days that steps were measured may not be a long enough time period to gather appropriate results. The authors also suggested that by measuring unintentional physical activity more directly, it might help the results of this study. Strengths of this study were that it suggested a new area to concentrate attention on when promoting people to become more active.

Physical activity is so important, that anything that will motivate an individual to increase current activity levels should be considered. That was the reason for the current research; to figure out how to increase physical activity in obese individuals. Kiviniemi et al. (2007) looked into the affective associations and cognitive beliefs about physical activity to see if there was any relationship. The purpose of this study was to determine if affective associations affect future decisions about performing physical activity. The authors believed that physical activity participation would increase when there was an affective association with it. Participants of this study included 433 people in which 180 were male and 249 were female. The subjects had a mean age of 33.4 years with a SD of 16.2 years. Participants from local community centers and college students were recruited for this study. Physical activity was measured with the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System. Those that stated they performed vigorous physical activity for 10 minutes once a week gave details about how long they exercised each day and how long they did vigorous activity. Attitudes towards physical activity, perceived behavioral control, perceived severity and susceptibility, benefits and barriers of physical activity, along with the affective associations with physical activity were determine. Results of this study indicated that affective associations were significantly related to physical activity, $r = 0.23$ ($p < 0.01$). Activity was found to increase in individuals whom reported more positive affective associations with activity.

This study mentioned that if individuals could be persuaded, advertised to, or learn to establish affective associations with physical activity then these activity levels might increase. The goal would be to get people to associate feeling good after working out, or the idea of considering their own health, and relating those feelings and behaviors to their personal activity level. This could be accomplished in the current research if the subjects being used could not only learn the benefits, but also feel the benefits of being active.

Limitations of this study were the affective associations and behaviors were self-reported. Also, this study only measured behavior and decisions made at one time. Kiviniemi et al. (2007)

suggested that a longitudinal study be performed to obtain more accurate results along with measuring behavior and affective associations in some other way than self-reporting.

Accelerometers

This literature review supported the current research and the decision to use the FITBIT accelerometer to measure activity levels. Specifically, the FITBIT was used to determine if it would motivate individuals to be more active. Sisson et al. (2012) conducted research looking at physical activity in U.S. adults using an accelerometer. The purpose of this study was to use the BMI, demographic, household income, and behavioral attributes of U.S. adults and determine physical activity categories based upon how many steps they took per day. An Actigraph AM-7164 was used in this study and the sensitivity of this accelerometer was censored so that it could be better compared to pedometer data. Activity levels were defined as sedentary: < 5000 steps/day, low active: 5000 to 7499 steps/day, somewhat active: 7500 to 9999 steps/day, active, 10,000 to 12,499 steps/day, and highly active: ≥ 12,500 steps/day. The participants that participated in this study were from the National Health and Nutrition Examination Survey. There were 4372 participants that wore the accelerometers. The four variables were measured and calculated. For data to be analyzed and used the subjects had to have data for greater than 10 hours of wear time on the accelerometer. The number of subjects went to 3744.

Results indicated that when data was censored on the accelerometer 36.1% of participants were sedentary, 46.7% were low to somewhat active, and 16.3% were active to highly active. Censoring was done to help correct for data that was collected below 500 counts/min, which is the threshold for sensitivity. Older age, higher BMI, females, ethnicities besides European-American, lower income, and smoking where more characteristic of sedentary behavior than those that were not in these categories. One third of the U.S. population was found to be sedentary according to the categories defined by steps taken per day. The importance of this study is it could help those in the health field to see which groups of people to target when promoting physical activity interventions.

A strength of this study was that it measures physical activity objectively instead of through self-report. The accelerometer used in the NHANES study was validated in its step counting even though it had to be censored because of its sensitivity. Also, the participants represent the U.S. population. A limitation of this study as the authors mention was that it was a cross-sectional study and does not provide data over a long period of time.

The current research will utilize a FITBIT accelerometer. There was no current research defending the reliability and validity of this device. There were a couple other studies that discuss the reliability and validity of accelerometers. For example Silva, et al. (2010) did a study looking at the technical reliability of the GT1M accelerometer. The purpose of this study was to assess the reliability of this accelerometer and its activity counts and steps. This research also looked at the threshold for which steps were counted. The methods included the Actigraph GT1M being put through 24 different accelerations and frequencies to assess the validity and threshold. There were fifty accelerometers used in this study and 15 second time periods were used to count the steps for six different conditions ranging from 2.5 miles per hour to 6.5 miles per hour. Each of the accelerometers was put on a mechanical shaker plate that was utilized for this study and a control accelerometer was used to compare all the other accelerometers too. The second part of the study involved 18 different conditions that were used to determine the threshold in which steps would be counted. Coefficient of variation (CV) and standard deviation were used to find intra-instrument reliability and inter-instrument variation. Mean difference percent was also figured to test for the variability within each unit.

Step reliability was CV intra = 1.1% and CV inter = 1.2%. The count reliability was CV intra = 2.9% and CV inter = 3.5%. There was a between device variability of 7.1% at 2.5 Hertz. Increasing intensity did not affect the variability of counts and steps. There were 94.42% of the accelerometers that did not read counts and steps at the speed and frequency of 0.5 g at 1.0 Hertz. When the acceleration intensity became greater so did the number of accelerometers that read counts and steps. Therefore it was proposed that the GT1M is reliable, but its threshold for detecting movement is a concern to the authors. Silva et al, (2010) believed this could be a problem over an extended amount of time or in people with shorter gaits. This study was important because it verified the reliability of one particular accelerometer.

A limitation to this study was that the GT1M may not have properly estimated activity when the speed of intensity was increased due to a threshold error. Limitations of this accelerometer were also its threshold for small movements such as walking around the office or home. As mentioned above, these limitations should not affect the overall results.

Another study looked at the validity of the New Lifestyles NL- 1000 Accelerometer (New Lifestyles, Inc., Lee’s Summit, Missouri, USA). McMinn et al. (2010) performed this study to determine if the accelerometer would measure moderate to vigorous physical activity in school aged children, while also proving its validity. The participants of this study were twelve 10 to 13 year olds. Each of the participants belonged to a running club and was instructed to go for their run with the accelerometer. The number of steps and the times in moderate to vigorous activity were recorded. The times were matched up with the GT1M accelerometer to analyze and compare the data collected. Secondly there were 18; 10 – 11 year olds that were part of a PE class used the NL-1000 accelerometer during the class. The times and steps were again recorded along with the data from the GT1M. Thirdly, 68 fifth and sixth graders were part of a program called *The Class Moves.* This was a program in which the class was broken up with 5 to 15 minute physical activity breaks. During these breaks the physical activity was measured with the NL-1000 accelerometer and compared to the criterion accelerometer the GT1M. Descriptive statistics were run and used to calculate step and time in moderate to vigorous activity. T-tests were also used to find any mean differences. A two-way ANOVA was also utilized to find moderate to vigorous activity for both accelerometers. Appropriate metabolic equivalent (MET) activity levels of three MET and four MET were used in this study to compare moderate to vigorous activity levels.

The data showed no mean differences between the two accelerometers time and steps calculated, and there was a high correlation between three MET and four MET activity collected for both devices. There was a mean difference between the three MET activity measured in the PE class, but not in the four MET measures. During the class with activity breaks there was mean difference for both the three and four MET activities between the two accelerometers. However, there was a correlation between both devices when measuring moderate to vigorous physical activity.

Limitations of this study were the lack of understanding of what an accurate MET activity level should be used in children. The sample sizes were small for the running club group and the PE class. Most of the limitations seemed to relate to the use in children and then comparing that to the GT1M data. In conclusion the authors stated that the NL-1000 may be used in the school setting, depending on its use and the individual study or purpose, because it is affordable and was proven valid in its measurements. McMinn et al. (2010) mentioned other studies that used the same sensor that the NL-1000 used and it was proven to be valid as well. This device was proven valid and compared to the GT1M data.

Chen et al. (2003) performed a study with two different accelerometers, one worn on the wrist and one on the hip, for comparison to a whole room indirect calorimeter, to determine energy expenditure. The purpose of this study was to validate the use of a triaxial accelerometer (Tritrac – R3D, Hemokentics, Inc., Madison, Wisconsin) and uniaxial accelerometer (ActiWatch AW64, MiniMitter Co., Sunriver, Oregon) when measuring energy expenditure performing different activities at different intensities. Participants included 60 women that were part of another potential study. Participants performed activities in a whole room indirect calorimeter while wearing the triaxial accelerometer on the hip and the uniaxial one on the wrist. The participants did three 10 – minute walks that ranged from 0.6 m/s, 0.9 m/s, and 1.2 m/s. They also did three 10 –minute bouts of stepping that ranged from 12 steps/10s, 18 steps/10s, and 24 steps/10s. There were 10 – minute rests issued between each exercise. Descriptive statistics, Pearson's correlation, and standard errors of estimation were utilized for analyzing the data. Non-linear prediction models for individual accelerometer use and combined use were tested to determine energy expenditure levels during activity.

Results of this study revealed that the two accelerometers were correlated with activity energy expenditure when physical activity was measured by counts per minute. The triaxial accelerometer had an r-value of 0.825 ± 0.046. The uniaxial accelerometer was correlated with energy expenditure at $r = 0.646 \pm 0.093$. The model where each accelerometer was measured individually, underestimated energy expenditure, compared to measured values by calorimetry in the room. The ActiWatch underestimated by 113 calories and the Tritrac underestimated by 85 calories. The model in which both devices were used showed no significant difference in measured energy expenditure. Therefore the results of this study showed that the combined model was most accurate in measuring energy expenditure and proved to be valid.

Limitations of this study were that females were the only subjects and they were primarily sedentary so the results were suggested not to be related to the general population accurately. A strength of this study was that it compared to accelerometers use to a whole room indirect calorimeter. This study validated the current research in the use of accelerometers in measuring physical activity.

Nowicki et al. (2010) completed a study similar to the current research. In this study the purpose was to determine if having a pedometer increased physical activity levels. This study was performed on chronic hemodialysis patients. There were 33 subjects that were receiving therapy for chronic hemodialysis. Measurements of physical activity were taken by using a commercial pedometer seven times in a four-month period. The pedometer was worn one day during the week between two mid-week dialysis sessions. There were two weekend days recorded, one in the beginning of the study and one at the end. Subjects also self-reported any other physical activity that involved strenuous effort, along with total number of steps taken.

The steps measured during the weekday increased from 9337 ± 5317 to 11921 ± 5909 steps. The days that dialysis was not performed showed an increase in steps from 3766 ± 1963 to 4978 ± 2495 per day. Therefore, in conclusion Nowicki et al. (2010) found that the use of an accelerometer increases motivation in subjects with renal disease to be more physically active.

Limitations of this study included whether the pedometers were calibrated prior to study. There was also a small sample size and the intervention was only 4 months, with only seven separate measurements. Compliance of the pedometer use could have also been a limiting factor in this study. Strengths of this study were that the data recorders repeated recordings when information did not seem accurate. Another strength was that previous pedometer recordings were compared to the patient’s strenuous physical activity data.

Human Activity Profile Survey

The Human Activity Profile (HAP) was the activity profile that was used in this current research to determine how active the subjects were before and after they were given the accelerometers (American Thoracic Society, 1999). Bilek, Venema, Camp, Lyden, & Meza (2005) conducted a study determining the reliability and validity of the HAP. The purpose of this study was to determine the reliability and validity of the HAP when measuring physical activity in those with rheumatoid arthritis (RA) and osteoarthritis (OA). This study also looked at changes the HAP would reveal after subjects performed an exercise program. There were 16 OA (40 - 69 years old) and 12 RA (20 - 69 years old) subjects used in this study. There were 13 of the 28 subjects that also participated in the part of the study in which change assessed by the HAP was measured after a 12-week exercise program. Test–retest reliability of the HAP was accomplished by having the subjects take the survey twice at least five to fourteen days apart. Validity of the HAP when measuring physical function was determined for use by arthritic individuals by having the scores of the HAP compared to the results of the other physical activity questionnaires listed in this study. Validity of the HAP with physical activity was determined by comparing the results with the results of the calculated $VO_{2\ max}$. The responsiveness to change of the HAP was also evaluated. The 13 subjects that volunteered answered the HAP before and after a 12-week exercise intervention. The other activity questionnaires were answered and the results were compared to each other. Changes in $VO_{2\ max}$ were also assessed. Test-retest reliability was determined by using a intraclass correlation coefficient. A Spearman’s rho was run to determine validity. A Wilcoxen’s signed rank test was run to help determine if the 12-week intervention was intense enough to show changes in the HAP.

The reliability for the HAP was 0.60 to 0.91. For the validity of the HAP scores there was a large (MAS 57 – 94; AAS 43 - 94). The maximum activity score was 57 – 94, and the adjusted activity score was 43 – 94. The HAP scores and the $VO_{2\ max}$ values were correlated (MAS and HAP $r = 0.76$; AAS and HAP $r = 0.85$). The responsiveness to change was equivalent of the other performance questionnaires and equated how the $VO_{2\ max}$ changed after the 12-week intervention. This study was significant because it showed the test-retest reliability and validity of the HAP in its use with arthritic subjects.

Limitations to this study were the smaller sample size and the fact that all thirteen subjects that performed the responsiveness to change part of this study were all female. The questionnaires were all self-reported, which could have affected the results. The authors made mention that the HAP only asks, have you done a particular activity, instead of, could you do this activity. Strengths of this study were that it compared the HAP to several physical activity questionnaires and $VO_{2\ max}$ testing. Also, the fact that the HAP was measured before and after an intervention helped the strength of the study.

Teixeira-Salmela et al. (2007) conducted another study that looked at the validation of the HAP. The purpose of this study was to test the validity of the HAP in stroke patients when activity was reported, observed, or proxy reported. Variables that affected physical activity levels were to be determined along with any inconsistencies between activity that is self-reported and observed. There were stroke subjects 24 subjects with a mean age of 63.89 ± 11.57 years. The subjects had all experienced a stroke between four months to eight years ago. There were 23 control subjects that had a mean age of 65.52 ± 6.35 years. Proxies were selected by having the subjects choose someone that new their daily activities best. The procedures involved subjects performing a 10-meter walk test. Each of the subjects then filled out the HAP. The subjects were then to complete the activity that represented the score they had achieved on the HAP to verify the maximal activity level they could accomplish. Walking gait in a hallway was also calculated, along with proxy self-reports. A Pearson's correlation was run to find any relationship between the HAP scores and observed scores. Also, the proxy scores and the observed scores were correlated. For self-reports, proxy, and observed scores, intraclass correlation coefficients were used. An ANOVA was run to find any differences between the three scores.

Results showed correlations for observed scores and self-reports to be above 0.80. Correlations between observed and proxy scores were 0.75 for the maximum activity score (MAS) and 0.65 for the adjusted activity score (AAS). The intraclass correlation for MAS was 0.86, and AAS was 0.89. The control group's intraclass correlation for MAS was 0.79 and for AAS was 0.69. The validity of the HAP proved that it was valid in assessing control and stroke subject's physical activity levels.

Limitations of this study were that the proxy reports were compared to observed reports instead of to the self-reports like many other studies have done. It was hard to make a comparison in this situation. Also, the HAP and the proxy reports were self-reports. The strength of the study was that the self-reports were validated to an actual observed study.

Baker, Gray & the Scottish Physical Activity Research Collaboration (2010) conducted a study that looked at a pedometer – based community walking intervention. The purpose was to determine how the pedometer and physical activity consultations effected health outcomes for those subjects that did not meet the physical activity guidelines. Subjects were recruited if they lived 1.5 kilometers from a West of Scotland university. Subjects were between the ages of 18 and 65 years of age. This study was part of the "Walking for Wellbeing in the West" program and went from baseline to 12 weeks. Physical activity was measured using the Omron HJ – 109

E Step – O – Meter pedometer and a self-report survey called the International Physical Activity Questionnaire (IPAQ). Health outcomes were measured using the Positive and Negative Affect Schedule (PANAS). Quality of life, body mass index, waist – to – hip ratio, body fat measurements, blood pressure, and fasting blood samples were all measured. Pedometer baseline data for each of the subjects in the treatment group was collected for one week. The subjects in the intervention group had a physical activity consultation and then began the 12 – week study. The control group subjects completed baseline data using a pedometer for a week and then wore one for week 12. There were 79 subjects in this study of which the average age was 49.2 ± 8.9 years. There were 31 females and eight males in the intervention group. There were 32 females and eight males.

An analysis of variance (ANOVA) was conducted to analyze steps per day and health outcomes. Results of this study indicated that there was a significant difference steps per day between groups and between time (F [1,77] = 25.18, p < .001, partial η2 0.25). There was also a significant increase in steps for the intervention group (t [38] = -6.06, p < .001, d = 0.79). The control group had no significant difference between baseline week and week 12 (t [39] = -0.50, p = 0.618, *CI* -463 – 770). The intervention group had significantly more subjects increase their steps by 15,000 per week. Regarding health outcomes, there was a significant interaction between group and time for the positive affect scores (F [1,77] = 4.26, p = 0.042). The intervention group had a significant increase in positive affect scores (t [38]= 2.29, p = .027) and the control group did not (t [39] = -0.524, p = 0.604). No other measured health outcomes had significance.

Strengths of this study included the use of a pedometer that was sealed at baseline, and the pedometers had a seven-day memory so the participants did not have to record daily steps.

Also, this study was one the United Kingdom's first study that looked at the use of a pedometer to increase physical activity levels. A limitation of this study was that the pedometers could not measure intensity level of movement.

This study was significant because it supports the idea that a step counter has been able to be used to increase physical activity levels. No physiological changes were seen in this study. This study used a consultation, which could be beneficial in future research with the FITBIT.

The problem looked at in this study was obesity and physical inactivity (Dumith et al., 2011; Spees et al., 2012; CDC, 2013). The problems have been expensive and have led to many health problems. (Chenoweth et al., 2006; Reddigan et al., 2011). Using a FITBIT was thought to be a tool that would help increase physical activity because increases have been seen using pedometers (Nowicki et al., 2010). Accelerometers and the HAP manual have been found to be reliable and valid in their measurements (McMinn et al., 2010; Silva et al., 2010) Therefore, it is the purpose of this study to determine if the use of the FITBIT accelerometer would increase physical activity levels.

CHAPTER THREE: METHODS

Participants

The participants used in this study were staff and faculty from the University of Central Oklahoma (UCO). Subjects were recruited from the Employee Wellness Program (EWP) at UCO, from the UCO wellness center staff, and from the kinesiology department's faculty. All subjects that volunteered were allowed to be part of this study. The subjects selected to volunteer were then split into two groups. There were 10 subjects in the treatment group because of equipment availability. Participants were recruited using a few email blasts. There were not any age requirements or previous activity level regulations for the participants. According to another study that used the HAP survey the sample size needed for this study was 50 subjects that were overweight or obese (α = 0.05, 1-β = 0.80, Cohen's d = 0.50; [Bilek et al., 2005; Cohen, 1988]). Bilek et al. (2005) performed a study looking at the reliability, validity and responsiveness to change in the HAP survey (Daughton, Fix, Kass, McDonald, & Stevens 1988). The effect size for both scores collected on the HAP was found to be 0.5. There were 10 subjects in this study that received the treatment of the accelerometer, while as many other subjects as possible were recruited. This study had a small sample size because the number of subjects that volunteered for this study was 21, even though the necessary number was 50.

Instruments

The HAP (Appendix C) was developed by Daughton, et al. (1988). The HAP is a 94 - question survey that was created to assess changes in physical activity seen specifically in chronic obstructive pulmonary disease individuals (American Thoracic Society, 1999). Normative data has now been collected from several different groups of adults, which will allow for comparison between similar types of people. The survey has three different answer columns that indicated whether the subject is: "*still doing the activity, has stopped doing this activity, and never did this activity.*" Once scores were collected the maximum activity score (MAS) and the adjusted activity score (AAS) were determined as described in the survey. The MAS represented the highest activity level an individual could perform. This was the maximum score that could be obtained on the HAP. The Adjusted activity score is the difference between the MAS score and the value from what the individuals answered they were no longer doing.

The HAP was chosen for use in this research because of its reliability, validity and responsiveness to measure change (Bilek et al., 2005). It was found to be significantly correlated with a pulmonary function test (FEV1) test in measuring activity levels (Daughton, et al., 1988.). Teixeria – Salmela et al. (2007) also found a large correlation between the HAP survey and physical activity in stroke and control group subjects. The correlations for the two groups of subjects were all found to be greater than 0.80 in observed physical activity scores and self-reported activity scores.

Procedure

This research will begin by the investigator obtaining permission from the Institutional Review Board at the UCO (Appendix A). With permission from the Employee Wellness (EWP) Coordinator at UCO, as many participants from the program were recruited as possible. Due to the small number of volunteers, subjects were recruited from the UCO Wellness Center, and the UCO kinesiology department. Upon recruitment the participants filled out an informed consent form (Appendix B). Ten subjects were then randomly selected to wear the FITBIT while the remaining 10 subjects made up the control group and completed the study with no other treatment besides what the EWP participants were receiving. The treatment group received both the EWP and the FITBIT. The EWP was an eight-week program that helped to educate and encourage faculty and staff to start exercising. Ten subjects were be randomly selected to receive a FITBIT accelerometer to measure physical activity, while the other ten followed the regular protocol of the EWP, or continued with their daily activities if they were not EWP recruits. Each of the subjects completed a HAP survey to determine current activity status to compare to end results. The primary researcher was the one person that administered the HAP pre-test and post-test. This eliminated any error in communicating what the purpose and directions of the survey were. One group of ten used the FITBIT for six weeks, while the other group did not. The FITBIT group was asked to wear the accelerometer all the time. This process will be completed to determine if physical activity changed more for those wearing a FITBIT accelerometer compared to those not wearing the FITBIT.

Statistical Analysis

Statistical tests were conducted to determine these results. A two by two-repeated measure Analysis of Variance (ANOVA) was run to determine if physical activity changed when an accelerometer was used. The first independent variable of time had two levels. Physical activity was measured pre-test and post-test. The second independent variable represented group; the treatment group or the control group. Significance for this study was set at $\alpha = 0.05$. The null hypothesis for this research stated that the use of an accelerometer would not increase physical activity levels as measured by steps. Another ANOVA was run to determine the main effect for time, for group and the interaction of time by group. An independent t – test was run to determine any differences between the two groups HAP scores.

The purpose of this study was to determine if the use of an accelerometer increased or altered physical activity levels. The hypothesis of this study was that the use of a FITBIT accelerometer would cause an increase in physical activity levels.

CHAPTER FOUR: RESULTS

The primary objective of this investigation was to examine if wearing a FITBIT accelerometer would lead to changes in physical activity from pre to post study. The secondary objective was to determine if the treatment group had changes in physical activity compared to the control group post experimentation.

Twenty-one subjects from the UCO EWP were recruited to voluntarily participate in this study. The participants were split into two groups. One group was the treatment or FITBIT group, the other served as a control group. There were 10 subjects in each group. There was one additional participant accepted in recruitment. The control group was able to accept more subjects due to the fact that no additional equipment was needed for them. The FITBIT group wore the FITBIT accelerometer for a total of six weeks and data was collected using a survey (Appendix D) sent out weekly to each of the 10 participants. Both groups completed the HAP survey (Appendix C) before the six-week study began and after the study was completed. The profile survey used, provided data showing the maximum activity score, (MAS) which was the maximum oxygen demanding activity that the subject was able to perform (MAS), and the adjusted activity score (AAS), which was the usual daily activities that were performed.

Descriptive statistics were determined from the 10 FITBIT participants for the MAS – pre, MAS – post, AAS – pre, and AAS – post. Descriptive statistics were determined for only nine control group subjects due to incomplete data collection for participants in this group. The mean score of the FITBIT group's MAS – pre was 86.20 compared to 84.10 for the MAS – post. The mean score of the control groups MAS – pre was 78.22 compared to 60.67 for the MAS – post. These values mean that both groups had higher maximum oxygen demanding activity scores pre – test than they did post- test. Research has shown that normative data according to

Daughton et al. (1988) showed that MAS scores were 83.5 ± 7.0 and AAS scores were 83.2 ± 7.8 in a sample of 477 subjects. The FITBIT group MAS scores decreased less than the control groups MAS scores. The AAS – pre mean value was 83.50 compared to 83.10 for the FITBIT group. The AAS – pre mean value was 77.44 compared to 60.56 for the control group. The values for AAS scores reveal a similar trend as the MAS scores for both groups. The FITBIT group had a smaller decrease in AAS scores than the control group did. Results from HAP survey are displayed in Table 1 and Figures 1 and 2.

Table 1

Descriptive Means of the Human Activity Profile Survey for FITBIT Group and Control Group Pre – and Post- Test

Variable	FITBIT		Control	
	Pre (SD)	Post (SD)	Pre (SD)	Post (SD)
MAS	86.2000 (6.46013)	84.1000 (7.09382)	78.2222 (29.93233)	60.6667 (45.63989)
AAS	83.5000 (7.42743)	83.1000 (6.96738)	77.4444 (29.91284)	60.5556 (45.58265)

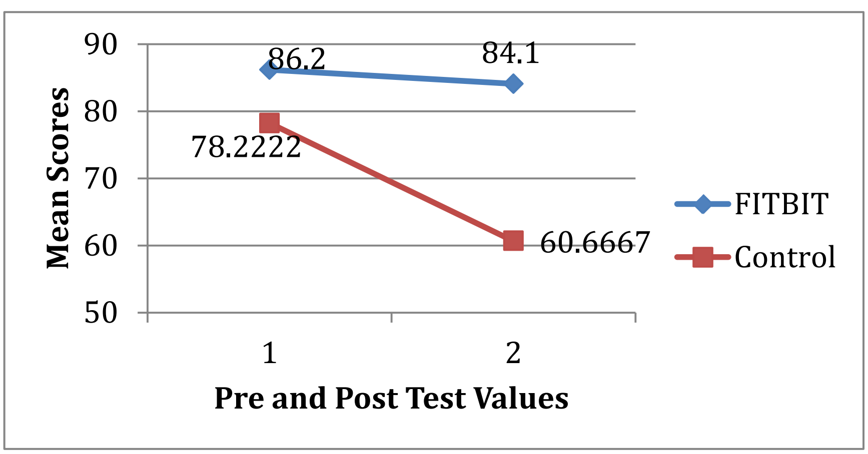

Figure 1. Mean maximum activity scores (MAS) from the pre – and post – Human Activity Profile survey.

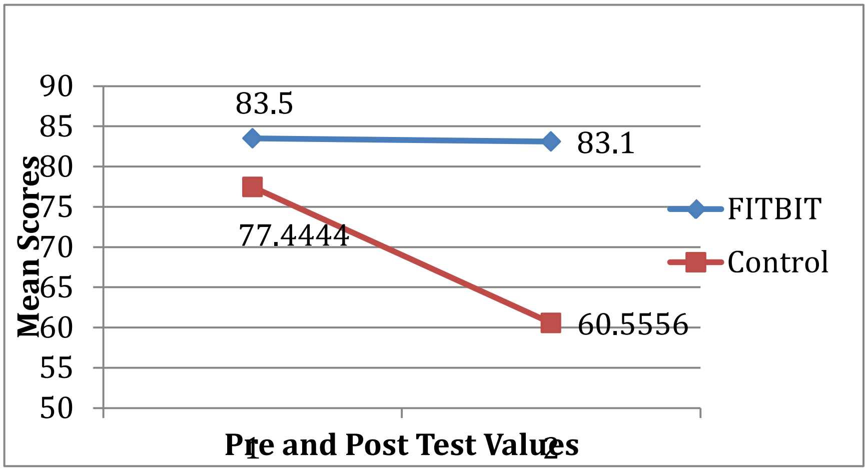

Figure 2. Mean adjusted activity scores (AAS) from the pre – and post – Human Activity Profile survey.

Descriptive statistics for seven of the 10 FITBIT group subjects, and their steps taken each of the six weeks, were analyzed and are shown in Table 2. The other three subjects reported FITBIT data that had outliers, because they did not wear their FITBIT for a large portion of time. This data was not included for analysis, because of the small sample size. The mean number of steps taken was 61,370 ± 49,102 for week one, 46,963 ± 14,678 for week two, 44,027 ± 19,066 for week three, 52,335 ± 33,214 for week four, 37,245 ± 19893 for week five, and 39,834 ± 15,747 for week six.

Table 2

Descriptive Statistics for FITBIT Group Steps per Week

Variable	N	Mean	SD	SE
Steps Week 1	7	61370.29	49102.14	18558.86
Steps Week 2	7	46963.86	14678.34	5547.89
Steps Week 3	7	44027.43	19066.67	7206.53
Steps Week 4	7	52335.57	33214.87	12554.04
Steps Week 5	7	37245.43	19893.89	7519.18
Steps Week 6	7	39834.29	15747.09	5951.84

An independent *t* – test was conducted to determine differences between the FITBIT and control group HAP scores. A repeated measures ANOVA was run to determine a difference in steps across time for the FITBIT group. Post hoc tests were run using Bonferoni to show the difference in steps between weeks. Significance levels of these tests were set at $\alpha = 0.05$.

The hypothesis was that the independent *t* – test would show no difference between group's pre – test, and a difference between groups post – test scores. A difference seen between groups post – test scores would have shown that one of the groups changed their physical activity levels. This was not the case. Results from the *t* –test showed no significance difference between groups for MAS – pre when equal variances were assumed, ($F = 3.36$, $t = 0.824$, $df = 17$, $p = 0.42$). Equal variance was assumed when the Levene's test was not significant, meaning the two groups show equal variance. Equal variances were not assumed when the Levene's test was significant, meaning there was significant variance between groups (Morgan, Leech, Goeckner, & Barrett, 2011). There was no significant difference seen in MAS – post either, when equal variances were not assumed, ($F = 46.94$, $t = 1.524$, $df = 8.35$, $p = 0.16$). AAS – pre showed no significant differences when equal variances were assumed, ($F = 3.21$, $t = 0.62$, $df = 17$, $p = 0.54$). AAS – post showed no significant difference when equal variances were not assumed, ($F = 46.83$, $t = 1.47$, $df = 8.34$, $p = 0.179$). Therefore, there was no significant difference seen between groups for either MAS or AAS scores, pre or post study. This means that the groups were similar at the beginning and at the end. Refer to Table 3 for the results of the independent *t* – test.

A repeated measures ANOVA was then conducted to determine if there was a main effect for time, a main effect for group, or an interaction of time by group. The main effect for time revealed whether there was any significant change, averaged over time, across both groups. The main effect for group tested whether, on average, one group's physical activity levels were different than the other group. The interaction of time by group was used to identify any significant difference between groups across time. There was no significant main effect for time F (1, 17) = 0.861, p = 0.367, or for group, F (1, 17) = 3.069, p = 0.98. There was also no significant interaction of time by group F (1, 17) = 0.783, p = 0.389. Table 4 shows the non – significant findings for this test.

Table 3

Independent T-test For FITBIT and Control Group MAS and AAS Scores (N = 19)

Variable	*t*	*df*	*F*	*p*
MAS – Pre	0.82	17	3.36	0.42
MAS – Post	1.52	8.35	46.94	0.16
AAS – Pre	0.62	17	3.21	0.54
AAS – Post	1.47	8.34	46.83	0.18

Note. $p \leq 0.05$.

Table 4

Repeated Measures Analysis of Variance of Main Effect for Time, Group, and Interaction of Time (N=19)

Variable	*df*	*MS*	*F*	*p*
Time	0.861	707.935	0.861	0.367
Group	0.783	643.935	3.069	0.098
Interaction of Time by Group	.783	822.508	0.783	0.389

Note. Significance was set at $^*p \leq 0.05$.

Another repeated measures ANOVA was run to determine if there was a significant change in steps taken across time. The results of this test revealed that steps taken by the FITBIT group were not significantly different from week one to week six, p = 0.41. Refer to Table 5 for the difference in steps across time.

Table 5

Difference in Steps Across Time Repeated Measures ANOVA

Variable	Mean Square	df	F	Significance
Steps	5.46×10^{8}	5	1.05	0.41

Note. Significance was set at $*p \leq 0.05$.

Because there was no significant change in steps taken from week one to week six, a Bonferoni post hoc analysis was run to determine if there was a significant difference between weeks. The only significant difference was seen between week three and week five. The mean difference between these two weeks was 6782 ± 2,725 steps, ($p = 0.047$). The step count for week three was 44,027 ± 19,066 and the step count for week five was 37,245 ± 19,893. There were less steps taken during week three than week five, but more steps taken during week four than week four or week five. Refer to Table 6 to see post hoc analysis results.

Table 6

Difference in Steps Across Time Post - hoc Analysis

Variable - Steps	Mean Difference	SE	Significance
Week 1 – 2	14406.43	19978.54	0.50
Week 1 – 3	17342.86	17313.45	0.36
Week 1 – 4	9034.71	21985.74	0.70
Week 1 – 5	24124.86	17558.95	0.22
Week 1 – 6	21536.00	20101.94	0.33
Week 2 – 3	2936.43	5272.99	0.60
Week 2 – 4	-5371.71	8707.59	0.56
Week 2 – 5	9718.43	4453.61	0.072
Week 2 – 6	7129.57	3349.08	0.08
Week 3 – 4	-8308.14	6833.34	0.27
Week 3 – 5	6782.00	2725.60	0.047*
Week 3 – 6	4193.14	3638.29	0.29
Week 4 – 5	15090.14	7578.81	0.09
Week 4 – 6	12501.29	7722.35	0.16
Week 5 – 6	-2588.86	3606.26	0.50

Note. Significance was set at *$p \leq 0.05$.

Due to the small sample size and non-significant results, effect sizes were calculated using the following formula: (Posttest mean – pretest mean) ÷ pretest standard deviation. . Effect sizes were calculated from the means and standard deviations in Table 1. Calculating effects sizes allows the FITBIT and the control group's HAP scores to be compared (Miller, 2012). The effect size for the FITBIT group MAS was $d = 0.325$. The control group MAS was $d = 0.587$. The FITBIT AAS effect size was $d = 0.054$. The control group AAS effect size was 0.565The FITBIT group had a smaller effect size than the control group for both the MAS and the AAS scores. The FITBIT group's effect was small and the control group's affect was moderate according to Cohen (1988). As already mentioned, results of the pre- and post- means from the HAP are displayed in Figure 1 and Figure 2.

CHAPTER FIVE: DISCUSSION

Review of Results

The goal of this research was to determine if the FITBIT accelerometer caused those wearing it to increase their physical activity levels. Physical activity levels between the FITBIT group and the control group were examined to discover if there were any differences between wearing and not wearing the device.

Subjects were recruited from the UCO Employee Wellness Program, the UCO Wellness Center staff, and Professors in the Kinesiology Department. Ten subjects were chosen to wear a FITBIT accelerometer for six weeks while 9 subjects made up the control group and did not wear a device. Data, including steps taken, was collected from the FITBIT group each week from an additional survey (Appendix D), created for the purpose of this research. All subjects received a HAP survey pre – and post – study. The HAP tested physical activity levels. Statistical tests were then run to determine if the FITBIT group walked more and had a higher activity level over the six-week time span compared to the control group.

The primary objective was tested using a repeated measures ANOVA to determine if physical activity (steps) changed from week one to week six in the FITBIT group. The repeated measures ANOVA revealed that there was no significant change in physical activity (steps) across time, ($F = 1.052$, $df = 5$, $p = 0.406$). The only significant difference was seen between week three and week five, ($p = 0.047$). This significant difference is thought to be from a participant or two not wearing the FITBIT for part of week five. Feedback was given that included forgetting to wear the FITBIT, losing it for a short time, or sending it through the washing machine. It does not appear that the use of the FITBIT caused this difference because according to the descriptive statistics week three showed a higher mean number of steps taken than week five. Although, obtaining significant results was not expected due to the very small sample size, an increase in physical activity, or a significant difference between group's physical activity levels was expected. Williams, Matthews, Rutt, Napolitano, Bess, (2008) conducted a study using pedometers, which showed that walking with a pedometer increased physical activity levels by 27% from baseline. Baker et al. (2008) also demonstrated that the use of a pedometer increased steps per day by 47% from baseline. The pedometer is not the same as a FITBIT accelerometer, but because the FITBIT has more features to offer than a basic pedometer the belief was the FITBIT would also show increases in physical activity levels.

An independent *t* – test was also conducted to determine if the FITBIT had higher activity scores than the control group post – test. It was important that the two groups had similar pre – test activity scores from the HAP manual because that would mean they had similar activity levels and any changes in activity post – treatment could be seen. There was no significant difference seen in pre or post – test scores. The independent *t* – test showed non – significant MAS – post ($F = 46.94$, $t = 1.524$, $df = 8.35$, $p = 0.16$) and non – significant AAS – post ($F = 46.83$, $t = 1.47$, $df = 8.34$, $p = 0.179$). This test's results mean that the two groups were similar pre and post study. The FITBIT was no different than the control group after six weeks of wearing a FITBIT accelerometer. These results do not agree with previous research (Bravata et al., 2007.; Arazia, Hewes, Gashetewa, Vella, & Burge, 2006). A meta – analysis by Bravata et al. (2007) found that the use of pedometers led to significant increases in physical activity. In their analysis, blood pressure and body mass index also improved (Bravata et al., 2007).

Main effect for time, main effect for group, and interaction of time by group were assessed using a repeated measures ANOVA. No significance was found for any of the three. Main effect for time had a non – significant value of $p = 0.367$, which means that there was no significant change in physical activity averaged over time across both groups. The main effect for group had a non – significant value of $p = 0.098$, which means that one group did not significantly increase or decrease physical activity levels more so than the other. Interaction of time by group had a non – significant value of $p = 0.389$, which means that there was no significant difference between group's physical activity levels across time.

The descriptive statistics showed that both the FITBIT and the control group had a decrease in the activity scores from pre – test to post – test. It can be seen from the mean MAS and AAS scores in Table 1 that the FITBIT group had less of a decrease. Because significance was not demonstrated in the results, effect sizes were calculated from the means in Table 1. Effect sizes provide magnitude of the difference between the independent variables and the dependent variable. The FITBIT had a smaller effect size than the control group for both the MAS and the AAS. The small effect sizes for the FITBIT group was 0.325 for MAS and 0.0539 for AAS. The moderate or typical effect size for the control group was 0.587 for MAS and 0.565 for AAS. None of the results were significant, but the FITBIT group had a smaller than typical effect size compared to the control group, and wearing the FITBIT may lessen the increase of physical inactivity.

The number of steps taken by the FITBIT group was much higher week one than week six. Steps for week one to week six respectively were 61,370 ± 49,102, 46963 ± 14,678, 44,027 ± 19,066, 52,335 ± 33,214, 37,245 ± 19,893, 39,834 ± 15,747. Table 2 shows the steps taken each week by the FITBIT group. A possibility for the decrease was that earlier in the semester it may have been easier to adhere to one's personal activity goals, but as it got later in the semester and people get busier, staying active became more difficult. Another possibility was that the newness and excitement for the FITBIT could have worn off as the weeks went by.

No increases in physical activity were observed, but the FITBIT group in this research had a lower effect size than the control group. The small effect size of the FITBIT group may have led to physical activity levels being more affected or having less of a reduction than the control group's physical activity levels. The control group could have experienced more of a decrease in physical activity levels because they were not wearing the FITBIT. Chan, Ryan, & Tudor – Locke (2004) found improvements in physical activity, in waist circumference, and resting heart rate when a physical activity intervention using pedometers was implemented. Araiza, Hewes, Gashetewa, Vella, & Burge (2006) also found that the active group in their study increased physical activity by 69%, and resting energy expenditure also increased after a six week study. Also, Bravata et al. (2007) and Richardson et al. (2008) both found that the use of pedometers led to health benefits. The current study did not show any improvements in step count or physical activity, but the effect size of the FITBIT group was lower compared to the control group. The control group was not being interacted with each week. The FITBIT group was receiving a survey once a week to log their FITBIT data. The decrease seen in the control group's activity levels could have been because of the demands being placed on the subjects as the semester drew on, or because of the lack of compliance to personal goals. Not wearing a FITBIT may lead to greater reduction in physical activity, potentially leading to the belief that the FITBIT could affect obesity.

Anecdotal feedback regarding FITBIT accelerometer included that the FITBIT made the subjects more aware about how inactive they were; the subjects enjoyed using the device; some of them mentioned the desire to walk more or attempt to be more active; and some even purchased a FITBIT after the study was completed. Comparing these statements to the actual data reveals that there were several limitations to this study.

The FITBIT accelerometer has much more to offer than a basic pedometer, such as measuring steps, calories burned, miles traveled, flights of stairs climbed, sleep, and an integrated website to log all of the data. Fulk, Combs, Danks, Nirider, Raha, & Reisman (2013) found the FITBIT to be accurate in measuring steps of stroke and traumatic brain injury subjects, when compared with the StepWatch Activity Monitor. Noah, Spierer, Gu, Bronner (2013) found the FITBIT and the FITBIT Ultra to be reliable and valid when measuring energy expenditure when not walking at an incline. The authors discovered the two FITBIT devices to also be reliable and valid when measuring step counts. The FITBIT is a non – expensive tracking device that has been found to be valid and reliable (Noah et al., (2013). The current study was not able to replicate such benefits of the FITBIT accelerometer, however the participants reported favorable use.

Limitations

The FITBIT accelerometer did not improve steps or physical activity measured in this study over a six – week time span. Limitations to this study were that accelerometers typically measure weight bearing exercise movement. Schmidt et al. (2012) suggested that non-weight bearing exercise or low – impact movement might be more advantageous for obese individuals, which may not have been captured with this device. Another limitation of this study was compliance on where the accelerator was worn. Accuracy of the FITBIT between subjects could have been compromised if not worn on the hip as suggested (Graser, Pangrazi, & Vincent, 2007). The small sample size may also have limited the inferences that would be gathered from this research. There was a small response to the recruitment email blast sent out and there was funding for only 10 FITBITS. The subjects recruited for this study were educated about physical activity, and some of them were already somewhat active individuals on a college campus. This study could have seen different results if subjects were not from a university setting or if previously sedentary individuals were used. The desire of the subjects to change personal activity levels could have been of importance in this study as well. Other factors that may have affected the results were forgetting to wear the FITBIT, placing the FITBIT in the washing machine, and misplacing the FITBIT, all of which were reported by participants.

Conclusion

In conclusion, use of a FITBIT accelerometer did not increase physical activity levels over a six – week time span. Although, there was no significant difference found in steps taken or physical activity from pre – to post – test, the FITBIT group did have a low or more desirable effect size. Because the FITBIT group had a low effect size and the control group had a moderate effect size, the use of the FITBIT could affect physical activity levels. More research needs to be performed using the FITBIT, for example performing this study with a larger sample size and over a longer period of time, but use of the FITBIT could be a potential tool to help decrease obesity.

Future Recommendations

Future research should (1) use a larger sample size over a longer time period of time (2) perform this study with a group of subjects that desire to increase physical activity or lose weight, and (3) use the FITBIT in a group of subjects that are not already educated about physical activity or already active so an education component about physical activity recommendations and the uses of the FITBIT could be added.

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Appendix A

Institutional Review Board Application

UNIVERSITY OF Central Oklahoma

UCO IRB Number ______________
For Office Use Only

INSTITUTIONAL REVIEW BOARD
APPLICATION FOR REVIEW OF HUMAN SUBJECTS RESEARCH
(Pursuant to Title 45-Code of Federal Regulations-Part 46)

Date: April 30, 2012

Title of Project: Does the Use of the FITBIT Accelerometer Increase Physical Activity Levels in Overweight or Obese Individuals.

Principal Investigator(s): Ryan Westrup

Name of Primary PI: Ryan Westrup

Title Mr. **Department:** Kinesiology & Health St **College:** Jackson College

Campus Box: ______ **Campus Phone:** ______ **PI Status:** Graduate Student

Email (UCO Preferred): Rwestup@uco.edu

Mailing Address: 1125 NW 49th St.

Daytime Phone: (405) 659-4072

Name of Co-PI: Gregory Farnell

Title Dr. **Department:** Kinesiology & Health St **College:** Jackson College

Campus Box: 189 **Campus Phone:** 974-5304 **Co-PI Status:** Faculty

Email (UCO Preferred): Gfarnell@uco.edu

Mailing Address: 100 North University Dr. Box 189

Daytime Phone: Edmond, OK 73034

Funding: Thesis

1. Describe the purpose/hypothesis of the project or the research problem in enough detail that we can ascertain what the project is about. Describe why it is being done and the importance of the knowledge expected to result.

The purpose of this research is to evaluate the effectiveness of the Fitbit Accelerometer. The Fitbit will be used to measure the amount of physical activity performed by overweight and obese subjects within the UCO Employee Wellness Program. *A FITBIT accelerometer is a device that measures step counts like a pedometer, measures calories burned throughout the day, tracks sleep patterns and shows how active the person wearing it is. The accelerometer also can be connected to the computer and track progress over time. It can be linked to the website LOSEIT to not only track activity, but how the activity affected the calories taken in and expended. Devices similar to the FITBIT have been used to measure activity levels in certain populations to show how active those populations are in particular environments, or under certain circumstances. The use of the FITBIT in this study will help determine if its use will not only be able to measure how active a particular population is, but how active that population is when wearing the FITBIT, compared to not wearing the FITBIT.*

Accelerometers are considered an appropriate and safe means of measuring physical activity (Mathie, Coster, Lovell, & Celler, 2004)The hypothesis is the accelerometers will increase amounts of physical activity. This study is being performed to help find a factor that may increase motivation to be active. The importance of this knowledge is in efforts to increase physical activity levels that may lead to a decrease in the obesity epidemic.

2. Describe the subjects needed for this project and, at a minimum, provide the following information:

a. The type of individuals needed as subjects:

Any UCO Student
Students in investigator(s) class
Other (describe below)

Staff and Faculty from the Employee Wellness Program at the University of Central Oklahoma.

b. The procedures used to recruit subjects:

Advertisement (flyer)
Email blast
Direct/targeted email
Online posting
In-class announcement
Other (please describe below)

An email will be sent to those individuals in the Employee Wellness Program. All participants in the program will be asked to participate in the research. Depending on how many participants volunteer, ten will randomly receive a FITBIT accelerometer while the others will be part of the control group.

c. Site of recruitment of subjects:
Email

d. Do you plan to recruit subjects from outside businesses, schools, or other organizations?

○ Yes ◉ No

If "yes," attach a copy of the required written permission (email or letter) from the appropriate person authorized to grant such permission.

e. Do you plan to recruit from specific classes?

○ Yes ◉ No

If "yes," attach a copy of the required written permission (email or letter) from the course instructor.

If instructor is a PI or Co-PI, describe measures to minimize undue influence or coercion during recruitment:

f. Do you plan to recruit subjects via email or conduct any of your research via the internet?

◉ Yes ○ No

If "yes," you must give a copy of your IRB application to the UCO Office of Information Technology for authorization. This may be done simultaneous to ORC submission.

g. Do you intend to use an oral or written script or any materials (flyer, letter, advertisement, announcements) as part of the recruitment of research subjects?

◉ Yes ○ No

If "yes," attach a copy of the these scripts/documents.

3. **a. What is the maximum number of subjects you expect to participate?**

20

Provide a justification for that number, i.e. effect size, variability.

300 subjects are needed for this research according to a power analysis. ($\alpha = 0.05$, $1-\beta = 0.80$, Cohen's $d = 0.34$; (Godin, Belanger-Gravel, Amireault, Vohl, and Perusse, (2011); Cohen, 1988). However available resources only allow for 10 Fitbits.

b. Will you be specifically including or <u>targeting</u> any of the following groups for research subjects? (Select all that apply)

Minors (<18 years old)
Cognitively Impaired
Pregnant Women
Prisoners
Native Americans
Seniors (65 or older)
None of the Above

If any were selected, please explain the additional safeguards used to protect the welfare of these vulnerable groups.

4. **a. Describe the experimental design, i.e. group assignments, measurements or observations of subjects or their environments, and explain what subjects will experience.**

Upon recruitment the participants will then fill out an informed consent form. Depending on how many participants volunteer to be a part of this research, ten subjects will wear the FITBIT accelerometer, while the remaining subjects will be the control group. Both groups will complete the EWP with no other treatment other than wearing the FITBIT. All exercise programs will be developed and monitored by the fitness coaches overseeing each client. The EWP is an eight-week program. Each of the subjects will complete the Human Activity Profile (HAP) survey to determine current activity status. The HAP was developed by Daughton, et al. (1988). The HAP is a 94 question survey that was created to assess changes in physical activity. These individuals will complete the Human Activity Profile survey before beginning The UCO Employee Wellness Program (EWP). This will be completed with their fitness coach, to determine their current activity level, three weeks into their program, and at the end of 6 weeks.

The survey platform to be used is the Qualtrics Survey Suite. The HAP manual survey has been created within this platform. There is a "Submit" button after completing the survey that will automatically send the survey to a holding file retrievable only by the PI.

b. Will you be using questionnaires, surveys, tests or other written instruments?

(●) Yes ( ) No

If "yes," attach a copy of these scripts/documents.

c. Where will data actually be collected (i.e. room number, place)?
Electronically. A digital version of the survey will be emailed to the participants

d. Will you be using existing data?

( ) Yes (●) No

If "yes," are data de-identified?

( ) Yes (●) No

If "yes," is database available to the public?

( ) Yes (●) No

e. Will tissue or blood samples be collected for data?

( ) Yes (•) No

If "yes," explain the procedures for disposal.

f. Projected start date:

(•) Upon IRB Approval ( ) Other (specify)

Projected end date: Dec 7, 2012

5. Will medical clearance be necessary for subjects to participate because of tissue or blood sampling, or administration of food or drugs, or physical exercise conditioning?

( ) Yes (•) No

If "yes," explain how the medical clearance will be obtained.

6. Does the research involve any of the following? (select all that apply)

Physical stress including exercise or exertion
Psychological or social stress
Exposure to radiation
Legal risk
Economic risk
Exposure to infectious disease
Personal or sensitive information about subject or family
Offensive, threatening, or degrading materials
Use of confidential records (medical or educational)
None of the above
Other (explain below)

Physical activity will be performed as determined by the exercise programs set up by their individual fitness coaches. This risk is assumed outside the scope of this study.

For each item selected:

a. Describe the degree of risk or harm.
The degree of risk is minor unless there is cardiovascular disease, metabolic disease, or several risk factors regarding health factors such as family history, metabolic disease, and high blood pressure. There is no known degree of risk for wearing the FITBIT accelerometer.) The degree of risk associated with exercise is minor unless there is cardiovascular disease, metabolic disease, or several risk factors regarding health factors such as family history, metabolic disease, and high blood pressure. There is no known additional degree of risk for wearing the FITBIT accelerometer. 6c) The initial risk will be minimized by having a doctor's permission to begin exercise only if needed. This will be decided by the fitness coaches and will be outside of the scope of this research. The fitness coach for each participant will design a personal exercise programs to meet each individual's goals. Each fitness coach will monitor his or her EWP participant's progress. Recruiting subjects in a private setting will minimize the risks associated with body weight sensitivity.

b. Justify why the risk is necessary.
The risk is necessary so that those that are overweight and have health risks associated with being overweight can begin to lose weight.

c. Explain how the risk will be minimized.
The risk will be minimized by having a doctor's permission to begin exercise only if needed. This will be decided by the fitness coaches and will be outside of the scope of this research. The fitness specialists for each subject will design personal exercise programs to meet each individuals goals. Each fitness coach will monitor their employee wellness program participant's progress.
The risks associated with the body weight will be minimized by recruiting subjects in a private setting.

7. Will the subjects be deceived or misled in any way?

○ Yes ◉ No

If "yes," describe the deception or omission, justify the necessity, and explain how and when subjects will be debriefed (attach script if used).

8. Will any inducements be offered to the subjects for their participation?

○ Yes ◉ No

a. If "yes," please describe the inducements.

○ Course Credit Option

○ Extra Credit

○ Money (specify amount) ____________

◉ Other (specify below)

Can't unselect "other"

b. If extra course credit is offered to research subjects who are students, what alternative means of obtaining additional credit are available to those students who do not wish to participate in the research project?

9. a. How will consent be obtained?

Select one:

Subject will sign consent form

Attach a copy of the consent form or information sheet (see Informed Consent Form guidelines at www.uco.edu/academic-affairs/research-compliance).

**Submit a Waiver of Documentation of Informed Consent (also available at our website) with your application if there is no signed consent form.*

b. Who will be consented? (select all that apply)

Participant
Child (<18)
Parent/Legal Guardian

c. Specify where consenting will occur:

Upon recruitment at the UCO Wellness Center Lab

d. Is a Waiver of Informed Consent requested? (If approved, informed consent will not be obtained. This is different from the *Waiver of Documentation of Informed Consent.*)

○ Yes ◉ No

e. Will you obtain a Certificate of Confidentiality?

○ Yes ◉ No

If "yes," please provide a copy once obtained.

10. **a. Will any aspect of the data be made a part of a record that can be identified with the subject?**

○ Yes ◉ No

If "yes," describe and justify the necessity.

b. Will a master code sheet be kept for purposes of identity security?

◉ Yes ○ No

If "yes," explain the process and protection of code sheets for identity.

A code sheet will identify each of the subjects in a way that the name and personal weight and physical activity participation cannot be identified.

c. Does the study involve?

Audio taping of the subjects
Video taping of the subjects
Taking photographs of the subjects
Digital Imaging of the Subjects
None of the above

If "yes," explain necessity and protections of anonymity. Attach a copy of release or permission form. Describe the storage, disposition, and security provisions taken to protect recordings/photos.

d. Will subjects be identifiable in these recordings?

○ Yes ◉ No

If "yes," explain why this is necessary.

11. Please describe the steps you will take to ensure the confidentiality of the data you collect by answering the following questions:

a. How will the data be reported or disseminated?

Group/aggregate

b. Where (specify office #) and how will the data be securely stored?

Faculty mentors office (CTL 225)

c. Who will have access to the data and/or password?

Both

d. Who will be responsible for secure storage?

Both

e. What will the length of time each of the following will be kept?

Paper data documents: 3 year

Electronic data documents: 3 year

Signed Informed Consent Forms
(Federal regulations require a minimum of 3 years): 3 years

f. How will the data be destroyed? Be sure to specify for electronic data, paper data, and code sheets (as relevant).

Paper data and code sheets will be shredded by the Co-PI and the electronic data will be deleted from the storing device.

12. Will the fact that a subject did or did not participate in a specific experiment or study be made a part of any record available to supervisor, teacher, or employer?

○ Yes ◉ No

If "yes," describe and justify the necessity.

13. Describe the benefits of participation for subjects (if any). [If there is none, say so.]
The benefits could potentially be any health benefits associated with increased physical activity such as decreased blood pressure and fat mass, to name a few.

14. Describe the benefits of your study to society.
Benefits of this study to society could be determining a possible motivator for increasing physical activity.

REQUIRED AUTHORIZATION SIGNATURES

SIGNATURE/AFFIRMATION/REPRESENTATION OF PRINCIPAL INVESTIGATOR(S):

(Primary PI must read and initial by hand at each of the below.)

1. ________ This application represents an accurate and complete description of my proposed research project.

2. ________ I agree to provide the proper surveillance of this project to ensure that the rights and welfare of the human subjects are properly protected.

3. ________ I agree to comply fully with any requirements made by the UCO IRB.

4. ________ The human contact portion of my (our) research will not begin until the UCO IRB has given its written approval.

5. ________ Any additions or changes after the project has been approved will be submitted to the IRB for approval prior to implementation.

____ ____________________

Signature of Primary Principal Investigator **Date**

____ ____________________

Signature of Co-Primary Principal Investigator **Date**

If additional Co-PIs are associated with this project, please attach an additional sheet with name, signature, and date.

I have reviewed this Application for Review of Human Subjects Research, and, subject to approval by the UCO Institutional Review Board, authorize the Principal Investigator(s) to conduct this research. My signature acknowledges that I am aware of this project.

Name of Department Chair: Dr. Debbie Traywick Department:KHS

____ ____________________

Signature of Department Chair **Date**

Name of College Dean: Dr. James Machell College: CEPS

Signature of College Dean

Date

UCO Office of Information Technology
(for all e-based research)

Name of UCO IT Representative

Signature of UCO IT Representative

Date

CHECKLIST FOR IRB APPLICATION SUBMISSION:

Please mark which documents you have attached to your IRB Application:

	Attached	Not Applicable
Research Proposal (i.e. thesis proposal, RCSA application, grant proposal)	◉	○
Recruitment Script/documents	◉	○
Informed Consent Form (or Waiver)	◉	○
Instrument(s) (questionnaires, surveys, etc.)	◉	○
Written authorization--classes, organizations	○	◉
Protecting Human Research Participants (PHRP) Training Certificate(s)	◉	○
Have you submitted your application to the Office of Information Technology for approval?	◉ Yes	○

CONTACT INFORMATION FOR QUESTIONS OR CONCERNS:

Dr. Jill A. Devenport
Chair, UCO Institutional Review Board
Director, Office of Research Compliance
Academic Affairs
405-974-5479
irb@uco.edu

Submit **one hard copy** of your application, with all required signatures to:

UCO-IRB Office
ADM 216
Edmond, OK 73034
405-974-5497
405-974-3825 (fax)

AND

Submit **one electronic file** without signatures to irb@uco.edu.

Please note your application will not be processed until the original application with all required signatures is received.

APPENDIX A

List all study personnel who will interact with subjects or private, identifiable data

Research Staff (Last, First)	Degree (B.A., Ph.D...)	Affiliation (UCO or Other)	Role in Research (Data Collection, Conduct Interviews, etc.)	PHRP* Training Certification Date	UCO Email Address
Westup, Ryan	B.S	UCO	PI; data collection	8/26/11	Ryan.westrup@gmail.com
Farnell, Greg	Ph.D	UCO	faculty mentor	12/13/11	gfarnell@uco.edu

*Protecting Human Research Participants (PHRP) is a National Institutes of Health on-line training course as required by the Department of Health and Human Services regulations. Visit http://phrp.nihtraining.com/users/login.php. Copies of Certificates of Completion should be attached to the application. Recertification is required every two years and CITI certification can be substituted.

APPENDIX B

Required for Student Investigators

Purpose of project: Masters Thesis

Student qualification to conduct research: (Select all that apply)

Currently in or completed research methods course
Protecting Human Research Participants (PHRP) training**
Prior experience as an independent or supervised Research Assistant
Other (specify below)

Faculty Oversight Assurance

I have reviewed and approved this application and I agree to ensure that all UCO IRB regulations will be complied with.

Name of Faculty Member: Greg Farnell

Signature of Faculty Member: ______________________________

Faculty Mentor

* See Student Research Guidelines on our website: www.uco.edu/academic-affairs/research-compliance.

*Protecting Human Research Participants (PHRP) is a National Institutes of Health on-line training course as required by the Department of Health and Human Services regulations. Visit http://phrp.nihtraining.com/users/login.php. All personnel working with subjects or identifiable data must be certified and should attach copies of certificates (see Appendix A).

UNIVERSITY OF CENTRAL OKLAHOMA

INFORMED CONSENT FORM

Research Project Title: Does the Use of the FITBIT Accelerometer Increase Physical Activity Levels.

Researcher (s): Ryan Westrup

A. Purpose of this research:

B. Procedures/treatments involved:

C. Expected length of participation:

D. Potential benefits:

E. Potential risks or discomforts;

F. Medical/mental health contact information (if required):

G. Contact information for researchers:

H. Contact information for UCO IRB:

I. Explanation of confidentiality and privacy:

J. Assurance of voluntary participation:

AFFIRMATION BY RESEARCH SUBJECT

I hereby voluntarily agree to participate in the above listed research project and further understand the above listed explanations and descriptions of the research project. I also understand that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty. I acknowledge that I am at least 18 years old. I have read and fully understand this Informed Consent Form. I sign it freely and voluntarily. I acknowledge that a copy of this Informed Consent Form has been given to me to keep.

Research Subject's Name: ______________________________

Signature: ______________________________

Date: ____________________

Appendix B

Informed Consent Form

UNIVERSITY OF CENTRAL OKLAHOMA

INFORMED CONSENT FORM

Research Project Title: Does the Use of Accelerometers Affect Physical Activity Levels

Researcher (s): Ryan Westrup

A. Purpose of this research: The purpose of this research is to determine if a FITBIT accelerometer has an effect on physical activity. FITBIT accelerometers are physical activity monitors that measure steps taken, flights of stairs climbed, calories burned, and sleep efficiency.

B. Procedures/treatments involved: The procedures and treatments of this study will include subjects in the treatment group to be randomly assigned to receive an accelerometer. Both the control group and the treatment group will have been assigned a fitness specialist, prior to the beginning of this research, to prescribe exercise that matches each individual's goals. The current study has nothing to do with the actual exercise program each participant is doing; the participant's fitness coach sets this. The current study is only interested in whether the use of a FITBIT has an effect on physical activity levels. EWP participants whom volunteer for this research will randomly be assigned into two groups, whether they receive a FITBIT or not. Both the control group and the treatment group will have been assigned a fitness coach, prior to the beginning of this research, to prescribe exercise that matches each individual's goals. The purpose of this research is to determine if physical activity levels are affected when a FITBIT accelerometer is worn. It is a small unit that is worn on a person's belt line. FITBIT accelerometers are physical activity monitors that measure steps taken, flights of stairs climbed, calories burned, and sleep efficiency. Prior to beginning this research the subjects will complete the Human Activity Profile survey, then at three weeks and after the sixth week. This survey will be administered through the Qualtrics Survey Suite platform. After completion of the survey the subjects will be able to click a submit button and the results will be pooled together. None of the subjects will be identifiable through this survey or its results.

C. Expected length of participation: This study is planned to last six weeks in length.

D. Potential benefits: The benefits of this study could be weight loss and increased motivation to be active. Long term effects could be financial medical savings, increased quality of life, and increased lifespan.

E. Potential risks or discomforts: Potential risks could be fatigue and loss of interest due to exercise treatment. Other risks could be increased heart rate and blood pressure due to exercise participation. Any prescreening will be taken care of by the fitness coaches. The fitness coaches will be in charge of any program intervention. Any screening measure or exercise program is outside of the scope and control of this research project. This research will only involve having certain participants wear a FITBIT, or not, as they are involved in the program designed and monitored by their EWP fitness coach.

F. Medical/mental health contact information (if required): The contact information for the Mercy Health Clinic is (405) 216-8960.

G. Contact information for researchers: Ryan Westrup (405) 659-4072

Ryan.westrup@gmail.com

Greg Farnell (405) 974-5304 Gfarnell@uco.edu

H. Contact information for UCO IRB: Jill A. Devenport or Ms. Pam Lumen (405) 974-5497 or (405) 974-5479

irb@uco.edu

I. Explanation of confidentiality and privacy: All subjects will be randomly assigned a number that they will be used to identify them. All data collected will be labeled with their number instead of their name. Data will be locked and secured in faculty mentors office in the University of Central Oklahoma Center for Transformative Learning. All informed consent forms will be kept for three years following the experiment.

J. Assurance of voluntary participation: Participation in this study is voluntary. Refusal to participate or not complete study will not result in any type of penalty or loss of benefits.

AFFIRMATION BY RESEARCH SUBJECT

I hereby voluntarily agree to participate in the above listed research project and further understand the above listed explanations and descriptions of the research project. I also understand that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time without penalty. I acknowledge that I am at least 18 years old. I have read and fully understand this Informed Consent Form. I sign it freely and voluntarily. I acknowledge that a copy of this Informed Consent Form has been given to me to keep.

Research Subject's Name: _____

Signature: ____ Date _____

Appendix C

Human Activity Profile Survey

Dear HAP requestor,

We are sending you a copy of the HAP and some abbreviated information from our manual. You are granted permission to use the scale in your research studies. However, you are not given permission to re-transmit this scale to other people.

Thank you for your interest in the HAP.

Sincerely,

David Daughton, M.S.
Behavioral Researcher
University of Nebraska Medical Center

DD/sm

HUMAN ACTIVITY PROFILE

Instructions

Please check each activity according to these directions:

Check Column 1 ("Still Doing This Activity") if:

You completed the activity unassisted the last time you had the need or opportunity to do so.

Check Column 2 ("Have Stopped Doing This Activity") if:

You have engaged in the activity in the past, but you probably would not perform the activity today even if the opportunity should arise.

Check Column 3 ("Never Did This Activity") if:

You have never engaged in the specific activity.

Human Activity Profile Test

By David M. Daughton and A. James Fix, Ph.D.

Name__________________ Age____ Male____ Female____ Smoker_____ Non-Smoker____
(Optional)
Occupation______________________ Married____ Single____ Separated/ Divorced______

Any chronic ailments? Yes____ No____ Highest school grade completed_______________

	Never Did This Activity	Still Doing This Activity	Have Stopped Doing This Activity
1. Getting in and out of chairs or bed (without assistance)			
2. Listening to the radio			
3. Reading books, magazines or newspapers			
4. Writing (letters, notes)			
5. Working at a desk or table			
6. Standing (for more than one minute)			
7. Standing (for more than five minutes)			
8. Dressing or undressing (without assistance)			
9. Getting clothes from drawers or closets			

10. Getting in or out of a car (without assistance)			
11. Dining at a restaurant			
12. Playing cards/table games			
13. Taking a bath (no assistance needed)			
14. Putting on shoes, stockings or socks (no assistance needed)			
15. Attending a movie, play, church event or sports activity			
16. Walking 30 yards (27 meters)			
17. Walking 30 yards (non-stop)			

Human Activity Profile Test

Activity	Still Doing This Activity	Have Stopped Doing This Activity	Never Did This Activity
18. Dressing/undressing (no rest or break needed)			
19.Using public transportation or driving a car (100 miles or less)			
20. Using public transportation or driving a car (99 miles or more)			
21. Cooking your own meals			
22. Washing or drying dishes			

23. Putting groceries on shelves			
24. Ironing or folding clothes			
25. Dusting/polishing furniture or polishing cars			
26. Showering			
27. Climbing six steps			
28. Climbing six steps (non-stop)			
29. Climbing nine steps			
30. Climbing 12 steps			
31. Walking ½ block on level ground			
32. Walking ½ block on level ground (non-stop)			
33. Making a bed (not changing sheets)			
34. Cleaning windows			
35. Kneeling, squatting to do light work			
36. Carrying a light load of groceries			
37. Climbing nine steps (non-stop)			

Human Activity Profile Test

Activity	Still Doing This Activity	Have Stopped Doing This Activity	Never Did This
38. Climbing 12 steps (non-stop)			
39. Walking ½ block uphill			
40. Walking ½ block uphill (non-stop)			
41. Shopping (by yourself)			
42. Washing clothes (by yourself)			
43. Walking one block on level ground			
44. Walking two blocks on level ground			
45. Walking one block on level ground (non-stop)			
46. Walking two blocks on level ground (non-stop)			
47. Scrubbing (floors, walls or cars)			
48. Making beds (changing sheets)			
49. Sweeping			
50. Sweeping (five minutes non-stop)			
51. Carrying a large suitcase or bowling (one line)			

52. Vacuuming carpets			
53. Vacuuming carpets (five minutes non-stop)			
54. Painting (interior/exterior)			
55. Walking six blocks on level ground			
56. Walking six blocks on level ground (non-stop)			
57. Carrying out the garbage			

Human Activity Profile Test

	Still Doing This Activity	Have Stopped Doing This Activity	Never Did This Activity
58. Carrying a heavy load of groceries			
59. Climbing 24 steps			
60. Climbing 36 steps			
61. Climbing 24 steps (non-stop)			
62. Climbing 36 steps (non-stop)			
63. Walking one mile			
64. Walking one mile (non-stop)			
65. Running 110 yards (100 meters) or playing softball/baseball			

66. Dancing (social)			
67. Doing calisthenics or aerobic dancing (5 minutes non-stop)			
68. Mowing the lawn (power mower, but not a riding mower)			
69. Walking two miles			
70. Walking two miles (non-stop)			
71. Climbing 50 steps			
72. Shoveling, digging or spading			
73. Shoveling, digging or spading (five minutes non-stop)			
74. Climbing 50 steps (non-stop)			
75. Walking three miles or golfing 18 holes without a riding cart			
76. Walking three miles (non-stop)			
77. Swimming 25 yards			

Human Activity Profile Test

	Still Doing This Activity	Have Stopped Doing This Activity	Never Did This Activity
78. Swimming 25 yards (non-stop)			
79. Bicycling one mile			
80. Bicycling two miles			
81. Bicycling one mile (non-stop)			
82. Bicycling two miles (non-stop)			
83. Running or jogging ¼ mile			
84. Running or jogging ½ mile			
85. Playing tennis or racquetball			
86. Playing basketball (game play)			
87. Running or jogging ¼ mile (non-stop)			
88. Running or jogging ½ mile (non-stop)			
89. Running or jogging one mile			
90. Running or jogging two miles			

91. Running or jogging three miles			
92. Running or jogging one mile in 12 minutes or less			
93. Running or jogging two miles in 20 minutes or less			
94. Running or jogging three miles in 30 minutes or less			

Scoring and Interpretation

Scores and Normative Information

The HAP produces a number of scores and classifications based on responses to the activity items. These scores, their definitions, method of calculation, and interpretation are outlined in Table 1 and described in detail below.

Several HAP scores have meaning only in comparison to an appropriate normative sample. Because studies have demonstrated age and gender effects, normative data are provided for different age groups for each gender. The normative sample for the HAP consisted of 477 individuals without significant medical problems. This sample ranged in age from 20 to 79.

Table 1
Outline of HAP Scores and Classifications

Scores and Classifications	**Definition**	**Formula**	**Interpretation**
Primary Scores Maximum Activity Score (MAS)	Highest oxygen-demanding activity that the respondent still performs	MAS = Highest item number answered *Still Doing*	Best estimate of respondent's highest level of energy expenditure, in comparison with peers of same age and gender

Adjusted Activity Score (AAS)	A measure of usual daily activities	AAS = MAS minus total number of *Stopped Doing* responses below MAS (i.e., with lower item numbers)	Best estimate of respondent's average level of energy expenditure, in comparison with peers of same age and gender

Development and Validation

Description of Research Samples

Several research samples were employed in the development of the HAP. These research samples were chosen to represent specific characteristics--age and physical health. Representing the extremes on the dimension of age were groups of healthy elderly adults and adolescents.

To analyze the effect of physical impairment on human daily activity, the HAP was administered to chronic lung disease patients, renal dialysis patients, and patients suffering chronic pain. To observe the effects of a critical health event that does not necessarily lead to permanent overall activity impairment, the HAP was given to a small group of patients with myocardial infarcts who were enrolled in a cardiac rehabilitation program.

To represent general overall normal adult health status, data were collected from several groups of essentially healthy adults. One group consisted of individuals who attended a local health fair, another group was comprised of students at two local colleges, and the remaining groups were selected because they represented occupations requiring widely differing skills. Employed city sewer workers, for example, were sought specifically because the occupation requires strenuous physical activity. Data were also collected from nurses and physician's assistant students, two groups with specific training in health issues and rehabilitation.

Table 12
Description of Research Samples

Sample	*N*	Age Range	MAS *M/SD*	AAS *M/SD*	Description of Sample
AD	96	9-18	90.1/3.2	87.0/5.4	Healthy adolescents living in a group home
IE	102	60-88	75.7/6.2	71.6/7.1	Elderly subjects living independently
HF	137	20-59	84.8/7.6	82.6/8.0	Health fair participants
CS	157	18-60	87.3/6.1	85.1/7.1	College students from two universities
TE	64	20-60	85.2/7.3	83.6/7.9	Teachers
NU	40	22-54	85.3/5.3	83.2/5.9	Nurses

PA	22	21-31	89.9/5.1	89.3/5.7	Physician's Assistant Students
SW	36	27-57	84.7/7.5	82.9/8.3	Municipal sewer workers
PAIN	83	16-65	63.3/13.1	51.6/16.2	Chronic pain patients treated in a pain center
COPD	30	37-77	58.8/13.2	48.7/14.2	Patients with chronic obstructive pulmonary disease
CARD	10	45-71	83.7/7.0	75.7/8.6	Myocardial infarct rehabilitation patients
RENAL	39	22-83	55.2/14.9	43.6/19.1	Renal dialysis patients
HEALTHY	654	9-88	84.8/7.8	82.2/8.9	Combined samples of AD, IE, HF, CS, TE, NU, PA, SW
IMPAIRED	162	16-83	61.8/14.8	50.7/17.6	Combined samples of PAIN, COPD, CARD, RENAL
NORM	477	20-79	85.3/7.0	83.2/7.8	Normative sample; subset of HEALTHY subjects between ages 20 and 79
YA	167	20-29	88.6/5.8	86.3/6.7	Young adult subset of HEALTHY subjects (ages 20-29)

Appendix D

FITBIT Instructions

FITBIT Instructions

1. Connect your FITBIT to the base station & charger and connect the USB cord to your computer.

2. Go to “www.fitbit.com/start” and select the “fitbit ultra” as your device.

3. You will be guided through downloading the FITBIT software to your computer.

4. After downloading the software to your computer, you will need to set up a new account.

5. After completing your setup you will see several tabs at the top. Click on the *Dashboard* tab. This is the page you will fill out the fitbit survey you will be receiving in your email once a week. You will click on “***WEEK***” rather than “day,” “month,” or “year”.

6. Once in the survey you will enter steps taken, floors climbed, and miles traveled. You will also enter the percentage of time being active from the pie chart, calories burned, hours slept, and weight gain or loss.

7. **Optional:** Click on the *Log* tab at the top of your screen and manually enter times that you were specifically active. For example, if you went to the gym and walked/ran on the treadmill.

8. **Optional:** Under the *Log* tab you can also log your weight changes, sleep times, heart rate, blood pressure, and glucose numbers. There is also an area where you can keep track of your food intake. This is not part of the study, but you are welcome to use it for personal use.

9. You can edit your profile throughout the study or change your privacy settings by clicking on your name at the top right hand corner of the FITBIT webpage. You will then either select *Account Settings* or *Privacy Settings.*

10. Please wear this device at your waist line during the whole day using the “belt holster” provided with the Fitbit.

11. You may wear it at night on your wrist with the wrist band if you wish to track your sleep patterns.

12. This study will last six weeks so please wear it at your waistline everyday for six weeks.

13. You will receive an email once a week to log your weekly activity. You will open the link provided in the email and fill out the data provided under the *Dashboard* tab of your FITBIT webpage. Be sure to submit the data you entered in the survey by clicking “*submit”.*

14. This is your device to use for the next six weeks. Feel free to use it however you wish (within the suggested recommendations provided in these instructions.

15. You may also utilize the other benefits available on the website.

16. See http://www.fitbit.com/manual for any related questions.

17. Please call or email me any time if you have any questions or difficulties. Ryan.westrup@gmail.com or (405)-659-4072. Thank you for your participation!

Appendix E

FITBIT Survey

FITBIT Activity Tracker Survey

Please answer the questions indicating the results from your FITBIT dashboard.

How many steps were taken this week?

How many floors were climbed this week?

How many miles were traveled?

Time spent being active?

Sedentary?

Lightly Active?

Fairly Active?

Very Active

Deficit of calories burned?

How many hours did you sleep?

Did you have a change in your weight this week? (Indicate by a plus or negative sign and then the number lost or gained)

How many times were you awaken from sleep this week?