INCREASEING THE PHYSICAL ACTIVITY LEVEL IN OLDER WOMEN

A Thesis by
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The following faculty members have examined the final copy of this thesis for form and content, and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Arts with a major in Aging Studies.

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DEDICATION

"A journey of a thousand miles begins with a single step."

—Lao-tzu Chinese philosopher (604 BC - 531 BC)

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ABSTRACT

The American College of Sports Medicine (ACSM) recommends older adults (OA) spend 30min/5d/wk engaging in moderate intensity physical activity (MVPA). PURPOSE: To determine the efficacy of detailed feedback (FB) to increase OA time spent in MVPA compared to a verbal recommendation (VREC) and control (CON) group. METHODS: Sixty-eight women recruited from senior-based programs for an 8-wk, 3-intervention arm trial, were randomly assigned to 1 of 3 groups: VREC, FB, and CON. Individuals meeting ACSM recommendations were excluded. All participants wore an accelerometer (ACCEL) to monitor 8 weeks of daily physical activity. VREC were read/received ACSM recommendations similar to mass media dialogue promoting MVPA and asked to meet recommendations by the 8-wk point. FB walked 3 d/wk on a monitored indoor walking track, and on their own 2 d/wk. FB received all VREC procedures, received MVPA walking instruction (HR monitored) and weekly ACCEL feedback (time spent in MVPA and MVPA goals for the next wk). CON continued their normal activities. RESULTS: Differences were noted between all 3 groups at Week 4 ($p \leq 0.05$) and Week 8 ($p \leq 0.05$). This reflects improvement in both the FB and VREC as well as a greater improvement by the FB compared to VREC. FB improved 264% over 8 weeks. VREC improved 85% from baseline to Week 8. There was no change in the CON. Difference between groups with respect to meeting ACSM recommendations (yes/no) were noted (, $p \leq 0.01$). The only group to improve was FB. CONCLUSIONS: Providing simple feedback significantly improved time spent in moderate intensity physical activity by the 4th week. Based on the results of this study, which indicate that the detailed feedback is more effective than recommendation alone, this walking program should be implemented by healthcare providers as a means to improve the amount of moderate intensity physical activity engaged in by older adults.

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CHAPTER 1

INTRODUCTION

According to the Center for Disease Control and Prevention (CDC), older adults are the fastest growing population in the US, yet they are the least active. Physical inactivity is a leading public health problem associated with decreased longevity as well as cardiovascular disease, cancer, obesity, diabetes, and other diseases (Woolf, et al., 2009). There is a positive association between habitual daily physical activity and functional fitness; that is, functional fitness is related to an older adult's ability to be able to live a healthy life and not require hospitalization and assistance (Aoyagi & Roy, 2009).

The American College of Sports Medicine (ACSM) suggests that participating regularly in moderate intensity physical activity is the key to staying healthy (Nelson, et al., 2007). It has been shown that physical condition (balance, walking speed and lower-extremity strength) is important to an individual's health in old age. Physical condition can predict the likelihood of an older adult developing disability, being hospitalized, and a predictor of an older adult's morbidity and mortality (Aoyagi, Park, Watanabe, Park, & Shephard, 2009). The Physical Activity Guidelines Advisory Committee Report (2008) indicates that in addition to the health benefits of regular physical activity for older adults, there is a strong association between physical activity and higher levels of functional fitness, lower risk of falling and even better cognitive ability.

In agreement with the ACSM recommendations to increase daily physical activity in older adults, the Center for Disease Control and Prevention and the American Heart Association, recommend that the older adult should spend at least 30 minutes, five days per week doing moderate-intensity physical activity or alternatively, 20 minutes of vigorous-intensity activity on at

least three days per week to maintain a good functional fitness (Pate, Pratt, & Blair, 1995). In contrast, the World Health Organization states that physical activity recommendations "may need to be increased" considering the obesity epidemic and the alarming growth in the number of people with metabolic syndrome. Increased levels of habitual physical activity could lessen the occurrence of functional impairment and disability caused by metabolic syndrome in older adults (Aoyagi & Roy, 2009).

According to the U.S Department of Health and Human Services (2005) in spite of well-recognized benefits of maintaining an active lifestyle to delay the onset of functional impairment and disability, only 25 percent of women and 33 percent of men aged 65-to- 74 years participate regularly in physical activities. Seniors older than 75 years had even lower levels of regular participation in physical activities with only 25 percent of men and just 14 percent of women engaging in any physical activity.

Our lab recently measured the physical activity intensity of older women to determine if they met physical activity recommendations. One hundred and seven women were recruited and divided into 3 age groups: 60-69 (n= 38, 65.26 ± 2.71 years), 70-79 (n= 46, 74.04 ± 2.99 years), and 80-89 (n= 23, 8 ± 2.71 years). No group met physical activity recommendations. The highest 5-day average was achieved by the 70-year olds with just over 16 minutes, followed by the 60-year olds with 14 minutes. The 80 year olds engaged in the least amount of moderate intensity activity with just over 8 minutes. These results are not encouraging in evaluating the number of older adults meeting recommendations. Eight of 38 (21%) 60-year olds, 4 of 45 (11%) 70-year olds, and 1 of 22 (5%) 80-year olds spent at least 30 minutes, five days per week engaging in moderate-intensity physical activity. Older adults do spend a significant amount of time engaging in low-level activity.

The 60- and 70- year olds engaged in more than one hour of low intensity activity, while the 80-year olds engaged in nearly 50 minutes.

The main form of physical activity among the older population is walking. Fortunately the advancement of technology in the measurement of this behavior has resulted in the development of small devises that can accurately and reliably measure walking behavior; these devices are pedometers and accelerometers. These are useful tools that can help provide both health professionals and researchers a better understanding of the older adults' habitual physical activity as well as in the devolvement of physical activity programs for older adults to increase their daily physical activity levels. (Aoyagi, Park, Watanabe, Park, & Shephard, 2009).

Walking is an appropriate option for physical activity as it requires no special skills or facilities and is achievable by virtually all age groups with little risk for injury (Davison & Grant, 1993). There are many studies that have examined the benefits of walking as the mode for physical activity (Morton, West, & Stephens, 2010, van Uffelen, Chinapaw, Hopman-Rock, & van Mechelen, 2009, Roussel, Garnier, Lemoine, et al. 2009, Nicklas, Wang, You, et al. 2009, Geddes, Costello, Raivel, & Wilson, 2009, Paschali, Goodrick, Kalantzi-Azizi, Papadatou, & Balasubramanyam, 2005, Koizumi, Rogers, Rogers, Islam, Kusunoki, & Takeshima, 2009). Several studies have indicated that walking interventions resulted in consistent increases in fitness (Morton, West, & Stephens, 2010, van Uffelen, Chinapaw, Hopman-Rock, & van Mechelen, 2009, Roussel, Garnier, Lemoine, et al. 2009, Nicklas, Wang, You, et al. 2009). In a systematic review of observational studies dealing with the relationship of walking and cardiovascular disease, Boon-Heinonen, Evenson, Taber, and Gorden-Larsen (2009), found that cardiovascular disease declines with an increased walking pace. Walking is the easiest form of exercise for older adults; however lack of knowledge or

understanding prevents them from achieving the moderate intensity activity that is recommended by the ACSM and CDC in order to maintain a healthy lifestyle.

1.1 Statement of the Problem

Our preliminary data suggests that older adults spend a considerable amount of time engaging in low-level activity and very little time in moderate-intensity activity. Therefore, the question becomes, how do health care professionals raise older adult's physical activity intensity to recommended levels? Perhaps the health industry needs to move beyond messages found in the mass media, (such as verbal or print recommendations that older adults spend at least 30 minutes, 5 days per week engaging in moderate intensity physical activity; or by defining "moderate intensity" as a level at which the individual has a small increase in heart rate, begins sweating, but are still capable of caring on a conversation with another person). Or, perhaps older adults are unaware of the CDC/ACSM recommendations or are incapable of perceiving and/or reaching a moderate intensity level of exercise. Perhaps it is difficult for the older adult to gauge activity intensity. If so, providing detailed feedback may provide the knowledge necessary for older adults to meet the recommendations provided by the ACSM, CDC, and AHA.

1.2 Significance of the Study

Regularly participating in moderate intensity physical activity is critical to staying healthy and maintaining quality of life. Research suggests that older adults do not meet the recommendations set forth by the ACSM, CDC, and AHA. Given the positive associations between moderately-intense habitual daily physical activity and health, reduced chronic disease and disability, and the maintenance and improvement of functional fitness, it is imperative that health

care professionals work with older adults to increase the intensity of their physical activity to recommended levels.

1.3 Purpose

To determine the efficacy of providing detailed physical activity feedback to increase the amount of time older adults spend in moderate intensity physical activity. The detailed feedback, produced by the Physical Activity Analysis Software, provided charts and graphs representing time spent in moderate intensity activity ($min \cdot d^{-1}$) for the previous 1-wk period. It was hypothesized that providing the heart rate session, accelerometer feedback, and individualized accelerometer-based weekly feedback to the intervention group would result in an increase in the intensity of daily physical activity above and beyond the Verbal and Control groups.

1.4 Assumptions

It was assumed that all participants would continue their routine physical activity during the two-week of wearing the accelerometer.

1.5 Limitations

Results of this study could have been affected by environmental factors (such as humidity, precipitation, and day length, duration of bright sunshine and mean ambient temperature) on the days participants were asked to wear their accelerometer and engage in daily physical activity on their own. Physical activity could decrease with increasing precipitation. Also, day length is an important factor in decreasing the activity level. The peak of daily step count is achieved at the mean outdoor temperature of around 63°F . Physical activity decreases in a quadratic way especially bellow this

temperature (Aoyagi & Roy, 2009). In this study, the summer and winter weather was avoided by conducting the research during the spring. But the rain or wind could not be avoided.

Another limitation is related to accelerometers. Accelerometers are not capable of recording some activities like swimming, bicycling, weight-training, yoga (Tudor-Locke, Hart, & Washington, 2009). There is also debate on how many days of accelerometer use would provide a reliable estimate of older adults' physical activity. One study reports a threshold of four days (Troiano, Berrigan, Dodd, Masse, T, & McDowell, 2008) another suggests when studying the older adult population, a minimum of five days is needed to accurately estimate daily physical activity (Rooney, Smalley, & Haven, 2003). However, it has been shown by Tudor-Locke, Johnson, and Katzmarzyk (2009) that most active people have a tendency to wear the motion sensors for more days and in contrast the least active people wear their accelerometers for fewer days. This means those who wear their pedometers for fewer days may have a sedentary life style.

The purpose of this study was to achieve 30 minutes of moderate intensity walking 5 days per week. The intent of the study was to have them achieve this activity level in one continuous bout. This is a limiting factor with respect to the ACSM recommendation as the ACSM indicates that multiple sessions of at least 10 minutes are acceptable to accumulate the desired amount of daily exercise. This may have impacted participant's ability to meet the recommendation on a consistent basis. Furthermore this may have impacted adherence if participants did not believe they could walk that long at a moderate intensity.

Finally, the social aspect of walking as a group may limit the results of this study. It is well-known that group exercise is a very socially rewarding activity. Given the Feedback group is the only group meeting to walk, this may impact their commitment to both the program and their

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individual goals. The social setting may provide additional motivation to the Feedback group that was not experienced by the Verbal or Control groups.

1.6 Delimitations

This study's results are limited to women 55 years and older old residing in an urban Midwest City.

1.7 Definitions

1. American College of Sports Medicine (ACSM) Recommendation: The American College of Sports Medicine recommends older adult spend at least 30 minutes, five days per week doing moderate-intensity physical activity or alternatively, 20 minutes of vigorous-intensity activity on at least three days per week activity 5 days a week for older adults to maintain a healthy lifestyle.

2. Duration: The amount of time engaged in physical activity. The recommendation for older adults is 30 minutes.

3. Intensity: Refers to how much energy is expended when exercising. It is the relative difficulty of the exercise or how hard the exertion feels. The recommendation for older adults is moderate or vigorous activity

4. Frequency: How often (days/week) an activity is performed.   The recommendation for older adults is 5 days a week).

5. Moderate Intensity Media/Lay Definition: Walking at a pace at which participants break a sweat and/or have a slight increase in heart rate, but are able to carry on a conversation

6. Moderate Intensity: 50%-70% of maximum heart rate

7. <u>Low Intensity Activity</u>: activity that is recorded as being less than 3 METs, the metabolic equivalent or measurement of expressing the energy cost of physical activities

8. <u>Maximum Heart Rate</u>: Modified Karvonan method for women. Determined by calculating 226-age (in years)

9. <u>Pedometer</u>: a device worn at the hip that records step count. It tracks the number of steps a person takes throughout the course of the day by detecting the upward motion of a person's hips.

10. <u>Accelerometer</u>: device that records daily physical activity through step count and intensity. For this study we used Lifecorder accelerometers. Lifecorder (Suzuken Co., Japan), a uniaxial accelerometer, allows subjects to wear the monitor for long periods of time at waist-level without interfering with normal movement. It is small in size (62.5 mm * 46.5 mm * 26.0 mm), light in weight (40 gm), and powered by a lithium battery (CR2032, 3V). It detects physical movements every four seconds and records these at two minute intervals to determine ten different exercise intensity levels (Niinomi et al., 1998). The Lifecorder EX uses a piezoelectric strain gauge and a research validated algorithm to not only accurately count steps—but to also detect the intensity of each step. It has the ability to store data continuously for as much as six weeks of continuous use. Data from the Lifecorder can easily be transferred into a personal computer and be stored in an Excel database for further analysis.

11. <u>Moderate Intensity Feedback</u>: Paper materials given to each individual every Thursday. Feedback was developed using the Physical Activity Analysis Software and provided in the form of graphs and charts indicating each individual participants' daily physical activity for

the past week. Information included time spent in low, moderate, and vigorous activity and step counts. Information regarding the upcoming week's goal was also provided.

12. Physical Activity Analysis Software: The PAAS Lifestyle Coach is a unique and user friendly software for analyzing the data measured by Kenz Lifecorder PLUS and EX activity monitors. The software is designed for Wellness Program, Health Club, Personal Trainer and Weight Management Professional to motivate individuals and group users to increase their physical activities for healthy lifestyles. Only study personnel had access to the software.

2.1 Older Adult Activity Level

According to the Centers for Disease Control and Prevention, older adults are the fastest growing age group of the population in the U.S., yet they are the least physically active. There is evidence of a negative relationship between being active and having several health related issues such as obesity, osteoporosis and coronary artery disease in older adults (Nelson et al., 2007). Moreover, there is a positive association between habitual daily physical activity with functional fitness, functional fitness is related to an older adult's ability to be able to live a healthy life and not require hospitalization and assistance (Aoyagi & Roy, 2009). Chronic conditions occur with the aging process so it is important that this rapidly growing population engage in physical activity in order to stay independent longer. Chronic conditions usually result in limitations in activity of daily living (ADL) or instrumental activity of daily living (IADL). Miller et al. (2000) determined that physical activity resulted in a slower development of ADL and IADL limitations.

According to the U.S. Department of Health and Human services (2005) in spite of well-recognized benefits of maintaining an active lifestyle to delay the onset of functional impairment and disability, only 25 percent of women and 33 percent of men aged 65 to 74 years participate regularly in physical activities. Seniors older than 75 years had even lower levels of regular participation in physical activities with only 25 percent of men and just 14 percent of women engaging in any physical activity. The physical activity of many older adults does not meet the recognized standards for health and disease prevention (Vogel et al., 2009). Another study by Ruchlin and Lachs (1999) investigated physical activity through surveying older adults about their physical activity habits. The

researchers discovered that less than half of the older adults walked for physical exercise during a two week stint. Of those who stated they walked, most walked for 15 minutes, one to five times per week. Increased physical activity was related to being white, having more than 1 year of college education, high income, living in a large city, living in all parts of the U.S. excluding the Northeast, and not having hypertension (Ruchlin & Lachs, 1999). This is of interest since; the main form of physical activity among the older population is walking (Tudor-Locke, Hart, & Washington, 2009).

Reasons for remaining and/or becoming inactive include behavioral, physiological, and psychological variables, as well as physical and social environmental factors (Pate, 1995). Researcher Nied and Franklin (2001) noted the common barriers that prevent older adults from taking part in exercise: low self-efficacy, negative attitude toward exercise, discomfort exercising, disability, poor balance, fear of injury, habit of not exercising, subjective norms, fixed income, environmental factors, cognitive decline, and illness or fatigue. Despite the barriers that inhibit older adults to engage in regular physical activity, research has determined there are far more benefits.

2.2 Benefits of Physical Activity for the Older Adults

Increased physical activity is associated with improvements in numerous health conditions, including coronary artery disease, thromboembolic stroke, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, colon cancer, breast cancer, anxiety, and depression (Haskell et al., 2007). There is also some evidence that physical activity prevents or delays cognitive impairment and disability (Nelson et al., 2007). Despite these recommendations and the well-documented evidence that physical activity is beneficial, more than half of all adults in the United States do not get adequate physical activity and approximately one quarter do not get any leisure time physical activity (Preventing obesity, 2005).

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The problem also extends globally as an estimated 3.2 million deaths are due to physical inactivity (World Health Organization, 2011). The economic burden associated with inactivity is huge. In a comprehensive analysis by Colditz (1999) the direct costs of inactivity was reported to be $24.3 billion, this accounts for only the people reporting no leisure-time activity (28.8%). Those who have chronic conditions and limitations may be subject to reliance on Medicare. In 1999, 20% of Medicare enrollees had impairment in IADLs (instrumental activities of daily living) or ADLs (activities of daily living) or were institutionalized (Federal Interagency Forum on Aging-Related Statistics, 2004). According to researchers Nelson et al. (2007) older adults need to be physically active to maintain their health. The results of the Stessman, Hammerman-Rozenberg, Cohen, Ein-Mor, and Jacobs (2009) study show that physical activity was associated with better survival as compared to being sedentary. Better survival rates were related to both those who were continuing to engage in physical activity and in those just starting to engage in physical activity in later life. This study supports that even sedentary older adults who engage in physical activity in later life will be able to obtain benefits for their health and independent functioning.

2.3 Physical Activity Recommendation for Older Adults

The American College of Sports Medicine suggests that participating regularly in moderate intensity physical activity is the key to staying healthy and enhancing the functional fitness of older adults (Nelson et al., 2007). The following are the physical activity recommendations set forth by The American College of Sports Medicine and the American Heart Association for older adults (men and women age >_ 65 yr and adults age 50 to 64 yr with clinically significant chronic conditions and/or functional limitations.) To promote and maintain health, older adults need moderate-intensity aerobic physical activity for a minimum of 30 min on five days each week or vigorous intensity

aerobic activity for a minimum of 20 min on three days a week. Moderate-intensity aerobic activity

involves a moderate level of effort relative to an individual's aerobic fitness. On a 10-point scale,

where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces

noticeable increases in heart rate and breathing (Nelson et al., 2007).

It should be noted that activities above the minimum recommendation provide additional

health benefits and results in higher levels of physical fitness. Older adults should engage in more

than the recommendations if they have no conditions that would be harmful if higher amounts are

obtained, in order to improve their personal fitness, improve management of an existing disease

where it is known that higher levels of physical activity have greater therapeutic benefits for the

disease, and/or to further reduce their risk for premature chronic health conditions and mortality

related to physical inactivity (Nelson et al., 2007).

2.4 Benefits of Walking

The costs associated with physical inactivity are high. Specifically, walking can help reduce

the economic burden. For example, if 10% of adults in the United States began a regular walking

program, an estimated $5.6 billion in heart disease costs could be saved (Preventing obesity, 2005).

A study by Bath and Morgan (1998) found that increases in mortality were significantly related to

physical activity levels, specifically walking for more than 10 minutes per day. Yet inability to walk

2-3 blocks was reported by 14% of men and 23% of women (Federal Interagency, 2004). In a 10

year follow up study researchers Smith, Wingard, Smith, Kritz-Silverstein, and Barrett-Connor

(2007) investigated the association of walking with mortality among persons with type 2 diabetes

compared to those with normal glucose tolerance. The sample (n=347) with type 2 diabetes and

(n=1,317) normal glucose tolerance consisted of community dwelling adults form the Rancho

Bernardo Study whose ages were between 50-90 in 1984-86. During the 10 year follow up, causes

of death, development of coronary heart disease, other cardiovascular disease (non-CHD CVD), and

other causes were recorded. Results of the Smith et al. (2007) study determined that adults with

diabetes who walked >_ 1 mile/day were half as likely to die from all-causes combined, and less

than one fifth as likely to die from non-CHD CVD compared to adults with diabetes who did not

walk. Walking was also found to be protective among adults who had normal glucose tolerance;

however, the results were not as significant. The results of this study demonstrate the association

between walking and reduced risk of all-cause and non-CHD CVD mortality among older adults

with diabetes.

In another study, researchers Gregg, Gerzoff, Casperson, Williamson, and Narayan (2003)

studied the association between walking and the risk for all-cause and cardiovascular disease (CVD)

mortality among persons with diabetes. The study sampled 2896 adults 18 years and older with

diabetes as part of the 1990 and 1991 National Health Interview Survey. Results of the study

determined that among a nationally representative sample of Americans with diabetes, a 34 to 39%

reduction in all-cause and CVD mortality is associated with walking at least 2 hours per week.

However, the greatest reduction in mortality was seen in those who walked 3 to 4 hours per week,

and for those that reported their walking to have involved moderate increases in heart and breathing

rates. It was determined that increased amount of walking was associated with up to a 54%

reduction in mortality. The results of the Gregg et al. (2003) study express the increased benefit of

moderate intensity walking.

2.5 Importance of Physical Activity Intensity

The older adult recommendation defines aerobic intensity as relative to fitness, in the manner of exercise prescription. For aerobic exercise, ACSM recommends a target intensity of 50-85% of oxygen uptake reserve—a range that includes both moderate and vigorous exercise (Franklin, Whaley, Howley, 2000). The ACSM considers moderate intensity exercise to have the best benefits in reducing the onset chronic conditions that older adults with sedentary lifestyles incur. It is shown that older adults who participate in more minutes of moderate-intensity physical activity perform at higher functional fitness levels (Aoyagi, Park, Watanabe, Park, & Shephard, 2009). Older adults that engage in moderate physical activity have greater physical function and reserve than those who are sedentary. Additionally, adults who performed high-intensity activities improved their physical function and reserve even more than those who performed either lifestyle activities or moderate-intensity activity, highlighting the importance of not only being physically active but that the intensity at which one is active is important to improve the impact of physical exercise on one's health.

2.6 Self Monitoring Through Accelerometers and Pedometers

The intensity at which one participates in is extremely important. Accelerometers are capable of estimating intensity by measuring physical activity minute-by-minute. However, due to data management needs (time and skilled personnel) and the high cost, accelerometers do not have widespread use outside the research studies. On the other hand pedometers are affordable and simple to use for individual and "population-level application." Pedometers are very good at capturing daily activity levels as steps per day. It is shown that people walk more for exercise as they

get older (Tudor-Locke & Ham, 2008). Marshall (2007) reports that pedometers/ accelerometers have advantages over self-report measures. For example, both units are sensitive to any change in participant's incidental physical activity, and the participant's data can be easily and accurately compared between different studies. The accurate measurements provided by the pedometers and accelerometers are helpful to both health professionals and researchers in understanding older adults' habitual physical activity and in developing proper exercise programs for older adults to increase their daily physical activity levels (Aoyagi et al., 2009). In addition, accelerometers and pedometers are helpful in terms of being a motivation to increase individuals physical activity level by giving them immediate feedback and helping them to set concrete goals. Although pedometers and accelerometers are similar in that they are both non-invasive tools that allow instant feedback regarding a person's activity level, they differ in the fact that pedometers only count the number of steps while accelerometers track step number as well as the intensity (i.e., frequency) of the step. The use of accelerometers is currently viewed as the minimum standard for physical activity assessment in epidemiologic research. They are able to demonstrate accurate measurements for both intermittent and spontaneous intensity-specific physical activity. (Corder & van Sluijs, 2010).

Several studies have documented the validity of accelerometry-based activity monitors (Freeson, Melanson, Sirard, 1998, Hendelman, Miller, Baggett, Debold, Freedson, 2000, Welk, Almeida, Morss, 2003) yet, there are few intervention studies that use accelerometers. There are however, an accumulation of studies that use pedometers as their main tool for monitoring daily physical activity. (Musto, Jacobs, Nash, DelRossi, & Perry, 2010, McMurdo, Sugden, Argo, Boyle, Johnston, Sniehotta, et al., 2010, Duru, Sarkisian, Leng, & Mangione, 2010, Norton, Norton, Lewis, & Dollman, 2011, Strath, Swartz, Parker, Miller, Grimm, & Cashin, 2011, Talbot, Gaines, Huynh, & Metter, 2003, Jensen, Roy, Buchanan, & Berg, 2004, Tudor-Locke, Bell, Myers, et al. 2004).

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2.7 Walking Programs

In a systematic review, Bravata et al. (2007) found pedometers to be small, relatively inexpensive devices worn at the hip to count the number of steps walked per day. In the review Bravata et al. (2007) also compared the results of 8 randomized controlled trials (RCTs) and 18 observational studies to evaluate the effectiveness of pedometers used to increase physical activity. The results of the collaboration of studies found that in the RCTs, pedometer users significantly increased their physical activity by 2491 steps per day more than control participants, and among the observational studies, pedometer users significantly increased their physical activity by 2183 steps per day over baseline. Overall, pedometer users increased their physical activity by 26.9% over baseline.

Two other studies investigated the impact of feedback on walking behavior. Geddes, Costello, Raivel, & Wilson 2009 conducted a study on 15 people. The 12 individuals who met the requirements of the study initially completed a 6 minute walk test (6MWT). Participants were given specific walking speeds according to their calculated HR range. Each participant was issued a Polar Fitwatch Heart Rate Monitor which was used to help the participant stay within their prescribed HR range. Participants received an individualized home walking program using HR range instructions and results from the baseline 6MWT. The group was also instructed to maintain an exercise log which included rate of perceived exertion (RPE) and received biweekly telephone calls. The control group was asked to refrain from any regular exercise during the 12-week period. The results of the study were inconclusive though there were a couple of factors that were considered. Change, although not significant, were observed in those who participated in the home walking program. The authors suggest that lack of significant improvement was due to the insensitivity of the submaximal intensity test (Geddes, Costello, Raivel, & Wilson, 2009). A study by Paschali,

Goodrick, Kalantzi-Azizi, Papadatou, & Balasubramanyam 2005, examined if giving activity feedback would improve adherence within a home-based walking program. For 3 months 26 adults (14 women 12 men) received behavioral counseling regarding exercise. Participants' activity was monitored through use of a triaxial accelerometer during these 3 months. Half of the participants were assigned to a group were no feedback was given but counseling was determined from their self-report logs. The other half was issued access to accelerometer data, where they received a computerized graph of their physical activity for the period between counseling sessions. This group received counseling based on that feedback. The feedback group showed an increase in exercise over the 3 mo. The nonfeedback group showed an increase in activity at 1.5 months but reverted to their baseline exercise levels by the 3 month mark. Unfortunately the hypothesis that the feedback group would improve adherence to the exercise cannot be supported due to analysis of variance showing that there was at least an 8% probability that this effect was due to chance.

The only study using accelerometers and feedback to increase physical activity in the older population was conducted in Japan. The Koizumi, et al., 2009 study involved sixty-eight community dwelling older women in Northern Iida. This intervention provided detailed physical activity feedback through use of a Kenz Liferecorder accelerometer and Physical Activity Analysis Software to monitor daily activity. Thirty-four participants were randomly assigned to the lifestyle physical activity intervention group (LIFE) and the other half to the control group. The LIFE group was prescribed a recommendation to accumulate 9000 steps and 30 minutes of moderate intensity physical activity (MPA) per day. Throughout the 12 week intervention, the LIFE group received detailed feedback concerning the quantity (number of steps) and their time spent in moderate intensity for every 2 week period. Participants in this group were provided with individualized recommendations (eg, increase steps by 500 and engage in 3 more minutes of MPA per day) based

on their previous 2 week results. The control group was instructed to continue their normal daily activities and wore a locked accelerometer. The LIFE group increased their biweekly step average by 16% and also increased their biweekly minutes of moderate intensity activity by 53% as compared to the control group who did not improve in either steps or intensity. Although the LIFE group spent 27 minutes performing MPA at the 12 week mark, this is still less than the ACSM recommendation of needing 30 minutes of MPA to achieve a healthy lifestyle. The study indicates that with intervention older adults can increase the amount of time they engage in MPA, but further research should examine the effectiveness of interventions that are implemented for longer periods of time.

CHAPTER 3

METHODOLOGY

3.1 Design

This study was an 8-week, 3-intervention arm, randomized trial to investigate methods designed to increase the amount of time older adults spend in moderate intensity physical activity. The main form of physical activity among the older population is walking (Tudor-Locke, Hart, & Washington 2009); therefore, the mode of this intervention was walking.

3.2 Participants

Sixty nine women were recruited from local community centers, senior centers, retirement communities, other senior-based programs and media publications. The inclusion criteria included: women aged 60+ years, and successful completion of the EASY (Exercise And Screening for You) screening tool (Appendix A). This tool was designed to ensure the absence of preexisting conditions that would prevent them from safely completing the exercise protocol. Exclusion criteria included: individuals who meet the ACSM recommendation for physical will be excluded from participation. Randomization: Women were be randomly assigned to one of three groups: Feedback, Verbal and Control.

3.3 Baseline

Baseline physical activity intensity was measured for 2 weeks prior to the onset of the intervention. To prevent feedback during baseline acquisition, accelerometers were locked in the

closed position. Following the 2 week period, data was downloaded to determine study eligibility and each participant's initial intensity goal.

3.4 Materials

<u>Daily Physical Activity Assessment</u>

Daily physical activity was monitored by a Lifecorder EX accelerometer for 2 weeks. Lifecorder EX variables analyzed the intensity of physical movement ranging from 0 (low intensity) to 9 (high intensity). Participants were asked to wear the accelerometer during all waking hours (taking it off to bathe or swim). The accelerometer was worn at the waistline, clipped to a belt or clothing and centered over the dominant foot. To prevent feedback during baseline acquisition, accelerometers was locked in the closed position. Following the 2 week period, staff downloaded accelerometer data to a research PC for further analysis.

The accelerometers record physical activity intensities in ten different levels - zero to nine, with higher numbers indicating higher intensity. Intensity is determined through the use of a proprietary filtering process that considers both frequency and magnitude of accelerations. Information regarding time spent in low, moderate and vigorous intensity was provided through the accelerometers companion software, Physical Activity Analysis Software, The following physical activity categories have been validated in adults (1-3 = light, 4-6 = moderate, 7-9 = vigorous). Zero corresponds to non-ambulatory physical activities performed in everyday life. Therefore, the more steps recorded per unit time indicates a higher intensity of activity. Intensity is detected every four seconds and recorded at two minute intervals. Physical activity data were saved as a) number of footsteps; and b) movement at different intensities (from 0 to 9). The accelerometer has the ability to store data continuously for as long as six weeks of continuous use. Data can easily be transferred

into a personal computer and stored in an Excel database for further analysis. The Kenz Lifecorder accelerometer has been validated as an accurate step counter and its intensities of 4 to 6 have been shown to correspond to moderate intensity physical activity (Crouter, Schneider, Karabulut, and Bassett, 2003; Kumahara, Schutz, Ayabe, Yoshioka, Yoshitake, Shindo, Ishii, & Tanaka, 2004; Mihalko, Wickley, and Sharpe, 2006; Kenko Nippon, 1999; Rooney, Smalley, & Haven, 2003).

ACSM Recommendation: Participants were read and shown a description of the CDC/ACSM physical activity recommendation (see Appendix A) similar to what would be read in lay publications.

Moderate Intensity Heart Rate Calculation: Maximum heart rate was calculated using a modified Karvonen method for older women (226 – age). Using their calculated maxHR a moderate heart rate zone (50% - 70% of maxHR) was calculated.

Heart Rate Education Session: To ensure participants understand how their body responds to moderate intensity activity, participants will wear a heart rate monitor and complete a 10-minute moderate intensity walk on an indoor track with a researcher. Paired with study personnel, participants walked on an indoor track for 15 minutes. Participants wore a Polar RS100 heart rate monitoring chest strap which wirelessly transmitted heart rate data to a wristwatch worn by study personnel. Participants began the education session with 5 minute warm-up and were instructed to gradually increase pace such that at 5 minutes they were at what they considered a moderate intensity pace. Participants received guidance from study personnel as they attempted to walk at a moderate-intensity pace. Study personnel relayed intensity information to the participant, and informed participant when their heart rate reached a moderate intensity level. Participants learned to either quicken or slow their pace to maintain a moderate-level pace. Participants walked for a total

of 15 minutes, 10 of those minutes were expected to be at a moderate intensity level. Heart rate and RPE was recorded at 5 and 10 minutes.

Rate of Perceived Exertion Scale: The rate of perceived exertion scale (RPE) is designed to quantify the intensity of exercise. The Borg scale has a range of 6 to 20: 6 to 11 (very, very light) – corresponding to warm-up and cool-down; 12 to 13 (somewhat hard) approximately 60% of maximum Heart Rate (HRmax) and 16 (between hard and very, hard) - approximately 90% of HRmax. Coupled with the heart rate information, this scale was used to help participants what it "feels" like to walk at a moderate intensity.

Individualized Feedback: Using the Kenz Physical Activity Analysis Software, participants received time spent in moderate intensity activity (min·d^{-1}) as well as graphs representing their activity levels for the previous 1-wk period (Fig 3.1). They could also monitor their own MVP by viewing their accelerometer at any time during the walking session, day, or week.

Goal Setting: Individualized goals (eg, increase moderate intensity walking by 5 minutes per day) were presented to participants based on the amount of physical activity achieved during the prior week. The consistency of time spent in moderate intensity physical activity demonstrated participants were capable of achieving that amount each day. MPA goals were increased if participants had achieved a consistent amount of moderate intensity physical activity for 3-5 days. Goals were increased until the participant met 30 minutes of moderate intensity 5 days per week. When the participant demonstrated their ability to meet this goal for two consecutive they were instructed to increase their MPA walking by 5 minutes until they reached a maximum goal of 45 minutes days per week. Goals beyond the ACSM recommendation of 30 minutes of MPA days per week were provided, however, participants were encouraged to do more but were not required to walk beyond the recommendations. The initial MPA goal was a 5 minute increase above their MPA

baseline. For example, if a participant walked for 10 minutes on a consistent basis, their new goal would be to walk at a moderate pace for 15 minutes. To encourage people to walk the total 30 minutes, they were also instructed to walk 2 laps at a slower pace for recovery and then try to walk at a faster pace for an additional 5 minutes. This pattern would continue until they had reached a total of 30 minutes of total activity.
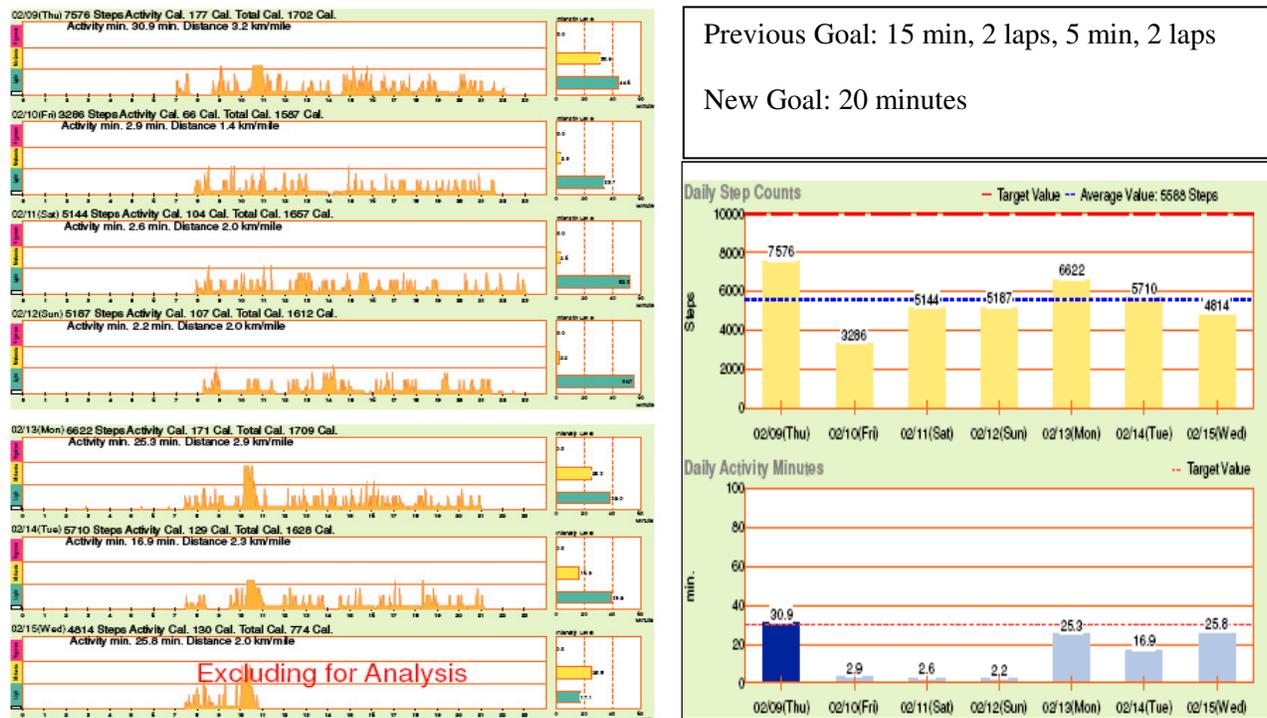
Figure. 3.1. Kenz Physical Activity Analysis Software and Feedback.

3.5 Procedure

Sixty-nine female older adults aged 55+ years were recruited from local senior-based programs and media publications. Following recruitment, participants were invited to attend an informational session where they completed the EASY screening tool and a questionnaire to measure knowledge regarding the CDC/ACSM recommendation. Participants also received a locked

accelerometer to wear for two weeks. Following the 2 week baseline physical activity monitoring,

participants met with study personnel to receive their specific intervention group and instructions.

Feedback: The Feedback group underwent a monitored cardio-respiratory fitness intervention

in which detailed feedback was given to aid participants in increasing their engagement in moderate

intensity physical activity. Each participant received instructions with regard to how to read and use

the accelerometer. They were read and shown a description of the CDC/ACSM physical activity

recommendation (see Appendix A) similar to what would be read in lay publications. Prior to the

start of the walking program, participants also underwent the heart rate education session to better

understand what it "feels" like to walk at a moderate intensity pace. Participants then completed a

30 minute cardiovascular endurance walk to determine if individuals were capable of achieving the

30 minute recommendation; this was completed at their own pace and did not require them to walk

at a moderate intensity. Once it was determined that they could walk continuously for 30 minutes,

study personnel could begin to help participants increase time spent in moderate intensity walking.

This group walked with study personnel 3 days per week on an indoor track and were asked to walk

on their own 2 days per week. Accelerometer information was downloaded every Wednesday and

detailed feedback and individualized goals were provided every Thursday.

Verbal Recommendation: The Verbal group was read and shown a description of the

CDC/ACSM physical activity recommendation similar to what would be read in lay publications.

They received oral instructions to spend 30min/5d/wk engaging in moderate intensity physical

activity and were given verbal examples of moderate intensity activities. Moderate-intensity walking

was defined as a pace at which participants break a sweat and/or have a slight increase in heart rate,

but are able to carry on a conversation (American College of Sports Medicine, 1998). Participants

were instructed on how to read and use the accelerometer. Participants were asked to return at 4 and 8 weeks for accelerometer download.

Control: Control participants were given an accelerometer and asked to continue their normal activities. They were also asked to return at 4 and 8 weeks for accelerometer download.

3.6 Informed Consent

The study protocol was approved by the Wichita State University Institutional Review Board. Prior to the study, all participants signed an informed consent document (Appendix B). If the EASY screening indicated, participants received written permission from their personal physician (Appendix C).

3.7 Data Analysis

Data analysis was completed using the statistical software program SPSS for Windows V.16.0 (SPSS Inc., Chicago, IL). To reduce the potential influence of outliers on the statistical analysis, box-and-whiskers plots were used to identify outliers, which were subsequently eliminated prior to analysis. An analysis of baseline moderate intensity activity level (independent sampled t-test) was performed to determine whether differences existed between the control group and two intervention groups. Difference between groups with respect to meeting ACSM recommendations (yes/no) was evaluated using the Cochran's Q non-parametric test. The principal mode of data analysis was a repeated measures analysis of variance (ANOVA, Wilk's criterion). Group (Feedback, Verbal, and Control) served as the between-subject factor, while Time (Baseline, 4 week, and 8 week) served as a within-subject factor. Univariate analyses were examined when significant multivariate main effects were observed and pairwise comparisons were conducted to determine

significance between and within groups. A probability value of less than 0.05 was considered statistically significant. In the case of multiple pairwise comparisons, a bonferroni adjustment was used.

CHAPTER 4

RESULTS

4.1 Normality and Assumptions

Non-significant Kolomogorov-Smirnov tests indicated all variables were normally distributed. In addition, histograms and normal Q-Q plots revealed normal distributions of variables in all groups. Assumptions of homogeneity of variance and sphericity were evaluated and not violated.

4.2 Adherence

Sixty nine women, aged 55 years and older, volunteered to participate in the program. Participants reported no incidence of injury as a result of the study. Of the 69 participants who entered the study, 45 completed all 8 weeks of the program. Seven participants dropped out of the feedback group due to health and transportation problems. Nine participants dropped out of the verbal group, 3 had defective monitors, 2 did not wear the accelerometer, 2 indicated they were too busy and had lost interest, and 2 were not available at the time of the 8 week download and their data was not available to be analyzed. Eight participants dropped out of the control group, 2 did not wear the accelerometer, one worked and indicated she was too busy, and 6 were unavailable at the time of download so their data was not available at time of analysis.

The average adherence to the feedback walking sessions was 88% with participants missing 42 of 360 walking sessions. Accelerometer adherence, percent time wearing the accelerometer, was high at 97% for feedback, 97% for verbal, and 92% for control.

4.3 Baseline Comparison

An analysis of age and baseline moderate intensity physical activity was completed to determine whether differences existed between the three groups (Table 4.1). With respect to age, the control group was significantly older than the other two groups (F=9.65, $p \leq .05$). However, no differences were found (F=0.27, $p \geq .05$) for moderate intensity, so although they were older they were engaging in the same amount of moderate intensity activity.

TABLE 4.1

BASELINE COMPARISONS

Activity Level	Feedback n = 14	Groups Verbal n = 14	Control n = 15
Age	67.40 (7.47)*	65.64 (5.98)*	76.43 (7.39)
MPA	10.53 (8.28)	10.83 (8.95)	8.58 (9.29)

* $p \leq 0.05$ (Mean (SD))

4.4 Moderate Intensity Activity – 5 Day Average

Table 4.2 presents change in time spent in moderate intensity activity (5 day average) in each of the 3 groups at baseline, 4-, and 8-weeks. The multivariate ANOVA revealed a significant interaction ($F = 5.49$, $p \leq 0.01$, $\eta^2 = .43$), necessitating subsequent repeated measures ANOVAs. The univariate ANOVA revealed a group by time interaction (F=21.26, $p \leq 0.01$, $\eta^2 = .51$) (Figure 4.1). Further analysis indicated significant group difference at 4-(F=21.16, $p \leq 0.01$, $\eta^2 = .??$) and 8-weeks (F=16.14, $p \leq 0.01$, $\eta^2 = .51$). Post hoc analysis revealed differences between all 3 groups at Week 4 ($p \leq 0.05$) and Week 8 ($p \leq 0.05$). This was reflective of improvement in both the Feedback and Verbal groups as well as a greater improvement by the Feedback compared to the Verbal group.

Improvement was seen within the Feedback and Verbal groups from baseline to Week 4 and

baseline to Week 8. No significant improvement was noted from Week 4 to Week 8. Feedback

improved 251% from baseline to Week 4 and 264% from baseline to Week 8. Not significant,

Feedback improved 4% from Week 4 to Week 8. Verbal improved 77% from baseline to Week 4

and 85% from baseline to Week 8. Although not significant, Verbal improved 4% from Week 4 to

Week 8. There was no change in the control group.

TABLE 4.2

MODERATE INTENSITY ACTIVITY – 5 DAY AVERAGE

	Baseline			Week 4			Week 8			
	Mean		SD	Mean		SD	B%	Mean		SD	W4%	W8%
Feedback	10.53	±	8.28	36.97	±	12.46	251	38.32	±	15.22	4	264
Verbal	10.83	±	8.95	19.22	±	13.12	77	20.07	±	17.31	4	85
Control	8.58	±	9.29	8.32	±	10.17	-3	8.30	±	9.41	0	-3

Values are Mean ± SD, B%=Baseline to Week 4, W4%=Week 4 to Week 8, W8% = Baseline to Week 8

‡ Different from Baseline $P \leq 0.05$
＊ Different from Verbal and Control $P \leq 0.05$
◆ Different from Control $p \leq 0.004$

Figure 4.1 Moderate Intensity Activity – 5 Day Average

4.5 Moderate Intensity Activity – Total Time over 5 days

Given the relationship between total time and a 5-day average it is not surprising to learn the similar results were found for all 3 groups f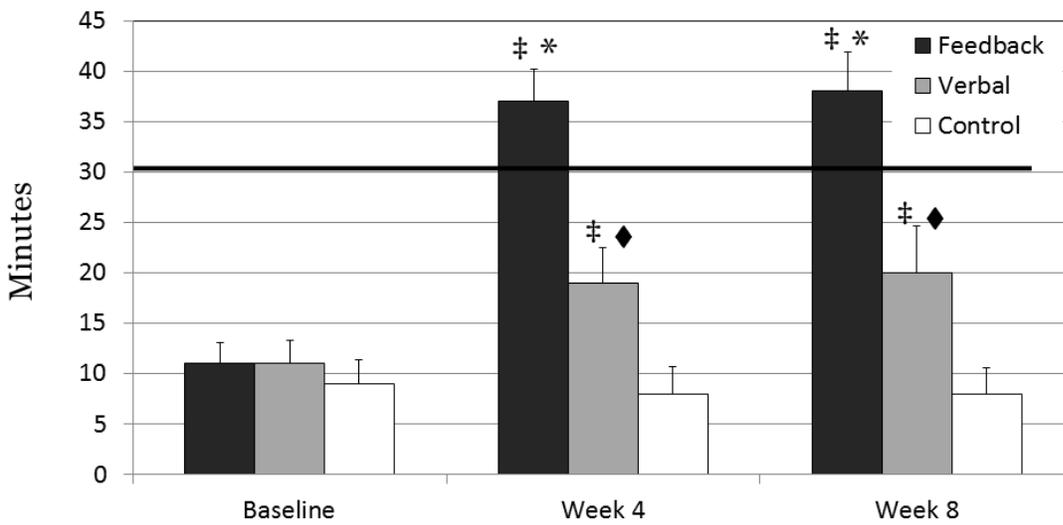or total time over 5 days spent in moderate intensity. Table 4.3 presents change in time spent in moderate intensity activity (Total Time of 5 days) in each of the 3 groups at baseline, 4-, and 8-weeks. The multivariate ANOVA revealed a significant interaction ($F = 5.49$, $p \leq 0.01$, $\eta^2 = .43$), necessitating subsequent repeated measures ANOVAs. The univariate ANOVA revealed a group by time interaction (F=21.25, $p \leq 0.01$, $\eta^2 = .51$) (Figure 4.2). Further analysis indicated significant group difference at 4-(F=21.16, $p \leq 0.01$) and 8-weeks (F=16.14, $p \leq 0.01$). Post hoc analysis revealed differences between all 3 groups at Week 4 ($p \leq 0.05$) and Week 8 ($p \leq 0.05$). This was reflective of improvement in both the Feedback and Verbal groups as well as a greater improvement by the Feedback compared to the Verbal group. Improvement was seen within the Feedback and Verbal groups from baseline to Week 4 and baseline to Week 8. No significant improvement was noted from Week 4 to Week 8. Feedback improved 251% from baseline to Week 4 and 264% from baseline to Week 8. Although not significant, Feedback improved 4% from Week 4 to Week 8. Verbal improved 77% from baseline to Week 4 and 85% from baseline to Week 8. Although not significant, Verbal improved 4% from Week 4 to Week 8. There was no change in the control group.

TABLE 4.3

MODERATE INTENSITY ACTIVITY – TOTAL TIME OVER 5 DAYS

	Baseline			Week 4			Week 8			
	Mean		SD	Mean		SD	B%	Mean		SD	W4%	W8%
Feedback	52.63	±	41.37	184.83	±	62.30	251	191.59	±	76.10	4	264
Verbal	54.17	±	44.73	96.12	±	65.53	77	100.34	±	86.55	4	85
Control	42.91	±	46.43	41.62	±	50.85	-3	40.76	±	47.39	-2	-5

Values are Mean ± SD, B%=Baseline to Week 4, W4%=Week 4 to Week 8, W8% = Baseline to Week 8

‡ Different from Baseline $P \leq 0.05$
✻ Different from Verbal and Control $P \leq 0.05$
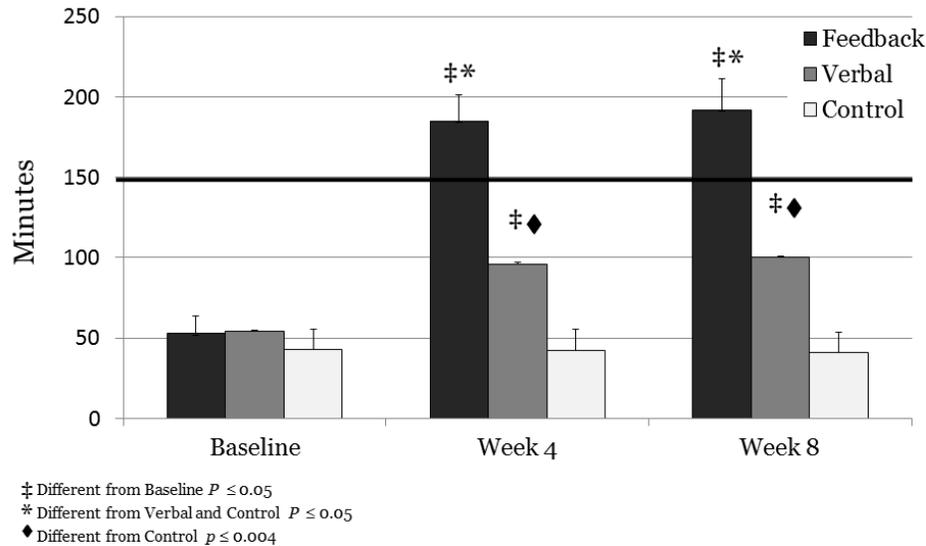◆ Different from Control $p \leq 0.004$

Figure 4.2. Moderate Intensity Activity – Total Time over 5 days

4.6 Low Intensity Activity – Total Time Over 5 Days

There were no group differences observed at the baseline and 4 week time point. However, there was a significant difference noted at week 8 (F=4.94, $p \leq 0.01$) at which time the verbal group exhibited an increase in time spent in low intensity activity. The Verbal group increased their low intensity activity compared to the Control group (Figure 4.3, Table 4.4).

TABLE 4.4

LOW INTENSITY ACTIVITY – TOTAL TIME OVER 5 DAYS

	Baseline			Week 4				Week 8			
	Mean		SD	Mean		SD	B%	Mean		SD	W4%	W8%
Feedback	41.27	±	11.10	50.80	±	15.81	23	52.62	±	18.20	4	28
Verbal	50.86	±	15.99	58.40	±	17.31	15	67.74	±	28.40	16	33
Control	43.58	±	16.13	49.21	±	21.03	13	43.25	±	17.50	-12	-1

Values are Mean ± SD, B%=Baseline to Week 4, W4%=Week 4 to Week 8, W8% = Baseline to Week 8
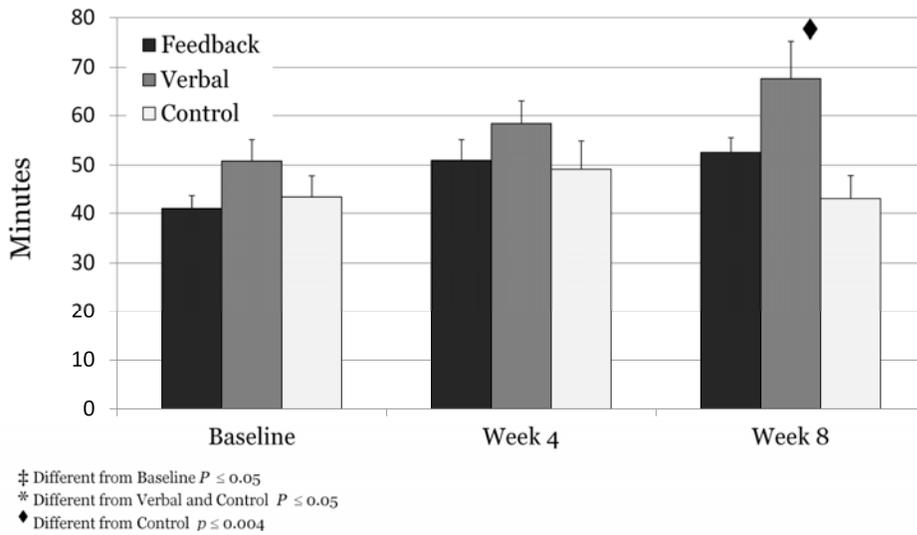
Figure 4.3. Low Intensity Activity – Total Time Over 5 Days

4.7 Meeting Recommendations

Difference between groups with respect to meeting ACSM recommendations (yes/no) were noted (, $p \leq 0.01$) (Table 4.5). The only group to improve was the Feedback group (Figure 4.4). Although the Verbal group exhibited a significant increase in the time spent in moderate intensity activity, change from baseline was not significant. Figures 4.5, 4.6, and 4.7 display the percent of participants meeting ACSM recommendations at each week.

TABLE 4.5

MEETING RECOMMENDATIONS AT BASELINE, WEEK 4, AND WEEK 8

	Baseline	Week 4	Week 8
Feedback	0	11	11
Verbal	0	1	4
Control	0	0	0

Values are Mean ± SD

33

‡ Different from Baseline $P \le 0.05$
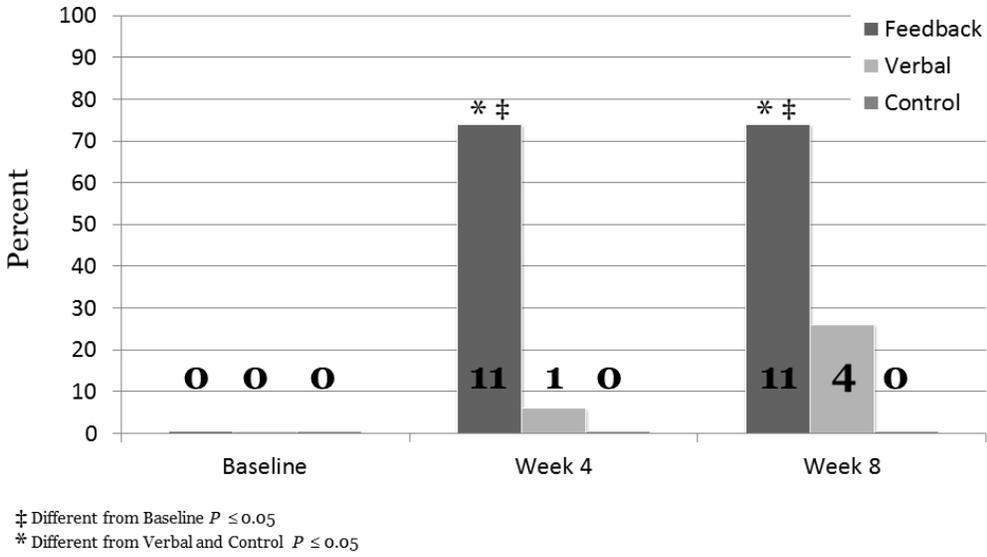* Different from Verbal and Control $P \le 0.05$

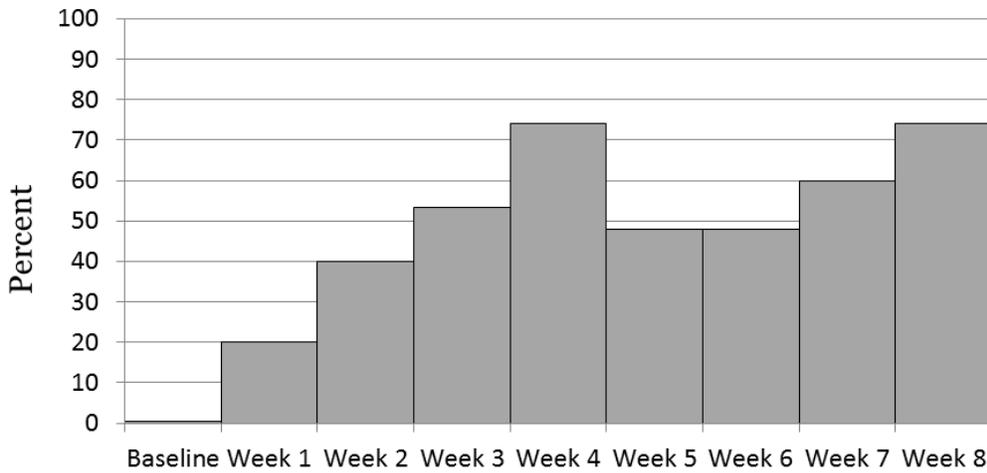Figure 4.4 Meeting Recommendations at Baseline, Week 4 and Week 8

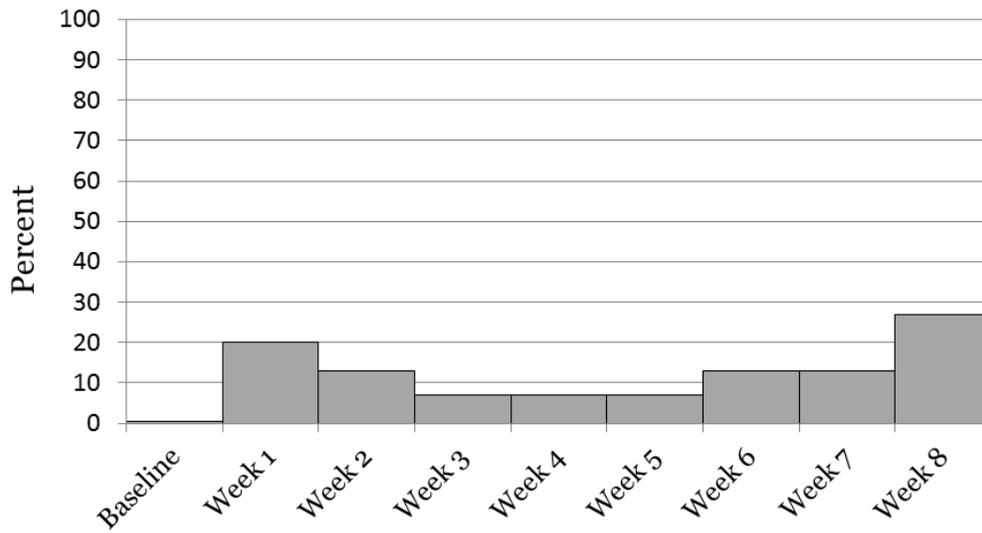Figure 4.5 Meeting Recommendations Feedback Group

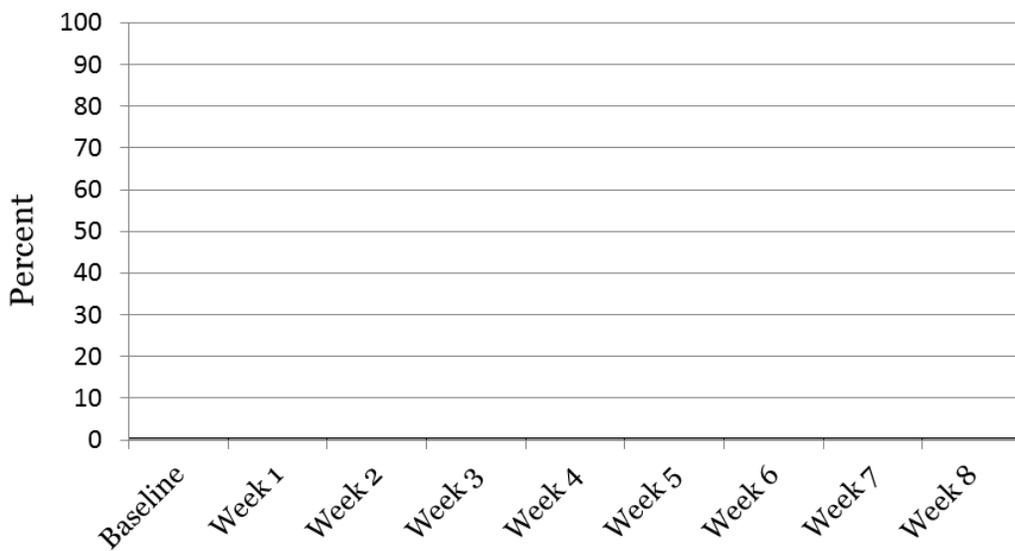Figure 4.6 Meeting Recommendations Verbal Group

Figure 4.7 Meeting Recommendations Control Group

CHAPTER 5

DISCUSSION

The design of this study was aimed to determine the efficacy of providing detailed feedback as a means to increase the quality of daily physical activity in older women. The Koizumi, D., Rogers, N. L., Rogers, M. E., Islam, M. M., Kusunoki, M., and Takeshima, N. (2009), study reported increases in intensity from baseline but participants did not achieve ACSM recommendations. Similarly, the Rice, Heesch, Dinger, & Fields (2008) study, investigated the ability of older women to learn/recognize walking at a moderate pace for at least 10 minutes if provided with a heart rate /practice session first. However, the study did not evaluate if they could walk for 30 minutes at a moderate intensity activity as recommended for older adults.

In the current study, no significant difference was noted in MPA at baseline between all 3 groups. After the 8-wk intervention, the Feedback group was the only group to meet ACSM recommendations. The Feedback group's improvement was significant compared to both Verbal and Control groups at both 4- and 8-weeks. Participants spent about 37 minutes performing moderate intensity activity by week 4 which had increased from the 12 minutes at baseline. Although the Verbal group exhibited significant improvement from baseline to Week 4, spending about 20 minutes in moderate intensity physical activity increasing from 12 minutes at baseline, they did not meet ACSM recommendations. It should also be noted that 11 of the 15 feedback participants achieved the ACSM recommendations by week 4, with all but 1 participant having achieved the recommendations at least once by the end of the 8-week intervention. In contrast, only 1 participant in the Verbal group met ACSM recommendations at Week 4, with only 4 of 15 participants meeting the recommendations by Week 8.

The ACSM recommendations prescribe 150 weekly minutes of moderate intensity physical activity. The ACSM also recommends physical activity on at least 5 days so participants' total time was computed using their best 5 days to compare their total time against the recommended 150 minutes. The results of this study indicated a relationship between all 3 groups and total time over 5 days spent in moderate intensity. The Feedback group improved total time spent in moderate intensity activity by 251% from baseline to Week 4 and 264% from baseline to Week 8. The participants spent about 180 minutes in moderate intensity physical activity compared to the 50 minutes they engaged in at baseline. Although not significant the Feedback group improved 4% from Week 4 to Week 8. The Verbal group improved 77% from baseline to Week 4 and 85% from baseline to Week 8. This group increased from 50 minutes of moderate intensity physical activity at baseline to about 100 minutes. Although not significant, Verbal improved 4% from Week 4 to Week 8. Despite the increase in total activity minutes from baseline to Week 8, the Verbal group did not meet the recommendations of 150 total weekly minutes. There was no change in the control group.

To our knowledge, this is only the second study designed to increase moderate intensity walking through the use of heart rate monitors and accelerometers. The Feedback participants were able to sufficiently learn/recognize walking at a moderate pace, which supports the results of the Rice, Heesch, Dinger, & Fields (2008) study. Within the first few weeks, 6 participants were already achieving the ACSM recommendations as compared to baseline at which time participants were not meeting recommendations. Several others where short of meeting recommendation in those same weeks but had still increased their overall activity minutes from baseline. This suggests that practicing walking at a moderate pace may help older women better understand what it feels like to walk at a moderate intensity and therefore achieve higher amounts of moderate intensity physical activity. In addition to the walking education session, detailed feedback representing time spent in

daily moderate intensity activity as well as individualized activity goals were given to Feedback participants each week. This feedback allowed participants to visually see if they were not walking fast enough to achieve the moderate pace or if they simply were not walking the recommended 30 minutes. This visual feedback may have given participants the motivation to achieve the recommendations set forth by the ACSM in order to live a healthy life. The face-to-face contact that was required to provide the Feedback group detailed feedback and personalized goals may have positively influenced the older women to increase their daily physical activity. The interaction with the participants may have independently influenced the participants to increase their amount of time walking at a moderate pace. Future studies should teach older adults how to increase their activity intensity and how to set their own goals based on their weekly achievements. This will allow researchers to offer this intervention without it being so time consuming to both participants and study personnel.

5.4 Meeting Recommendations

None of the 69 participants met ACSM recommendations at baseline. Following the 8 week intervention 11 of 15 Feedback participants met the ACSM recommendations. Only 4 of 16 Verbal participants met the ACSM recommendations, and no Control participants having met the ACSM recommendations. After the heart rate session the Feedback group gradually increased the amount of time they spent in moderate intensity activity, with six participants meeting the recommendations by Week 2. There were 11 participants that met the recommendations at week 4. After this week the number of participants that met the recommendations decreased slightly due to several becoming sick. Those individuals recovered and were able to achieve the recommendations again by week 8. All but one participant met the recommendations on at least one occasion throughout the 8 week

intervention. There may be an age cut off point due to the fact that the only participant in the

Feedback group who never met the recommendations was 83 years old with the next oldest person

being 77.

5.5 Low Intensity Activity – Total Time

Low intensity activity was analyzed to determine if increased walking occurred at a less than

moderate intensity. If this variable increased in the verbal group only, we could then infer that the

verbal group did in fact increase their walking, but not at a moderate pace. The Feedback group

increased the amount of time spent in low intensity physical activity from baseline to week 4 but not

from week 4 to 8. On the other hand the Verbal group indicated a significant increase in low

intensity physical activity from baseline to week 8. The increase in the amount of time spent in low

intensity within the Verbal group indicates that this group may have been walking to try to meet the

recommendations but failed to walk at a pace that is considered to be moderate. Research

comparing an increase in steps to amount of activity in both low and moderate intensity may indicate

the need for both a heart rate session and detailed feedback to increase moderate intensity physical

activity.

5.6 Conclusion

Based on the results of this study, which indicate that the detailed feedback is more effective than recommendation alone, this walking program should be implemented by healthcare providers as a means to improve the amount of moderate intensity physical activity engaged in by older adults. Healthcare professionals need to move beyond verbal recommendations. Providing simple feedback significantly improved time spent in moderate intensity physical activity by the 4th week.

The authors are cognizant of the time constraints on the modern day healthcare provider. Therefore future research should be aimed at evaluate less time-intensive programs. One such study should evaluate home-based walking programs where participants meet with the research staff once per week for feedback and goals. This would be similar to the Koizumi, et al., 2009; however the future study should focus more on ACSM recommendations and also include the heart rate education sessions. Additional, the Verbal arm of this study should be repeated but also include the heart rate education session as well as a more in-depth discussion regarding the relationship between intensity and duration. The authors believe that the verbal group could have performed better in the current study if they had a better understanding of their accelerometers, and the fact that if they were walking more, but not recording moderate intensity minutes they should quicken their pace. The socialization aspect of the study also needs to be considered in future research. The Feedback group significantly increased the amount of time they spent in moderate intensity activity. In fact, several of the participants in that group began to achieve amounts of time in moderate intensity well above the ACSM recommendations. The individuals where enthusiastic about the program and their new walking habit, however, meeting with study personnel 3 days a week may have lead them to feel more accountable for their daily walking activity.

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APPENDICES

APPENDIX A

EXERCISE AND SCREENING FOR YOU FORM

easy
Exercise And Screening for You

Getting Started

It is always a good idea to start at a level that is easy for you and to build up slowly. See the attached safety tips.

While it is generally not necessary to see a health care provider before beginning every-day physical activities that are of light or moderate intensity, we encourage you to talk with your health care provider about your health and exercise as part of your regular visits.

The EASY tool at www.easyforyou.info helps identify ways you can be active safely.

For more information
on using the EASY tool please contact:
Phone: 979-458-3507
Email: ahpp@srph.tamhsc.edu

www.easyforyou.info

Nearly all older adults can safely meet the national recommendations of engaging in moderate intensity physical activity (such as brisk walking or gardening) for at least 30 minutes a day, most days of the week. The EASY tool helps you know when to see a health care provider to discuss your exercise plan and how to choose activities for optimal benefit if you have any health problems.

www.easyforyou.info

Answering the Six Easy Questions:

EASY QUESTIONS (Circle Response):

1) Do you have pains, tightness or pressure in your chest during physical activity (walking, climbing stairs, household chores, similar activities)?	Yes	No
2) Do you currently experience dizziness or lightheadedness?	Yes	No
3) Have you ever been told you have high blood pressure?	Yes	No
4) Do you have pain, stiffness or swelling that limits or prevents you from doing what you want or need to do?	Yes	No
5) Have you fallen in the past year, or do you feel unsteady or use a cane or walker while standing or walking?	Yes	No
6) Is there a health reason not mentioned why you would be concerned about starting an exercise program?	Yes	No

www.easyforyou.info

Revised 11/15/2007

WICHITA STATE
UNIVERSITY
Department of
Public Health Sciences

Increasing Physical Activity Intensity of Older Women

You are invited to participate in a study to examine different methods to increase the intensity level of physical activity in older adults. We also hope to identify relationships between daily physical activity and strength, balance, flexibility, mobility, and cardiovascular fitness in older individuals. Knowledge gained from this project will also assist exercise and medical professionals in prescribing activity and in helping older individuals maintain their independence. We would like you to take part in this study. You were selected as a possible participant in this study because your age is within the range in which we are interested. We will recruit approximately 80 people to participate in this project.

If you decide to participate, you will be asked to perform a series of baseline assessments. These assessments are designed to measure your functional fitness, ability to walk at a moderate intensity, aerobic fitness level, and daily activity level. The assessments will 1:30 minutes and will be completed at Health Strategies.

During the assessments we will ask you to perform a timed test where you will be asked to stand from a chair, walk 8 feet, and return to the chair. Your lower body flexibility will be assessed while sitting in a chair and reaching toward your toes and strength will be assessed while rising from a chair and sitting down for 30 seconds. Your walking ability will be assessed by having you walk around a 50-yard perimeter for twelve minutes. Your upper body strength will be assessed while lifting a dumbbell (5 pounds for women, 8 pounds for men) for 30 seconds and flexibility by placing your arms behind your back. To measure your ability to walk at a moderate intensity, you will walk on an indoor track, during which you will be asked to demonstrate, without assistance, a moderate-intensity walking pace for 15 minutes. During the walk you will wear a heart rate monitoring chest strap which will transmit heart rate data to a computer monitored by study personnel. You will also be asked to complete a sub-maximal bicycle test.

To measure your typical daily activity, you will be given a "locked" accelerometer, a small device attached at your waist, to wear for 2 weeks. We will explain when and where to wear the accelerometer. Two weeks after the assessments, we will meet with you at Health Strategies to "unlock" your accelerometer and download information pertaining to your daily activities.

Following baseline assessments, you will be randomly assigned to one of three groups. Dependent on your group selection, you will be asked to do the following activities:

Group 1. You will meet with study personnel 4 times over the 8-week intervention (baseline, verbal recommendation, accelerometer download during month 2, and mid-assessment). Each meeting will occur at Health Strategies fitness center. You will be given verbal instructions on how to increase your moderate intensity activity (30 minute session). The amount and intensity of you daily physical activity will be monitored by an accelerometer which you will wear during all waking hours (taking it off to bathe or swim). You will meet with study personnel 2 other times to download your accelerometer data (10 minute session) and complete post assessments (1:15 min session).

Group 2. Meet with study personnel for 1 hour, 3 days per week for 8 weeks at Health Strategies fitness center. Health Strategies has an indoor walking track where you can walk in a safe environment under the observation of study personnel. You will also be asked to walk on your own two additional days per week over the 8-week intervention. You will receive all verbal recommendations as described in group 1. In addition to meeting and walking at a designated time, you will receive additional pieces of information: 1. direct experience, guidance, and measurement of walking at a moderate intensity, 2. accelerometer feedback detailing the amount of daily moderate intensity activity you partake in, and 3. goals to increase your total walking time to at least 30 minutes per day for 5 days per week, followed by goals to increase your time spent in moderate intensity walking. You will also wear a heart rate monitoring chest strap which will transmit heart rate data to a computer monitored by study personnel. Time spent in moderate intensity physical activity will be increased by 4 minutes each week or until the overall goal of 30 minutes of moderate intensity physical activity is attained.

Group 3. Meet with personnel 3 times per week over the 8-week intervention (baseline, accelerometer download during month 2, and mid-assessment). Participants assigned to this group will be asked to continue their normal activities for 8-weeks. You will meet with study personnel 2 times over the 8 weeks to download your accelerometer data (10 minute session) and complete post assessments (1:15 min session).

Following completion of the first 8 weeks of the study, group crossover will occur. Group 2 will begin the second 8 weeks focusing on maintaining the ACSM recommendations on their own, without feedback or designated walking times. Both Groups 1 and 3 will begin the protocol described for Group 2.

Potential Risk
There are potential health risks associated with participation in physical activity. The most likely risk is the possibility of muscular-skeletal injury. Typically these injuries involve minor muscle

soreness in previously sedentary individuals who exercise unwisely and are typically associated with overuse or abrupt changes in exercise routine.

However, if you suffer from hidden heart disease, physical activity could cause chest pain, dizziness, or bouts of irregular heart rhythms. Also, there is always a slight risk of a heart attack occurring during physical exertion in persons with preexisting heart disease. You will be asked about any type of disease that you may have. The risk of serious medical complications is most persistently associated with very high intensity exertion in high-risk participants with infrequent exercise habits. This program will promote moderate intensity walking. Risk will be minimized by requiring physician consent if you are at-risk for a cardiovascular or cerebrovascular incident.

There is a risk of temporary balance loss or falling while performing the walking or functional fitness tasks. This risk will be minimized by providing spotters, having sturdy chairs nearby to grab and/or sit and rest if a temporary loss of balance is encountered, and by study personnel walking with participants. Additional research personnel will monitor participants for signs of fatigue and distress during the 30 minute walking sessions.

<u>Potential Benefits</u>

You will benefit from participating in a monitored walking program specifically designed for older adults. You should increase your cardio-respiratory function and become more aware of exercising at a moderate intensity. This will improve your fitness and may allow you to maintain an independent lifestyle for longer periods of time. You will gain an understanding of your own physical abilities and an appreciation for the effects of physical activity on these parameters.

In general, this study will improve the knowledge concerning the potential for improved functional fitness in older individuals, enhancing the ability to help people live independently for longer periods of time. This study will also contribute to our understanding of the relationships between physical activity, health, and functional fitness in older adults. Data pertaining to enhanced functional fitness as an outcome of a cardio-respiratory fitness program for older adults will have far reaching implications as these issues continue to be studied more extensively. The information and resulting data from this study will permit professionals in many areas, such as exercise and medicine, to actively provide appropriate interventions to the public sector which will enhance prevention techniques. Additionally, the study can provide new ways to address the loss of functional capacity that individual's experience later in their life. Ultimately, a goal from this study will be for older individuals to understand the potential for improved functional fitness, thus enhancing their ability to live independently for a much longer period of time.

If you take part, your results will be combined with other participants so it will not be possible to identify your responses in a published report; your name will not be directly associated with any of the results.

You have been informed and you understand that Wichita State University does not provide medical treatment or other forms of reimbursement to persons injured as a result of or in connection with participation in research activities conducted by Wichita State University or its

faculty. If you believe that you have been injured as a result of participating in the research covered by this consent form, you should contact the Office of Research Administration, Wichita State University at 316-978-3285.
If you have any questions concerning this study, you may contact Dr. Rogers at work (316-978-6684) or at home (316-686-7749). You may also contact the Office of Research Administration at 316-978-3285.

YOU ARE MAKING A DECISION WHETHER OR NOT YOU WILL PARTICIPATE IN THIS STUDY. YOU SHOULD NOT SIGN UNTIL YOU UNDERSTAND ALL THE INFORMATION PRESENTED IN THE PREVIOUS PAGES AND UNTIL ALL YOUR QUESTIONS ABOUT THE RESEARCH HAVE BEEN ANSWERED TO YOUR SATISFACTION. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE IN THIS STUDY.

You will be offered a copy of this letter to keep.

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

_____   _____
Signature of Participant   Date

_____
Name Printed

_____   Date   _____
Nicole L. Rogers, PhD
Principal Investigator

APPENDIX C

MEDICAL CLEARANCE FORM

Increasing the Physical Activity Levels of Older Adults

MEDICAL CLEARANCE OF PERSONAL PHYSICIAN

Your patient, _____, has expressed an interest in participating in a Community-Based Walking Program, offered through the Department of Public Health Sciences Aging Studies Program and Department of Human Performance Studies at Wichita State University and Health Strategies.

We would appreciate your medical opinion and recommendations concerning this individual's participation in exercise. If you feel that this individual might benefit from participation in the program, we would greatly appreciate your endorsement of his/her participation.

Assessments: **The program participants are asked to complete a series of functional fitness assessments as well as a moderate intensity walk. This are completed to identify weaknesses in physical parameters associated with activities of daily living and to more effectively prescribe appropriate exercise.**

Physical Parameters	Assessments	Approval	
Cardiovascular	12 minute walk	yes ___	no___
Muscular Strength / Endurance	30 second chair stand	yes___	no___
	30 second arm curl	yes___	no___
	Flexibility	Chair sit-and-reach	
	yes___	no___	
	Back scratch	yes___	no___
Balance & Gait	8 foot up-and-go	yes___	no___
	Computerized Postural Sway	yes___	no___
	Computerized Limits of Stability	yes___	no___
Moderate Intensity Walk	15 minute walk at moderate intensity *wearing heart rate monitor	yes___	no___
Submaximal exercise test	YMCA Bicycle Test	yes___	no___

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Walking Program:

Group 1. Meet with study personnel 4 times over the first 8-weeks of the intervention (baseline, verbal recommendation, accelerometer download during month 2, and mid-assessment). Be given verbal instructions on how to increase moderate intensity activity. The amount and intensity of daily physical activity will be monitored by an accelerometer which your patient will wear during all waking hours.

Group 2. Meet with study personnel 3 days per week for 8 weeks at Health Strategies fitness center. Health Strategies has an indoor walking track where your patient can walk in a safe environment under the observation of study personnel. Your patient will also be asked to walk on their own two additional days per week over the 8-week intervention. They will receive all verbal recommendations as described in group 1. In addition to meeting and walking at a designated time, they will receive two additional pieces of information: 1. direct experience, guidance, and measurement of walking at a moderate intensity and 2. accelerometer feedback detailing the amount of daily moderate intensity activity you partake in.

Group 3. Patients assigned to this group will be asked to continue their normal activities for the duration of the 16-week project.

Following completion of the first 8 weeks of the intervention, group crossover will occur. If your patient was assigned to groups 1 or 3 they will be invited to participate in the activities described in group 2.

Walking Program Approval: yes ____   no _____

Please list any modifications/comments for testing and the walking program:

_____

Please indicate by your signature below that your patient is medically cleared to participate in the specific portions of testing and training as described. Please call Dr. Rogers if you have any question concerning the program at (316) 978-6684.

_____   _____   _____

Signature of Physician   Print Name of Physician   Date

Physician phone #: (____) _____ - _____

Please return this form by FAX or Postal Mail to:

Nicole L. Rogers, PhD

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