ACCELEROMETER DETERMINED PHYSICAL ACTIVITY IN OLDER WOMEN: A DESCRIPTIVE STUDY

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 in Gerontology.

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DEDICATION

To my husband, Ali, and my son, Mohammad
I give my deepest expression of love and appreciation for the encouragement that you gave and the sacrifices you made during this graduate program.

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This study is done with the cooperation of four Senior Centers (El Dorado, Downtown Wichita, Linwood Wichita and Hesston), one fitness center (Health Strategies) and one public event (Senior Expo). Thanks to all older adult who participated in this research and to volunteers who helped on data collection. Also a special thank to my colleague and friend Mindy L. Slimmer who was a big help all through the research.

ABSTRACT

Older adults are the fastest growing age group of the population in the US, yet they are the least physically active group compared to the others. The Center for Disease Control and Prevention, and the American Heart Association, all recommend that older adults should spend at least 30 minutes, five days per week doing moderate-intensity physical activity or 20 minutes of vigorous-intensity activity on at least three days per week to maintain good functional fitness. With respect to the amount (steps) of daily physical activity, there are few recommendations. A general consensus suggests that to remain healthy and maintain functional fitness, older adults should attain between 6,000 and 8,500 steps per day. One hundred and seven women aged 60 – 80 years old (73.23 ± 7.73 yrs) were asked to wear an accelerometer during all waking hours for two weeks. Daily physical activity was monitored for 2 weeks, variables analyzed were steps and intensity of physical movement ranging from low to high intensity.

Evaluating the descriptive statistics of this study and comparing them to the suggested adult of physical activity levels (Sedentary = 2000-4999, Low Active = 5000-7499, Somewhat Active= 7500-9,999, Active = 10,000 - 12,999, and Highly Active = 13,000 or more), no age group was Active. Even when evaluating the mean of participant's one high day, the two most active age-groups (60s and 70s) were only considered Somewhat Active at approximately 8,200 daily steps. This 8,200 daily step rate does meet the older adult recommendations suggested by more recent research. With respect to the recommendation about the intensity level of physical, no group met this goal. The highest 5-day average was achieved by the 70-year old group at just over 16 minutes, followed by the 60-year olds at just over 14 minutes. The 80 year old group engaged in the least amount of moderate intensity activity with their highest average at just over 13 minutes once per week.

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CHAPTER 1

INTRODUCTION

According to the Center for Disease Control and Prevention, older adults are the fastest growing age group of the population in the US, yet they are the least physically active group compared to the other age groups. 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). There is a positive association between habitual daily physical activity with 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 assitance (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 and enhancing the functional fitness of older adults (Nelson, et al., 2007). It has been shown that physical condition (balance, walking speed and lower-extremity strength) is important to the health and functional fitness 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 reccommendations 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. 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 methabolic syndrome. Increased levels of habitual physical activity could lessen the occurrence of functional impairment and disability caused by methabolic 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. The main form of physical activity among the older population is walking; therefore, the number of steps taken per day could be a good indicator of an older adult's daily physical activity (DPA) (Tudor-Locke, Hart, & Washington, 2009). Most of the earlier studies measuring daily physical activity in older adults have used questionairres to assess physical activity. Recently, older participants' daily step-count and the intensity of daily physical activity have been more accurately measured in recent pedometers and accelerometer studies. The accurate measurements provided by the pedometers and accelerometers are more 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, Park, Watanabe, Park, & Shephard, 2009).

1.1 Statement of the Problem

As adults reach advanced ages, their chronic disease status is generally well established and the purpose of physical activity shifts from disease prevention to functional mobility – the ability to continue an active lifestyle, stay in good physical shape, and remain independent. Physical activity thus becomes critically important to delay the onset of functional limitations, maintain independence, and improve quality of life. Findings from this study will be used to determine if older adults in an urban setting meet the ACSM recommendations and how many minutes they spend in low, moderate, and high intensity activity.

1.2 Significance of the Study

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). However, the duration of activity is difficult to predict (Rowe, Kemble, & Robinson, 2007). Although recommendations suggest 30-minutes of moderate intensity exercise, given the discrepancy between objective and subjective data and the potential difference between activity for disease prevention and activity for functional fitness, this duration may in fact be less than 30 minutes. These findings will be significant not only as they provide evidence-based support documenting the need for older adults to remain physically active, but may also serve as preliminary data for the establishment of physical activity recommendations necessary for the maintenance of functional ability.

1.3 Variables

This project was a descriptive study to determine the daily physical activity level (amount and intensity) of older adult women. Daily physical activity was monitored by a Lifecorder EX accelerometer for 2 weeks. Lifecorder EX variables analyzed were: steps and intensity of physical movement ranging from 0 (low intensity) to 9 (high intensity). The following physical activity categories have been validated in adults (1-3 = light, 4-6 = moderate, 7-9 = vigorous) and were utilized in this study. Daily physical activity was organized into the following physical activity categories: Moderate-Intensity Activity at 5 minute intervals from 0 to 1 hour and 45 minutes and Amount of Activity: Very Sedentary (1999 or less), Sedentary (2000-4999), Low Active (5000-7499), Somewhat Active (7500-9,999), Active (10,000-12,999), and Highly Active (13,000).

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 they were asked to wear their accelerometer and engage in daily physical activity. Physical activity would 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 fall and 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. The threshold is four days (Troiano, Berrigan, Dodd, Masse, T, & McDowell, 2008). 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. Also it's been reported that pedometer use could be a motivation especially for women to do more activities (Marshall, et al., 2009).

1.6 Delimitations

This study's results are limited to women 60-80 years old residing in an urban Midwest City.

1.7 Definitions

1. Daily Physical Activity Assessment: Daily physical activity was monitored by a Lifecorder EX accelerometer for 2 weeks. Lifecorder EX variables analyzed were steps and 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 the PI and staff downloaded accelerometer data to a research PC for further analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 Physical Activity Recommendations for Older Adults

According to researchers Nelson et al. older adults need to be physically active to maintain their health (2007). Older adults should do moderate-intensity aerobic physical activity a maximum of 30 minutes five days a week or vigorous-intensity aerobic activity or a minimum of 20 minutes three days a week. Moderate-intensity aerobic activity is relative to an older adult's aerobic fitness. For instance, for some people a moderate-intensity walk is a slow walk, and for others it is a brisk walk. They may combine moderate- and vigorous-intensity activity to meet this recommendation in addition to the activities they engage in during their normal routine (e.g., self care, washing dishes, and taking out trash, walking to and from their car in a parking lot). As well, older adults should do anaerobic activities at least twice a week. The minimum recommendation is to perform eight-to- ten exercises at least two days a week.

It is suggested to exceed the minimum recommended amount of physical activity to improve functional fitness, reduce the risk factors of chronic diseases and disabilities and also to prevent weight gain (Nelson et al., 2007). If older adults want to maintain the flexibility needed for regular physical activity and daily life, they should perform activities that preserve or increase flexibility, two days a week for at least 10 minutes. Improving balance by exercise will help older adults to reduce risk of injury from falls. There are those older adults who have one or more medical conditions and physical activity is therapeutic for them; therefore, they should carry out physical activity in a way that effectively and safely takes care of their condition(s). Older adults should make a plan for gaining adequate physical activity and also they should self-

monitor their own physical activity on a regular basis modify exercise plans as their abilities get better or as their health condition changes.

2.2 Physical Activity and Health

Researchers Yukitoshi and Shepard (2009) studied the impact of habitual physical activity on older adult's health. They did a cross-sectional analysis on existing data from an eight year study of 1000 Japanese aged 65 and older. Daily step counts and daily duration of activity of < 3 and > 3 METs (i.e. metabolic equivalent) was measured by using accelerometers which could detect more than 10 levels of intensity of physical activity. The researchers in their analysis found an association between the health of older adults and both "the duration of effort undertaken at an intensity of $\geq$ 3 METs and the daily step count." In men, health was more related to duration, and in women, health was more related to step count. The result also indicates the mental benefit of physical activity is seen earlier with much smaller amount of activity compared to physical health benefits that need more efforts. The researcher's observation proposes that "better overall health is seen in people who take an average of $\geq$ 8000 steps/day and/or spend $\geq$ 20 min/day at intensity $\geq$ 3 METs." They also considered weather as a factor that controls the amount of activity an older adult was able to accomplish. As precipitation increased, the amount of activity decreased to an average of 4,000 steps/day. The peak of daily step count occurred at a temperature of 63 degrees Fahrenheit.

Another study looking at health and physical activity tried to find "the association of age and activity level with risk factors of chronic disease" (Woolf, Reese, Mason, Beaird, Tudor-Locke, & Vaughan, 2008). The participants were 49 young, 62 midlife and 47 older women, who

were asked to wear a pedometer for seven days. Based on the average step count, the participants were classified into two distinct categories: active (≥ 7500 steps per day) or sedentary (≤ 7500 steps per day). Participants also completed a weighed food record during the same seven days. Researchers measured weight and height and waist circumference. A blood test was taken to determine the level of chronic disease related risk factors (serum lipid, CRP, insulin, leptin, thyroid stimulating hormone, and plasma glucose levels). The result of this cross-sectional study showed that more physical activity in all three age groups is associated with less risk factors of chronic disease with younger age and greater physical activity being the two indicators.

2.3 Physical Activity, Functional Fitness and Health

Researchers Purath, Buchholz and Kark (2009) studied the relationship between functional fitness, demographic characteristics, physical activity and health in 34 participants aged 60 or older in a community setting. Functional fitness was measured by using the Senior Fitness Test. Older adults were asked to do a self-report of ther demographics, general health and also the level of their physical activity during a one-week period.The result of data analysis indicates that those older adults who reported fewer chronic conditions and better health condition had better scords on the SFT measures. Also, those with more reported physical activity "had significantly better upper and lower body strength, aerobic endurance, and dynamic balance."

An interesting one-year study in Japan on 76 male and 94 female older adults between the ages of 65 and 84 tried to find the association between functional fitness and year-long accelerometer determined physical activity (Aoyagi, Park, Watanabe, Park, & Shephard, 2009).

The Aoyagi et alls. study tries to overcome the limitations of similar studies which used only a questionnaire to measure physical activity or did not consider the effect of seasonal weather changes on physical activity levels in older adults. Participants were asked to wear an accelerometer for one year, so the researchers could measure the average steps per day and also the duration of physical activity at intensity level of ≥ 3 METs. At the end of the one year period, to measure functional fitness, the researchers assessed "preferred and maximal walking speeds, peak handgrip force, peak knee extension torque, total body sway and maximal functional reach." The results show a significant positive relationship between both the daily steps and the duration of activities at the intensity level of ≥3 METs and lower body function like knee extension torque and walking speed, especially in people 75 or older.

2.4 Pedometers and Accelerometers

Accelerometers are capable of estimating intensity by measuring physical activity minute-by-minute; however, because of 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." Also it has been shown that its output correlate with accelerometers. (Tudor-Locke, Williams, Reis, & Pluto, 2002). 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). A study by Troiano et al (2008) indicates that older adults usually do not engage in high intensity physical activities; therefore, measuring the volume of their activity is sufficient and does not require the usage of accelerometers. Also, Marshall (2007) mentions 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. 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.

2.5 Intensity of Physical Activity

Researchers Brach, Simonsick, Kritchevsky, Yaffe, and Newman (2004) wanted to determine if those older adults who exercise regularly have better functional fitness levels compared to those who are active but do not exercise. They designed a cross-sectional study on 3075 women and men aged 70 to 79. Participants were divided into three groups based on the participants answers to a "modified leisure-time physical activity questionnaire": inactive, lifestyle active and exercise group. To measure functional fitness, researchers used the Established Populations for the Epidemiologic Studies of the Elderly (EPESE) battery, which includes chair stands, balance and 6-meter walk. In addition they did a 400-meter walk test and also isokinetic strength testing of the knee extensors.

The result of the Brach et al. study shows the importance of the intensity level in physical activity (2004). The older adults in the exercise group, who expended similar amount of energy to the active group, but at a higher intensity level, had better functional capacity. Researchers conclude that while daily life activity might protect against functional limitation exercise is essential to support greater functional capacity in older adults.

A group of researchers (Marshall, et al., 2009) tried to define moderate intensity activity by using commercially available pedometers to measure the steps per minute of their participants. The researchers knew that people, who use pedometers, increase their physical

activity level by 27 percent; therefore, they specifically wanted to know how many steps in 30 minutes make the walk a moderate-intensity physical activity. Ninety-six participants with a mean age of 32.1 [±10.6] years were asked to wear pedometers and walk on a treadmill at 65, 80, 95 and 110 mile.min^{-1}. The energy expenditure was measured at each speed, then "step rate cut points associated with minimally moderate-intensity activity (METs)" were determined. The results indicate that people need to walk at least 100 steps per minute to have a moderate-intensity activity. However, the study shows that step rate is a poor proxy for METs but the authors suggest that it can be used as a general promotion: 3000 steps in 30 minutes, five days a week. They also mention that older adults and people with higher BMIs will need less steps.min^{-1} to be considered moderately active.

Regarding the intensity level of physical activity there is a study (Tudor-Locke, Johnson, & Katzmarzyk, 2009) which used the 2005-2006 National Health and Nutrition Examination Survey (NHANES) samples of 3744 participants ≥ 20 year. Researchers computed steps per day once using all steps (i.e., uncensored) and again one more time after "censoring the steps taken at an intensity< 500 activity count per minute" (inactivity intensity). The result showed that adults in the US take about 10,000 uncensored steps per day, which is questionable considering other studies of physical activity in the United States. The suggestion is that until more valid conversion factor is assigned to translate steps taken per day to an intensity level using of the <500 activity count per minute threshold is the best choice.

Authors Tudor-Locke, Hart and Washington (2009) reviewed 28 articles to update what are the expected values for "pedometer-determined physical activity" in people older than 50 who are healthy and living independently. Most of the studies (61%) used the model length of

seven days to monitor the activity level. Mean physical activity ranged from 2000 to 9000 steps/day which shows variability of physical activity among older adults. There is a consistent pattern in the studies reporting that men generally take more steps per day compared to the same age group of women. Also, as people get older, their step rate decrease; in addition, those who have normal weight based on their BMI, walk more than overweight older adults.

A Japanese study (Aoyagi, et al., 2004) develops a new method to define moderate-intensity physical activity for older adults. Researchers had 10 male and 13 female participants aged 65-74 years and healthy. They were asked to walk at their preferred walking velocity over a five-meter distance and later walk the same distance as fast as they can. The "peak isometric knee-extension strength" was also measured. In another visit, resting oxygen intake (V_ O2rest), resting heart rate (HR rest), V_ O2max and HR max were measured to determine maximal walking velocity. The result showed that a moderate intensity for an older adult is "approximately 60% of the maximal walking velocity or 110-115% of the preferred walking velocity." Also that "maximal walking velocity is an indicator of both peak knee-extension torque and VO_{2max}." Previous studies (Nagasak, Itoh, & Furuna, 1995) and (Nagasaki, Itoh, & Furuna, 1995) also had shown those with low preferred walking velocity are poor in functional fitness measures, too. Aoyagi et al. (2004) suggest the use of walking velocity as a method to regulate the intensity level of exercise for healthy older adults since walking is simple, safe and effective. The researchers believe the maximal velocity of walking over five-meters is higher than could be tolerated in a six-minute walk.

A study (TOGO, et al., 2008) tried to determine the minimum number of observed days to have a reliable estimation of a year-long physical activity in older adults. The researchers had 37 male and 44 female participants, aged 65 to 83 years, all of them healthy. Subjects were asked

to wear a pedometer for a year so their steps/day could be measured. The results showed that “if observations are distributed by day of the week and season or randomly” instead of consecutively, fewer numbers of observation days will be needed to obtain reliable estimates of an elderly individual's annual physical activity. Therefore, the researchers suggest the motivational efforts to increase a person's physical activity should be focused on “the season when activity for a given individual is at its lowest.”

A study by Cocker, Bourdeaudhuij and Cardon (2008) compares the reported physical activity through pedometer with questionnaires. The participants were 310 healthy adults with the mean age of 38.7 (SD 11.9) years: they were asked to wear a pedometer for seven consecutive days and complete and activity log for each day. The participants filled out three self-administered questionnaires and were interviewed by trained staff about their daily physical activities. The result of this study demonstrates a low positive correlation between objectively measured step counts and subjectively reported physical activity levels which the authors explain it as either a lack of sensitivity of the questionnaires or the participant’s underestimation of their walking. In conclusion, researchers found that accelerometers can measure intensity level of activities, while pedometers provide adequate data about physical activity in large, independent populations.

A concern among researchers is that using unsealed pedometers may lead to accrue more steps. The reason could be either participant’s desire to please the researcher or just because of the motivation to be more active by seeing their step counts. Marshall (2007) tried to find out if the feedback from an unsealed pedometer would encourage participants to walk more steps every day. Participants, who were randomly chosen to wear a pedometer for two weeks, included 105 older adults. During the first week they were required to monitor and record their steps and then

seal it for the second week. The results indicate a significant increase of the step count (400 step/day equal to 5 minute walk) while participants were using unsealed pedometers. Interestingly enough, the women accumulated more steps compared to men. The author concludes that despite the statistically significant difference between wearing a sealed versus unsealed pedometer, the difference is not considered clinically significant: it is important to keep in mind that the difference observed between sealed and unsealed pedometers is considerably below what is considered a successful pedometer-based intervention. (Bravata, et al., 2007). Thus, the results suggest that using unsealed pedometers and receiving immediate feedback does not encourage older adults to increase their walking behavior.

Rowe, Kemble and Robinson (2007) looked at day-to-day physical activity among older adults and evaluated whether a 10,000 step goal is accurate for classifiying it as 30 minutes of moderate to vigorous physical activity (MVPA). Ninety-one participants older than 60 were asked to wear a pedometer and an accelerometer for a week. The results indicate that even though the 10,000-step cut point might be accurate to identify days with less than 30 minutes of MVPA, it is not accurate enough for days with more than 30 minutes of MVPA. For that reason, authors conclude that because of low day-to-day variability in physical activity of older adults compared to other age groups, the 10,000-step goal is not adequate when determining 30 minutes of daily MVPA.

A study by Tudor-locke et al. (2004) looks at the "intra-individual variability" in pedometer-determined steps per day. Two hundred-nine participants (age=47$\pm$17) self-monitored their PA for a week. Statistical analyses while considering sex, age group, race, income level, education and BMI category, compared mean steps per day. Researchers analyzed "weekdays versus weekend days, workdays versus non-workdays and days of exercise versus no

participation.” The results show significant differences by age, BMI, race, education and income level; in addition, steps taken on weekdays were significantly higher than those taken on weekend days, steps taken on workdays were more than those taken on non-workdays and steps taken on exercise days were more than those on non-exercise days. In spite of the large SD, which shows a wide distribution of ambulatory behavior, significant differences were obvious.

2.6 Environmental Factors

Environmental factors (such as humidity, precipitation, day length, duration of bright sunshine and mean ambient temperature) could affect physical activity. Physical activity would decrease with increasing precipitation. Furthermore, the length of the day length is more of a factor affecting physical activity compared to humidity, wind speed and the duration of the sun shine in decreasing the activity level. The peak of daily step count is achieved at the mean outdoor temperature of around 63 degrees Fahrenheit. Physical activity decreases in a quadratic way especially below this temperature (Aoyagi & Roy, 2009). A longitudinal study by Chan, Ryan, and Tudor-Locke (2006) on 25 males and 177 females, measures participants’steps per day by pedometer and compares it with objective weather data. The result shows that weather related indices (total rain, mean temperature, total snowfall, maximum wind speed, accumulated snow on ground) with consideration of participants’ gender and BMI, can affect their activity level. The study also showed that physical activity level is affected by the day of the week and the seasons. In agreement with the Chan et al. study is the year-long study conducted by Akitomo et al. in Japan with 41 male and 54 female older adults (2008). Results of the Akitomo et al. study found that regardless of age and sex, there are clear "seasonal differences in the month-averaged step count and the length of low- and moderate-intensity activity.” The

measures peaked during the spring and/or fall and decreased to the lowest level in the winter. In direct contrast to the Chan et al. study and the Akitomo et al. study is the study conducted by Salmon, Owen, Crawford, Bauman, and Sallis (2003), which found that those who enjoy doing exercise usually do not consider the weather as a barrier to obtaining physical activity.

CHAPTER 3

METHODOLOGY

3.1 Participants

One hundred and seven women aged 60 – 80 years old (73.23 ± 7.73 yrs) were recruited from four senior centers (El Dorado, Downtown Wichita, Linwood Wichita, Hesston), one fitness center (Health Strategies) and one public event (Senior Expo). The Wichita State University Institutional Review Board has approved the study protocol. All participants were asked to read and sign an informed consent document (Appendix A).

3.2 Screening

Written permission from their physician was required to participate in the study (Appendix B) if results of the EASY (Exercise and Screening for You) (Appendix C) deemed it necessary.

3.3 Assessments

Demographics

A demographics questionnaire was given to each participant. It asked about variables such as current age, race/ethnicity, marital status, years of education, and household/family income, self-reports of alcohol consumption, smoking status, personal history of disease, and medication use. This questionnaire is attached (Appendix D).

Daily Physical Activity Assessment

Daily physical activity was monitored by a Lifecorder EX accelerometer for 2 weeks. Lifecorder EX variables analyzed were steps and 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 the PI and 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. Daily activity summary files (summary of steps and the number of 4 second intervals measured in each of the 9 activity categories) were easily downloaded to an Excel spreadsheet. Simple formulas were then utilized to calculate time spent in physical activity categories. 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.

To examine the impact of varying activity levels on measures of interest, accelerometer data was organized in the following physical activity categories: Moderate-Intensity Activity at 5 minute intervals from 0 to 1 hour and 45 minutes and Amount of Activity: Sedentary (1999 or less), Sedentary (2000-4999), Low Active (5000-7499), Somewhat Active (7500-9,999), Active (10,000-12,999), and Highly Active (13,000).

3.4 Data Analysis

The data are expressed as mean ± SD. Data analysis was completed using the statistical software program SPSS for Windows V.16.0 (SPSS Inc., Chicago, IL). Data were screened for outliers, and the assumptions of normality and homoscedasticity. 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. Each variable was examined for normality using the Kolomogorov-Smirnov test. Assumptions of homogeneity of variance and sphericity were evaluated. Data were downloaded into Excel and separated into two week sections. Data were then organized into six categories: daily steps, micro activity, sedentary activity, low intensity activity, moderate intensity activity, and high intensity activity. Each category was sorted from high to low. The following means and standard deviations were calculated: highest day, lowest day, 2 day average, 3 day average, 4 day average, 5 day average, 6 day average, and 7 day average. Age-group comparisons were made using one-way ANOVA's with follow-up Post Hoc analysis. A probability value of less than 0.05 was considered

statistically significant and a Bonferroni adjustment was used to correct for multiple measurements.

CHAPTER 4

RESULTS

4.1 Normality and Assumptions

Non-significant Kolomogorov-Smirnov tests indicated that steps were not normally distributed. To correct for non-normality, step were transformed using a Log10 transformation. Conducting a second Kolomogorov-Smirnov test on the transformed daily step variable revealed a successful transformation, with step being normally distributed. In addition, histograms and normal Q-Q plots revealed normal distributions for both groups. Assumptions of homogeneity of variance and sphericity were evaluated and not violated.

4.2 Missing Data

Missing data was divided into two types: complete loss and daily loss. Overall seven of 120 accelerometer data files contained limited data and were considered a complete loss. Loss was likely due to participants not wearing the device or to the lack of hip translation, and subsequent lack of data recording, during activity. Each site had limited missing data: Downtown FSAH = 2, Linwood FSAH-O+ = 2, El Dorado = 0, Hesston = 0, Health Strategies = 2 and the Senior Expo = 1. With respect to missing days, only 21 of 678 days were missing. The most number of days lost by one group was the Senior Expo group (n=12), followed by Health Strategies with 7missing days, and El Dorado with 2 days. Downtown FSAH-O+, Linwood FSAH-O+, and Hesston had complete files.

4.3 Participant Demographics

One hundred and seven participants completed the study. Participants were divided into three 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).

4.4 Daily Steps

Table 4.1 presents step with respect to high and low values as well as the step averaged for 2-7 days for 3 age-groups (60-, 70-, and 80-years). Univariate analysis revealed age-based differences for all 8 variables (high, low, and 2-7 day averages). Post Hoc comparisons indicate differences between the 60- and 80- age groups and the 70- and 80- age groups. No differences existed between the 60 and 70 age groups. Evaluating the descriptive statistics and comparing them to the suggested levels of physical activity (Sedentary = 1999 or less, Sedentary = 2000-4999, Low Active = 5000-7499, Somewhat Active= 7500-9,999, Active = 10,000 - 12,999, and Highly Active = 13,000 or more), no age group would be considered Active. Even when evaluating the mean of participant's one high day, the two most active age-groups (60s and 70s) were only considered Somewhat Active at approximately 8,200 steps. Using an age-adjusted activity level which considers 6,000 steps as active, the 80 year old group is still not considered active. However, the 60 and 70 year old groups both reached this level, with the 60 year olds attaining over 6,000 steps 5 days of the week and the 70 year olds attaining over 6,000 steps 6 days of the week. Using the age-adjust level of 8,000 steps; the 60- and 70-year olds met this level once in 7 days.

TABLE 4.1

STEPS: HIGH, LOW, AND DAILY AVERAGES

	Steps								
	60-69 years n = 38			70-79 years n = 46			80-89 years n = 23		
	Mean	±	SD	Mean	±	SD	Mean	±	SD
High	8190	±	3534	8341	±	4034	5424	±	2761 *
Low	3266	±	2045	3428	±	2191	2115	±	1633 *
2 Day Avg	7489	±	3278	7701	±	3884	5193	±	2720 *
3 Day Avg	6998	±	3139	7239	±	3827	4878	±	2666 *
4 Day Avg	6602	±	3028	6858	±	3725	4693	±	2566 *
5 Day Avg	6243	±	2957	6480	±	3593	4388	±	2448 *
6 Day Avg	5910	±	2854	6127	±	3463	4104	±	2338 *
7 Day Avg	5564	±	2724	5754	±	3243	3828	±	2222

* Indicates difference between both the 60 and 70 year old age groups

4.5 Step Frequencies

Table 4.2 presents step frequencies in each of the 2-7 day averages for the 60 year old age group. Categories are based on research by Tudor-Locke and are defined as: Sedentary = 1999 or less, Sedentary = 2000-4999, Low Active = 5000-7499, Somewhat Active= 7500-9,999, Active = 10,000 - 12,999, and Highly Active = 13,000 or more. With respect to the recommendation that healthy adults should walk 10,000 steps per day, only 3 participants met this goal by walking at least 10,000 steps 7 days of the week. Evaluating the 2-6 day averages, 4 participants were considered Highly Active 2 days per week and 2 participants were highly active 3 days per week. This means 7 participants walked at least 10,000 steps 2 and 3 times per week. On the other end of the activity spectrum, 17 of 35 participants were considered Sedentary; 9 were low active, and 6 were somewhat active. With respect to daily averages, participants were more active on fewer days of the week and this should be considered when

determining how many days of the week should be used to characterize individual's activity levels.

TABLE 4.2

STEP FREQUENCIES: 60 YEAR OLD WOMEN

	Step Frequencies: 60 Year Olds Daily Averages					
	2	3	4	5	6	7
Activity Level	n = 38	n = 38	n = 37	n = 36	n = 36	n = 35
Sedentary	0	0	0	0	0	1
Sedentary	11	12	14	15	16	16
Low Active	10	10	9	8	8	9
Somewhat Active	10	9	8	8	9	6
Active	3	5	6	5	3	3
Highly Active	4	2	0	0	0	0

Table 4.3 presents step frequencies in each of the 2-7 day averages for the 70 year old age group. With respect to the recommendation that healthy adults should walk 10,000 steps per day, only 3 participants met this goal by walking at least 10,000 steps 7 days of the week. Evaluating the 2-6 day averages, 1 participant was considered Highly Active 2 days per week and 1 participant was highly active 3 days per week. Eight participants were Active 2 days of the week and 5 were Active 3 days of the week. This means 9 participants walked at least 10,000 steps 2 times per week and 6 walked at least 10,000 steps 3 days per week. On the other end of the activity spectrum, 20 of 46 participants were considered Sedentary; 16 were low active, and 7 were somewhat active. With respect to daily averages, participants were again more active on fewer days of the week.

TABLE 4.3

STEPS FREQUENCIES: 70 YEAR OLD WOMEN

	Step Frequencies: 70 Year Olds Daily Averages					
	2	3	4	5	6	7
Activity Level	n = 45	n = 45	n = 45	n = 45	n = 45	n = 46
Sedentary	0	1	2	2	2	3
Sedentary	12	12	13	13	16	17
Low Active	9	13	14	18	18	16
Somewhat Active	15	13	11	7	6	7
Active	8	5	5	5	3	2
Highly Active	1	1	0	0	0	1

Table 4.4 presents step frequencies in each of the 2-7 day averages for the 80 year old age group. This was the least active group. With respect to the recommendation that healthy adults should walk 10,000 steps per day, no participants met this goal on a 7 day average. Evaluating the 2-6 day averages, no participant was considered Highly Active. Two participants were Active 2 and 3 days of the week. This means that only 2 participants walked at least 10,000 steps 2 or 3 times per week. On the other end of the activity spectrum, 17 of 22 participants were considered Sedentary; 2 were low active, and 3 were somewhat active. The majority of these participants were much less active compared to the 60- and 70-year olds.

TABLE 4.4

STEP FREQUENCIES: 80 YEAR OLD WOMEN

	Step Frequencies: 80 Year Olds Daily Averages					
	2	3	4	5	6	7
Activity Level	n = 23	n = 23	n = 22	n = 22	n = 22	n = 22
Sedentary	3	4	4	4	4	4
Sedentary	10	9	9	11	12	13
Low Active	7	7	6	4	3	2
Somewhat Active	1	1	2	2	3	3
Active	2	2	1	1	0	0
Highly Active	0	0	0	0	0	0

Tables 4.5 – 4.7 presents age-group comparisons of the STEP frequencies for each of the 2-7 day averages. To allow for comparison between groups, data is presented as the frequency of occurrence with respect to the number of participants in each group. As described above, the 80 year age group is significantly less active compared to the 60- and 70- year olds.

TABLE 4.5

STEP FREQUENCIES: 2 & 3 DAY MEANS

	Step Frequencies					
	2 Day Mean			3 Day Mean		
	60 yr	70 yr	80 yr	60 yr	70 yr	80 yr
Activity Level	n = 38	n = 45	n = 23	n = 38	n = 45	n = 23
Sedentary	0%	0%	13%	0%	2%	17%
Sedentary	29%	27%	43%	32%	27%	39%
Low Active	26%	20%	30%	26%	29%	30%
Somewhat Active	26%	33%	4%	24%	29%	4%
Active	8%	18%	9%	13%	11%	9%
Highly Active	11%	2%	0%	5%	2%	0%

TABLE 4.6

STEP FREQUENCIES: 4 & 5 DAY MEANS

	Step Frequencies					
	4 Day Mean			5 Day Mean		
Activity Level	60 yr n = 37	70 yr n = 45	80 yr n = 22	60 yr n = 36	70 yr n = 45	80 yr n = 22
Sedentary	0%	4%	18%	0%	4%	18%
Sedentary	38%	29%	41%	42%	29%	50%
Low Active	24%	31%	27%	22%	40%	18%
Somewhat Active	22%	24%	9%	22%	16%	9%
Active	16%	11%	5%	14%	11%	5%
Highly Active	0%	0%	0%	0%	0%	0%

TABLE 4.7

STEP FREQUENCIES: 6 & 7 DAY MEANS

	Step Frequencies					
	6 Day Mean			7 Day Mean		
Activity Level	60 yr n = 36	70 yr n = 45	80 yr n = 22	60 yr n = 35	70 yr n = 46	80 yr n = 22
Sedentary	0%	4%	18%	3%	7%	18%
Sedentary	44%	36%	55%	46%	37%	59%
Low Active	22%	40%	14%	26%	35%	9%
Somewhat Active	25%	13%	14%	17%	15%	14%
Active	8%	7%	0%	9%	4%	0%
Highly Active	0%	0%	0%	0%	2%	0%

4.6. Moderate Intensity Activity Averages

Table 4.8 presents Moderate Intensity Activity with respect to high and low values as well as the daily averages for 2-7 days in the 3 age-groups (60-, 70-, and 80-years). Univariate analysis revealed no difference between moderate intensity based on age group.

TABLE 4.8

MODERATE INTENSITY: HIGH, LOW, AND DAILY AVERAGES

	Moderate Intensity Activity (minutes)								
	60-69 years n = 38			70-79 years n = 46			80-89 years n = 23		
	Mean	±	SD	Mean	±	SD	Mean	±	SD
High	23:32	±	20:46	25:07	±	26:01	13:33	±	13:45
Low	03:30	±	05:44	03:03	±	05:04	00:51	±	01:18
2 Day Avg	20:30	±	18:54	21:50	±	25:17	12:04	±	12:37
3 Day Avg	17:59	±	17:19	19:38	±	24:30	10:34	±	11:11
4 Day Avg	16:02	±	15:49	17:44	±	23:29	09:33	±	09:55
5 Day Avg	14:18	±	14:18	16:12	±	22:34	08:28	±	09:06
6 Day Avg	12:55	±	13:04	14:48	±	21:32	07:33	±	08:29
7 Day Avg	11:50	±	11:50	13:09	±	19:06	06:36	±	07:22

With respect to the recommendation that healthy adults should engage in 30 minutes of moderate intensity activity 5 days of the week, the overall averages of each age-group did not meet this goal. The highest 5-day average was achieved by the 70-year old group at just over 16 minutes. The 80 year old group engaged in the least amount of moderate intensity activity with their highest average at just over 13 minutes once per week. Their 5 day average was 8:28 min.

4.7. Moderate Intensity Activity Frequencies

Table 4.9 presents Moderate Intensity Activity frequencies in each of the 2-7 day averages for the 60 year-old age group. Categories are based on 5 minute intervals. With respect to the recommendation that healthy adults should engage in 30 minutes of moderate intensity activity 5 days of the week, 8 of 38 participants met this goal. Looking at other days of the week, 8 of 38 participants met this goal 4 days per week and 9 met this goal 3 days per week. Five participants engage in at least 30 minutes of activity all 7 days of the week.

TABLE 4.9

MODERATE INTENSITY ACTIVITY FREQUENCIES: 60 YEAR OLD WOMEN

	Frequencies: 60 Year Olds 2-7 Day Averages					
	2	3	4	5	6	7
Minutes	n = 38	n = 38	n = 38	n = 38	n = 38	n = 37
0-4	7	12	13	15	15	14
5-10	8	4	6	7	10	11
11-15	7	8	6	5	3	2
16-20	2	2	2	2	1	1
21-25	3	2	2	0	1	2
26-30	1	1	1	1	2	2
31-45	5	5	5	7	6	5
46-60	4	4	3	1	0	0
61-106	1	0	0	0	0	0

Table 4.10 presents Moderate Intensity Activity frequencies for the 2-7 day averages for the 70 year old age group. With respect to the 30-minute recommendation, 4 of 45 participants met this goal 5 days of the week. Six met this goal 4 days per week and 6 met the goal 3 days per week. Two participants engage in at least 30 minutes of activity all 7 days of the week.

TABLE 4.10

MODERATE INTENSITY ACTIVITY FREQUENCIES: 70 YEAR OLD WOMEN

	Frequencies: 70 Year Olds Daily Averages					
	2	3	4	5	6	7
Minutes	n = 45	n = 45	n = 45	n = 45	n = 45	n = 45
0-4	9	11	13	15	16	17
5-10	11	11	11	11	11	11
11-15	6	5	5	4	5	7
16-20	1	4	4	6	5	4
21-25	5	4	3	1	3	2
26-30	3	3	3	3	1	2
31-45	6	4	4	3	2	1
46-60	2	1	1	1	2	1
61-106	2	2	1	1	0	0

Table 4.11 presents Moderate Intensity Activity frequencies in each of the 2-7 day averages for the 80 year old age group. With respect to the recommendation that healthy adults should engage in 30 minutes of moderate intensity activity 5 days a week, 1 of 22 participants met this goal. Two met this goal 3 days per week and 1 met this goal 4 days per week. Zero participants engage in at least 30 minutes of activity all 7 days of the week. This age-group was much less active compared to the other two groups.

TABLE 4.11

MODERATE INTENSITY ACTIVITY FREQUENCIES: 80 YEAR OLD WOMEN

	Frequencies: 80 Year Olds Daily Averages					
	2	3	4	5	6	7
Minutes	n = 23	n = 23	n = 22	n = 22	n = 22	n = 22
0-4	9	10	10	10	11	12
5-10	4	6	5	5	4	4
11-15	4	1	1	4	4	4
16-20	1	2	4	1	2	1
21-25	1	2	0	1	0	0
26-30	2	0	1	0	0	1
31-45	2	2	1	1	1	0
46-60	0	0	0	0	0	0
61-106	0	0	0	0	0	0

Tables 4.12 – 4.14 present age-group comparisons of the Moderate Intensity Activity frequencies for each of the 2-7 day averages. To allow for comparison between groups, data is presented as the frequency of occurrence with respect to the number of participants in each group. As described above, there were no significant differences between age-groups.

TABLE 4.12

MODERATE INTENSITY ACTIVITY FREQUENCIES: 2 & 3 DAY MEANS

	Frequencies					
	2 Day Mean			3 Day Mean		
Minutes	60 yr n = 38	70 yr n = 45	80 yr n = 23	60 yr n = 38	70 yr n = 45	80 yr n = 23
0-4	18%	20%	39%	32%	24%	43%
5-10	21%	24%	17%	11%	24%	26%
11-15	18%	13%	17%	21%	11%	4%
16-20	5%	2%	4%	5%	9%	9%
21-25	8%	11%	4%	5%	9%	9%
26-30	3%	7%	9%	3%	7%	0%
31-45	13%	13%	9%	13%	9%	9%
46-60	11%	4%	0%	11%	2%	0%
61-106	3%	4%	0%	0%	4%	0%

TABLE 4.13

MODERATE INTENSITY ACTIVITY FREQUENCIES: 4 & 5 DAY MEANS

	Frequencies					
	4 Day Mean			5 Day Mean		
Minutes	60 yr n = 38	70 yr n = 45	80 yr n = 22	60 yr n = 38	70 yr n = 45	80 yr n = 22
0-4	34%	29%	45%	39%	33%	45%
5-10	16%	24%	23%	18%	24%	23%
11-15	16%	11%	5%	13%	9%	18%
16-20	5%	9%	18%	5%	13%	5%
21-25	5%	7%	0%	0%	2%	5%
26-30	3%	7%	5%	3%	7%	0%
31-45	13%	9%	5%	18%	7%	5%
46-60	8%	2%	0%	3%	2%	0%
61-106	0%	2%	0%	0%	2%	0%

TABLE 4.14

MODERATE INTENSITY ACTIVITY FREQUENCIES: 6 & 7 DAY MEANS

	Frequencies					
	6 Day Mean			7 Day Mean		
Minutes	60 yr n = 38	70 yr n = 45	80 yr n = 22	60 yr n = 37	70 yr n = 45	80 yr n = 22
0-4	39%	36%	50%	38%	38%	55%
5-10	26%	24%	18%	30%	24%	18%
11-15	8%	11%	18%	5%	16%	18%
16-20	3%	11%	9%	3%	9%	5%
21-25	3%	7%	0%	5%	4%	0%
26-30	5%	2%	0%	5%	4%	5%
31-45	16%	4%	5%	14%	2%	0%
46-60	0%	4%	0%	0%	2%	0%
61-106	0%	0%	0%	0%	0%	0%

4.8. High Intensity Activity Averages

Table 4.15 presents High Intensity Activity with respect to high and low values in the 3 age-groups (60-, 70-, and 80-years). It is interesting to note that the average for the highest level of activity engaged in by the 60 year olds engaged was 2:27 minutes, and less than a minute for both the 70- and 80-year olds.

TABLE 4.15

HIGH INTENSITY: HIGH AND LOW AVERAGES

	High Intensity Activity (minutes)								
	60-69 years n = 35			70-79 years n = 43			80-89 years n = 15		
	Mean	±	SD	Mean	±	SD	Mean	±	SD
High	02:27	±	05:12	00:54	±	01:17	00:40	±	00:42
Low	00:04	±	14:01	00:16	±	00:04	00:14	±	00:14

4.9. Low Intensity Activity Averages

Table 4.16 presents Low Intensity Activity with respect to high and low values in the 3 age-groups (60-, 70-, and 80-years). It is interesting to note that the 60- and 70- year olds engage in more low intensity activity, approximately 1 hour and 7 minutes, compared to 48:31 minutes by the 80-year olds. This suggests that the two younger age groups are in general more active at a lower level, likely leading to more activity throughout the day.

TABLE 4.16

LOW INTENSITY: HIGH AND LOW AVERAGES

	Low Intensity Activity (minutes)								
	60-69 years n = 35			70-79 years n = 43			80-89 years n = 15		
	Mean	±	SD	Mean	±	SD	Mean	±	SD
High	1:06:53	±	21:46	1:08:29	±	28:05	48:31	±	23:10
Low	25:37	±	15:12	30:17	±	15:58	20:34	±	15:37

4.10. Relationship between Steps and Moderate Intensity Activity

Table 4.16 presents correlations between step averages and moderate intensity activity averages. The analysis revealed high positive correlations between all data points. This indicates that as the number of steps increases so does the level of moderate intensity activity. The relationship is maintained across all daily averages.

TABLE 4.17

CORRELATIONS BETWEEN STEPS AND MODERATE INTENSITY ACTIVITY AVERAGES

		Mod.Hi	Mod.Lo	Mod.2 Day	Mod.3 Day	Mod.4 Day	Mod.5 Day	Mod.6 Day	Mod.7Day
Step.High	Pearson Correlation	.868**	.642**	.848**	.837**	.829**	.820**	.811**	.810**
	N	107	107	107	107	106	106	106	105
Step.Low	Pearson Correlation	.683**	.719**	.685**	.690**	.688**	.689**	.693**	.705**
	N	107	107	107	107	106	106	106	105
Step.2Day	Pearson Correlation	.887**	.682**	.876**	.869**	.863**	.855**	.847**	.847**
	N	107	107	107	107	106	106	106	105
Step.3 Day	Pearson Correlation	.883**	.698**	.877**	.874**	.870**	.865**	.858**	.858**
	N	107	107	107	107	106	106	106	105
Step.4 Day	Pearson Correlation	.876**	.710**	.873**	.874**	.872**	.869**	.863**	.864**
	N	105	105	105	105	105	105	105	104
Step.5 Day	Pearson Correlation	.872**	.720**	.871**	.873**	.873**	.872**	.867**	.868**
	N	104	104	104	104	104	104	104	103
Step.6 Day	Pearson Correlation	.867**	.730**	.867**	.870**	.871**	.871**	.868**	.869**
	N	104	104	104	104	104	104	104	103
Step.7 Day	Pearson Correlation	.858**	.739**	.858**	.861**	.863**	.863**	.860**	.863**
	N	103	103	103	103	103	103	103	103

** Correlation is significant at the 0.01 level (2-tailed)

CHAPTER 5

DISCUSSION

This study was a descriptive study designed to determine the daily physical activity level (amount and intensity) of older adult women. The ACSM, Center for Disease Control and Prevention, and the American Heart Association, all recommend that older adults 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 good functional fitness. With respect to the amount (steps) of daily physical activity, there are few recommendations. A general consensus suggests that to remain healthy and maintain functional fitness, older adults should attain between 6,000 and 8,500 steps per day.

5.1 Daily Steps

With respect to the amount (steps) of daily physical activity, there are few recommendations. In fact, the idea of attaining 10,000 steps per day was adopted by Japanese walking and hiking organizations promoting the goal of accumulating 10,000 steps as a slogan. This same slogan/goal has been adopted by a variety of US organizations, including the American Academy of Family Physicians (AAFP) and America On the Move. Despite the adoption of the 10,000 steps/day slogan, there is no research supporting the claim and unfortunately may suggest an undocumented threshold necessary to achieve health benefits. Although 10,000 steps/day may be a reasonable baseline level for young and/or healthy individuals, it is an unreasonably high initial goal for sedentary individuals. Moreover, it is unlikely that a universal goal exists that can be safely applied to all populations. Not only is the

level an unreasonable goal for sedentary individuals, it may also be impossible for some individuals to obtain, particularly those comprised of older individuals and persons with chronic health problems like arthritis, diabetes, and heart disease. Iwane et al. (2000) reported that less than 9% of their patients could maintain their 10,000 steps/week program.

The first recommendations were published by Tudor-Locke (2001) to classify step determined physical activity in healthy adults (not older adults). Evaluation of these indices will involve comparing body composition in each of the five categories: sedentary lifestyle: <5,000 steps/day, low active: 5,000-7,499 steps/day, somewhat active: 7,500-9,999 steps/day, active: > or =10,000 steps/day, and highly active: 12,500. More recently, Tudor-Locke we concluded that healthy older adults take between 6,000–8,500 steps/day. This conclusion was based on four studies with limited sample sizes. A follow-up study by the same author suggests that single value for steps/day fails to capture the fact that older adults range in ability and habit with age as well as other factors. In recognition of this phenomenon, the authors also conclude that the range of 2,000–9,000 steps/day more likely reflects the true variability of physical activity behaviors in healthy older populations.

A recent analysis identified preliminary steps/day cut points for adults that best discriminated between BMI defined normal weight and overweight/obesity. Simultaneous consideration of a number of different indices produced estimates of 10,000 steps/day for females aged 50–59.9 years (n = 366), and 8,000 for females aged 60–94 years (n = 214). Rowe et al. conducted Receiver Operator Curve analysis to identify steps/day associated with achieving 30 minutes of continuous moderate-to vigorous physical activity (typically associated with public health recommendations for physical activity) by older adults (mean age 74 years). An estimate of 7,000 to 8,000 steps/day was determined. It is important to emphasize that this

study focused on time in moderate-to-vigorous physical activity and not health benefits associated with a distinct number of steps. Yukitoshi and Shepard (2009) suggest that "better overall health is seen in people who take an average of ≥ 8000 steps/day".

Evaluating the descriptive statistics of the current study and comparing them to the suggested adult of physical activity levels (Sedentary = 2000-4999, Low Active = 5000-7499, Somewhat Active= 7500-9,999, Active = 10,000 - 12,999, and Highly Active = 13,000 or more), no age group was Active. Even when evaluating the mean of participant's ***one*** high day, the two most active age-groups (60s and 70s) were only considered Somewhat Active at approximately 8,200 daily steps. This 8,200 daily step rate does meet the older adult recommendations suggested by more recent research. However, this step rate occurs only one time during one week, not the recommended 7-days per week. The 7-day step average was just over 5,500 for the 60- and 70-year olds and just over 3,800 for the 80 year old group. This 7-day average also does not meet Tudor-Locke's findings that healthy older adults take between 6,000–8,500 steps/day.

With respect to the number of older adults meeting step recommendations, only 3 participants walked at least 10,000 steps 7 days of the week. Evaluating the 2-6 day averages, 4 participants were considered Highly Active 2 days per week and 2 participants were highly active 3 days per week. This means 7 participants walked at least 10,000 steps 2 and 3 times per week. On the other end of the activity spectrum, 17 of 35 participants were considered Sedentary; 9 were low active, and 6 were somewhat active. With respect to daily averages, participants were more active on fewer days of the week. This does not agree with Rowe et al.'s findings that older adults (over 60 years of age) between-day reliability is high and that only 2 days are sufficient to obtain a stable estimate. Our data suggests all 7-days should be recorded,

and for a greater understanding of older adults physical activity levels, more weeks may be needed.

5.2. Moderate Intensity Activity

The ACSM, Center for Disease Control and Prevention, and the American Heart Association, all recommend that older adults should spend at least 30 minutes, five days per week engaging in moderate-intensity physical activity or alternatively, 20 minutes of vigorous-intensity activity on at least three days per week to maintain good functional fitness.
With respect to this recommendation, no group met this goal. The highest 5-day average was achieved by the 70-year old group at just over 16 minutes, followed by the 60-year olds at just over 14 minutes. The 80 year old group engaged in the least amount of moderate intensity activity with their highest average at just over 13 minutes once per week. Their 5 day average was 8:28 min. When evaluating the number of older adults in each age-group meeting this goal, the results are not encouraging. 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. With respect to the suggested 20 minutes of vigorous-intensity activity on at least three days per week to maintain good functional fitness, the 60 year olds averaged 2:27 minutes of vigorous activity one day per week, and the 70- and 80-year olds spent less than a minute at high levels of activity. Older adults do spend a significant amount of time engaging in low level activity. The 60- and 70- year olds engaged in approximately 1 hour and 7 minutes of low intensity activity, while the 80-year olds engaged in 48:31 minutes.

5.3. Conclusion

In conclusion, regularly participating in moderate intensity physical activity is the key to staying healthy and maintaining the older adult's life quality. Moreover, should likely exceed the minimum recommended amount of physical activity to improve functional fitness, reduce the risk factors of chronic diseases and disabilities and also to prevent weight gain (Nelson et al., 2007). Our results indicate that the older adults in our sample do not meet the recommendations set forth by the ACSM, Center for Disease Control and Prevention, the American Heart Association, or independent researchers. Given the positive association between habitual daily physical activity and health, reduced chronic disease and disbility, and well as maintain or improve functional fitnhealtess and is imperative that health care professionals work with older adults to increase both the amount and intensity of their daily activity levels. Future research should continue investigating older adult's daily physical activity levels and expand to examine the effect of habitual daily physical activity on the functional fitness levels of older adults.

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APPENDICES

APPENDIX A

CONSENT FORM

WICHITA STATE UNIVERSITY

FAIRMOUNT COLLEGE OF LIBERAL ARTS AND SCIENCES

School of Community Affairs

vity and Functional Fitness in Older Adults

You are invited to participate in a study to examine physical fitness and activity levels. We 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 300 people to participate in this project.

If you decide to participate, you will be asked to perform a series of assessments. These assessments are designed to measure your ability to maintain your balance and to measure your functional ability. The assessments will be done at the site you were recruited from.

During the assessments we will ask you to stand on a balance platform and on a piece of foam while your balance is assessed. You will also 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 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 your recruitment site to “unlock” your accelerometer and record step counts for that week.

Potential Risk

Physical movement rarely causes problems in healthy adults. However, if they suffer from hidden heart disease, an exercise test could cause chest pain, dizziness, or bouts of irregular heart rhythms. Also, there is always a slight risk of a heart attack occurring during the exercise tests in persons with preexisting heart disease. You will be asked about any type of disease that you may have.

Muscle soreness could also occur following any of these physical activities. You will receive proper instruction for all activities. The supervisors of the program have extensive experience leading activities like the ones you will perform.

Potential Benefits

Many studies have found that poor functional fitness is a major limitation in gaining and maintaining physical independence. 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.

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.

APPENDIX A (continued)

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

_____ _____

Nicole L. Rogers, PhD Date

Principal Investigator

APPENDIX B

MEDICAL CLEARANCE FORM

A Community-Based Multi-Component Physical Activity Program for Older Adults

MEDICAL CLEARANCE OF PERSONAL PHYSICIAN

Your patient, _____, has expressed an interest in participating in a Community-Based Physical Activity Program, offered through the School of Community Affairs Gerontology Program at Wichita State University and Senior Services, Inc. Downtown Senior Center. This multi-component physical activity program, under the direction of Nicole Rogers, PhD, has been offered in community settings for the past 6 years.

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. 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___

Physical Activity Class Approval: yes ____ no _____

Please list any modifications/comments for testing and exercise class:

_____

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

Fax: 316.978.3626

Assistant Professor, Gerontology
School of Community Affairs
Wichita State University
1845 Fairmount - Campus Box 135
Wichita, Kansas 67260

Phone: 316.978.6684
Email: nicole.rogers@wichita.edu

easy
Exercise And Screening for You

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.

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

Revised 11/15/2007

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**

APPENDIX D

DEMOGRAPHIC QUESTIONNAIRE

Participant ID _____

Demographic Questionnaire

1. What is your age in years?

_____ years

2. What is your ethnic background?

- ☐ White/Caucasian
- ☐ Black/African American
- ☐ Hispanic or Latino
- ☐ American Indian/Alaska Native/Pacific Islander
- ☐ Asian or Asian/American

3. What is your marital status?

- ☐ Married/Or Live With Significant Other
- ☐ Single/Live By Self
- ☐ Divorced/widowed/live by self

4. What is the highest grade you have completed in school?

_____ *(record grade number)*

5. What is the title of your current job/position?

_____

6. List the “prescription” medications that you currently take: (by exact name or by type)

Type of medication	For what condition
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

7. Smoking Status

Do you currently smoke cigarettes? No ____ Yes ____

If yes, number of cigarettes smoked on an average day _____

If no, have you ever smoked? No ____ Yes ____

For how many years? _____

How many cigarettes did you smoke on an average day _____

How many years since you stopped? _____

8. How many drinks of an alcoholic beverage do you have in a typical week?

_____ Bottles or cans of beer

_____ Glasses of wine

_____ Wine coolers or other malt beverages

_____ Mixed drinks or shots of liquor