EFFECTS OF THE 12-WEEK WELLREP EXERCISE PROGRAM ON FUNCTIONAL FITNESS 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 in Gerontology.

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DEDICATION

To my mother who I will love always

“A journey of a thousand miles begins with a single step.”

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

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ABSTRACT

Persuading people to adopt and maintain a regular physical activity program are two major challenges facing public health. Providing social support may increase the adoption and adherence rate of participation in exercise programs. It was hypothesized that participation in a 12-week WellREP designed to meet the goals of the ACSM and CDC with respect to appropriate physical activity programming for older adults would result in improvements in functional fitness, balance, and daily activity.

The WellREP group consisted of 18 older women (X= 73 ± 7 yrs). The WellREP group met at a senior center for 12 wk, 2d•wk for a 50 min. training program and used an Omron pedometer to measure daily physical activity throughout the week. The Control group consisted of 15 older adults (X= 75 ± 6 yrs). Program effectiveness was assessed using the Senior Fitness Test to measure functional fitness (chair stand, arm curl, sit and reach, up & go, scratch test, and 12-min walk), balance: movement velocity, endpoint excursion, maximum endpoint excursion, and directional control for forward, right, left and back movements, pedometer measured daily physical activity, and weight.

No differences between the WellREP group and the control group existed at baseline. All functional measures, excluding flexibility, in the WellREP group exhibited an 8% to 46% significant increases as compared to a -3% to 8% change in the CON group. Significant improvements in limits of stability measures were only observed in the maximum excursion measure (forward - 20% and backward - 23%). Significant improvements were observed in daily physical activity. Participants in the WellREP group increased their STEPS by 64% compared to a 5% increase in the CON group.

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CHAPTER 1

INTRODUCTION

The American College of Sports Medicine (ACSM) considers exercise to be an inexpensive way to increase the number of quality years in older adults by delaying the onset, or reducing the disabling factors, of chronic conditions that older adults with sedentary lifestyles experience (Chodzko-Zajko et al., 2009). The physical activity of many older adults is not at the level of recognized standards suggested for healthy independent living and disease prevention (Vogel, Brechat, Lepetre, Kaltenbach, Berthel, & Lonsdorfer, 2009). An inverse relationship between daily physical activity and advancing age exists, in that is as one gets older, their everyday physical activity declines (Chipperfield, 2008). Following the Centers for Disease Control and Prevention (CDC) and ACSMs recommendations for limiting disability in old age, it is recognized that older adults need to stay physically active in order to prevent and even treat chronic conditions (Nelson et al., 2007).

Even though most of the aging population is considered sedentary and on the road toward disability, studies have shown that the majority of older adults have a high enthusiasm for exercise programs initiated within their community senior centers, local gathering settings for socialization and obtaining needed age-related services (Wallace et al., 1998). YMCAs, senior centers, park and recreation centers, and senior housing facilities account for the majority of exercise programs offered for older adults in the United States, and thus are the best places to introduce an exercise intervention for the aging population (Hughes, Prohaska, Rimmer, & Heller, 2005). When introducing effective exercise interventions in community settings, it is not clear as to what types, intensity, and duration of exercise are best suited for optimal gains in functional fitness and daily physical activity for older adults at a reasonable cost to the community center or to the older adult.

1.1 Statement of the Problem

The majority of older adults in the United States are sedentary, an inactive state that affects the individual's independence. Older adults need to increase their daily physical activity and functional fitness levels in an effort prevent or delay the onset of disability, which is the product of chronic disease. Traditional exercise intervention programs held at a community site are typically one dimensional when they should be focused toward a multi-dimensional approach (i.e. include cardio-respiratory, strength training, balance, and flexibility). Findings from this study will be used to determine if a multi-component exercise program improves functional fitness, balance and daily physical activity levels in older adults.

1.2 Significance of the Study

The U.S. Census Bureau (2005) indicates that the population of older adults is expected to double by the year 2030. Most of the older adult population is sedentary, a condition that leads to many chronic health problems. Chronic health problems lead to disability. Disability leads to the inability to function independently.

All factors associated with being sedentary lead to great financial hardship for the older adult and the country (Booth & Chakravarthy, 2002). Specifically, chronic conditions are reported by around 50% of adults, who consume up to 80% of the U.S. medical care costs (Hoffman, Rice, & Sung, 1996). Sedentary adults utilize 96% of home care visits, 83% of prescription drug use, 66% of physician visits, and 55% of emergency department visits. Adults with chronic conditions represented 69% of hospital admissions, requiring longer hospital stays (7.8 days), compared to persons without chronic health conditions (4.3 days). Seventy percent of all deaths in the United States in 1996 were attributable to four chronic health conditions (i.e. cardiovascular disease, cancer, chronic obstructive pulmonary disease, and diabetes). Sedentary activity is responsible for consuming approximately 15% of the US health care budget, which is a problem due to the ever increasing costs of medical provisions. One solution to eliminating the costs of medical expenses is relatively inexpensive…exercise. Findings from this study will be used to develop an inexpensive and effective way to disseminate quality exercise programs that focus on increasing daily physical activity, functional fitness, and balance. These findings will promote future research into the quantity of support required when providing exercise interventions to the aging population.

1.3 Variables

The independent variable for this study was the Well-Rounded Exercise Program (WellREP) Intervention that the older adults participated in 2 days per week for 12-weeks. A control group was monitored and asked not to participate in anything beyond their normal daily activities for 12-weeks.

The dependent variables for this study were the Functional Fitness measures of: 30-sec arm curl, 30-sec chair stand, chair sit and reach, scratch test, 8-foot up & go, and 12-min walk; Limits of Stability: reaction time, movement velocity, endpoint excursion, maximum excursion, and directional control; and daily activity (STEPS) as monitored by pedometer.

1.4 Research Hypothesis

It was hypothesized that participation in a 12-week WellREP designed to meet the goals of the ACSM and CDC with respect to appropriate physical activity programming for older adults would result in improvements in functional fitness, balance, and daily physical activity.

1.5 Assumptions

It was assumed that all individuals volunteering to participate in the study would continue their normal exercise routines outside of class, but would refrain from beginning any new exercise classes or programs until after completion of the balance classes. It was assumed that participants would not be involved in any strenuous activity before pretest and posttest assessments. It was also assumed that participants performed their best on pretest and posttest assessments.

1.6 Limitations

Results of this study may have been affected by the survival bias (i.e., those with the healthiest lifestyle choices and attitudes were most likely to be alive and participate in the study). Participants were recruited on a volunteer basis only which resulted in a large age range and probably more fit individuals volunteered to participate in this study. Participants were asked to move to a higher resistance Thera-Band exercise band when they felt their current resistance was too easy. However, participants may have not progressed at appropriate levels.

1.7 Delimitations

The results of this study are limited to older adults residing in an urban Midwest city.

1.8 Definitions

1. Functional Fitness: Functional fitness is defined as "…having the physiologic capacity to perform normal everyday activities safely and independently without undue fatigue. "
    a. 30-Second Chair Stand: The purpose of this assessment was to measure lower body strength. Each participant sat in the middle of the chair, back straight, and feet approximately shoulder width apart and flat on the floor. Arms were crossed and held against the chest. On the signal "go" the participant rose to a full stand and then returned to the initial seated position. Each participant was instructed to complete as many full stands as possible within a 30-second time period. The score was recorded as the total number of stands executed correctly within 30 seconds. If the participant was over halfway up upon completion of the 30 seconds, it counted as a full stand.
    b. 30-Second Arm Curl: The purpose of this assessment was to measure upper body strength. The participant was seated in a chair, back erect, feet flat on the floor, and with the dominant side of the body close to the edge of the chair. A weight was held at the side in the dominant hand. The test began with the arm in the down position beside the chair, perpendicular to the floor. On the signal "go" the participant curled the arm through a full range of motion, and then returned to the starting position. The participant repeated this movement as many times and as quickly as possible in 30-seconds. The score was recorded as the total number of

curls made correctly within 30 seconds. If the participant's arm was over halfway up at the end of 30 seconds, then it counted as a completed curl. A 5-lb dumbbell was used for females, while an 8-lb dumbbell was used for males.

c. Sit and Reach: The purpose of this assessment was to assess lower body (primarily hamstring) flexibility. The test began with the participant sitting on the front edge position of a chair. Keeping one leg bent and foot on the floor, the other leg (the preferred leg*) was extended straight in front of the hip, with heel on the floor and foot flexed. With the extended leg as straight as possible, the participant slowly bent forward at the hip joint sliding the hands (one on top of the other with the tips of the middle fingers even) down the extended leg in an attempt to touch the toes. The reach was held for two seconds. A ruler was used to measure the number of inches (nearest ½ inch) a person is short of reaching the toes (minus score) or reaches beyond the toes (plus score). The participant was given two practice trials. The score was the best measure of two trials. * The preferred leg is defined as the one that results in the better score.

d. Back Scratch: The purpose of this assessment was to assess upper body (shoulder) flexibility. In a standing position, the participant placed the preferred hand* over the same shoulder and reached as far as possible down the middle of the back, palm down and fingers extended. Hand of other arm was placed behind back, palm up, reaching up as far as possible in an attempt to touch (or overlap) the extended middle fingers of both hands. The distance of overlap, or distance between the tips of the middle fingers was measured to the nearest ½ inch. Minus scores (-) were given to represent the distance short of touching middle fingers;

plus scores (+) represent the degree of overlap of middle fingers. The "best" score was used to evaluate performance. *The preferred hand is defined as the one that results in the better score.

e. 8-Foot Up & Go: The purpose of this assessment was to measure physical mobility involving speed, agility, and dynamic balance. The participant was fully seated in a chair, hands on the thighs, and feet flat on the floor. On the signal “go”, the participant stood up from the chair as quickly as possible, walked around a cone positioned 8 feet in front of the chair, and then returned to a seated position in the chair. The score was given as the amount of time it took for the participant to get up from the chair on the "go" signal, walk around the cone, and then return to a seated position.

f. 12-Minute Walk: The purpose of this test was to assess aerobic endurance. The test involved assessing the maximum distance that can be walked in 12 minutes along a 50-meter course, marked into 5-meter segments. Participants continuously walked around a measured lap throughout the 12-minute period, trying to cover as much distance as possible. On the signal "go", participants were instructed to walk as fast as possible (not run) the marked distance around the cones as many times as they can within the time limit. If necessary, participants could stop and rest, sit on chairs provided, then resume walking. The score was the total number of yards walked in 12 minutes to the nearest 5 meter indicator.

2. <u>Daily Physical Activity</u>: Daily physical activity is defined as “..any bodily movement produced by skeletal muscles that results in energy expenditure. [Daily] physical activity

…can be categorized into occupational, sports, conditioning, household, or other activities (Caspersen, Powell, & Christenson, 1985).

3. Limits of Stability (LOS): Measures dynamic balance by quantifying the maximum distance a person can lean in a given direction without stepping, losing balance, or reaching for assistance. LOS assesses reaction time, movement velocity, endpoint excursion, maximum excursion, and directional control.
   a. Reaction Time (RT): the amount of time, in seconds, between the computer auditory signal to move and the initiation of movement by the participant.
   b. Movement Velocity (MVL): the average speed, measured in degrees per second, of the participant's center of gravity (COG) movement. Higher scores indicate a greater ability to control dynamic balance.
   c. Endpoint Excursion (EPE): the point at which the initial movement towards the target ceases and corrective movements are initiated. Endpoint excursion is expressed as a percentage of the maximum LOS reached by the participant.
   d. Maximum Excursion (MXE): the furthest distance, expressed as a percentage, a participant's COG advanced towards the target.
   e. Directional Control (DCL): the difference between the amount of extraneous movement away from the target and the amount of intended movement towards the target. Directional control is expressed as a percentage, with perfect DCL having a score of 100%.
4. Thera-Band Stability Trainers: Elliptical foam pads approximately 16" × 9" × 2". The stability trainers were available in two different levels of compliance. Green pads were

firmer and less compliant, while blue pads were more compliant and thus, more difficult to stand on and maintain balance.

5. Thera-Band Exercise Bands: Latex bands cut in 5-foot long strips and ranging in resistance from least to greatest as follows: red, green, blue, black, gray, and gold.
6. WellREP Intervention: The intervention incorporated the *Well-Rounded Exercise Program (WellREP)* which provides a simple 4-step routine to increase physical activity. The program includes four components: cardio-respiratory, flexibility, strength, and balance. Flexibility, strength and balance were addressed during class sessions, while cardio-respiratory was addressed on an individualized basis outside of class. Instructors progressed through the program at a pace deemed appropriate for participants. Program progression involved the addition of new fitness components and additional exercises during each class session until participants were performing all 3 components during each class session. Participants begin with flexibility and strength and progressed to balance activities. Balance activities were started at approximately the 2 week mark. Participants began balances exercises on the floor and progressed to the Thera-band stability trainers. As an added safety measure, chairs were position near participants to provide stability, if needed, during balance exercises.

CHAPTER 2

LITERATURE REVIEW

2.1 Recommendations for Successful Aging

The most qualified experts to prescribe the recommended physical exercise necessary for successful aging come from the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM). According to the CDC, to gain important health benefits, older adults need on a weekly basis at minimum two-and-a-half hours of walking and bi-weekly resistance activity. Authors Chodzko-Zajko et al. (2009) addressed the ACSMs position on exercise and physical activity in promotion of functional fitness. The ACSM considers moderate intensity exercise to have the best benefits in reducing the onset or the disabling factor of chronic conditions that older adults with sedentary lifestyles incur; moreover, moderate intensity exercise will increase the healthy active years of the older adult. Specifically, an exercise routine that includes both aerobic and resistance training in tandem is more effective than either type of exercise done separately. The ACSMs optimal exercise routine would include aerobic exercises, resistance exercises, flexibility exercises, and balance exercises.

2.2 Physical Activity of Seniors

The physical activity of many older adults does not meet the recognized standards for health and disease prevention (Vogel et al., 2009). Researchers Schoenborn, Vickerie, and Powell-Griner (2006) observed that half of older adults between the ages of 55 and 64 engage in any leisure-time physical activity (LTPA), while that percentage decreases to one-quarter of adults aged 85 and older. One-fourth of adults age 55 and above engaged in regular leisure-time physical activity, while that percentage decreases to 10 percent of adults aged 85 and older. Men were more likely than women in all older adult age groups to participate in LTPA.

Another study looking at physical activity involved surveying older adults about their physical activity habits (Ruchlin & Lachs, 1999). 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; Singh, 2004). The most popular LTPA amongst the older adults was walking (DiPietro, 2001; Vogel et al., 2009).

Researchers Rafferty, Reeves, McGee, and Pivarnick (2002) set out to discover the prevalence of walking for exercise by American adults. To collect information about walking behavior, they used the Centers for Disease Control (CDC) Behavioral Risk Factor Surveillance System, an annual, population-based telephone survey in 1998. One question within the survey was used to provide important information about the two most popular LTPAs the individual engaged in: “During the past month, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?” Follow-up questions were used to assess the frequency and duration of each LTPA.

Focusing on the older adult age group, walking was prevalent in 37-45% of all older adults with older adults who listed walking as their only LTPA around 60% (Rafferty et al., 2002). The duration of walking for older adults was approximately thirty minutes and the frequency was between three to four times per week. Without the intensity being collected in this study, it is difficult to estimate how many of the study’s subjects indeed did follow the CDCs recommendation of 30 minutes of moderate-intensity exercise five times a week; however, with the available information provided, most older adults do not get enough exercise during the week, regardless of the intensity level.

Researchers Bassett, Schneider, and Huntington (2004) studied the physical activity levels of a group of Amish older adults to determine if the amount of exercise obtained during the week is due the influence of modern technology. The study participants (n= 98) were Old Order Amish adults who were primarily farmers and between the ages of 18 and 75 consisting of 53 men and 43 women in Southern Ontario. Demographic information was completed along with the International Physical Activity Questionnaire (IPAQ), wherein the participants provide their activity habits over the past week. The participants also were asked to list the frequency and duration of vigorous, moderate, and walking activity. Body mass index (BMI) and body fat percentage was also measured at baseline. Participants were given a Yamax Sw-200 pedometer to wear for a week to measure their physical activity. Data was collected during the spring primary planting season.

Results of the Bassett et al. 2004 study contain information about the entire population age 18 and up. Participants age 50+ made up 13 percent of the study population: no significant age-related decline in steps per day was observed. Men took more steps than women per day, a result that is confirmed by another study (Aoyagi, Park, Watanabe, Park, & Shephard, 2009). The only day of the week encountered by Basset et al. to have significantly lower numbers of steps compared to the rest of the days of the week was Sunday. Men had an average of 18,425 ± 4,685 steps daily. Women had an average of 14,196 ± 4,078 steps daily. All the participants met the CDCs and ACSMs recommendations criteria for health and wellness in regards to the amount and intensity of physical exercise to be performed weekly. The rates of being overweight (26%)

and obese (4%) in the Amish adult population were much lower than in the general Canadian (51% and 15% respectively) or American (65% and 31% respectively) public, likely resulting from the Amish adults physically demanding daily routine and lack of technology. The results of this study are hindered by the intake of data at one point in time and the lack of other groups of Amish or modern farmers to provide comparisons.

Most non-Amish older adults are sedentary, a state of inactivity which is linked to chronic diseases (DiPietro, 2001; Vogel et al., 2009). Researcher Chipperfield studied sedentary behavior in older adults (2008). A negative relationship between everyday physical activity (EPA) and advancing age was discovered (i.e. as one gets older their everyday physical activity declines). Women do not show an EPA decline until age 85. EPA was found to predicative of 2-year mortality. Sedentary behavior increased the risk of dying 3-fold. Sedentary EPA was more detrimental for men than for women: one-third of sedentary men and one-tenth of sedentary women were deceased within the 2-year mortality spectrum. Limitations of the study included considering people who nap as sedentary and the use of a single-day measure to assess EPA. Researcher Neid 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 (Nied & Franklin, 2001).

2.3 Benefits of Physical Activity for Older Adults

Following the CDC and ACSMs recommendations for limiting disability in old age, it is recognized that older adults need to stay physically active in order to prevent and even treat chronic conditions; ironically chronic conditions is the main reason provided by many older adults who do not exercise (Nelson et al., 2007). Researchers Brach, Simonsick, Kritchevsky, Yaffe, and Newman (2004) recognize that in order to protect against functional limitation, older adults need to engage in lifestyle-active exercise. Lifestyle-active exercise is performing daily chores and normal walking habits. Older adults that engaged in moderate physical activity (i.e. 30 minutes of regular activity beyond normal day-to-day activity expenditure) have greater physical function and reserve than those who are sedentary or lifestyle active individuals. Moreover, adults who performed high-intensity activities improved their physical function and reserve even more than those who performed either lifestyle-active or moderate-intensity activity, underlining 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.

The health benefits of exercise are related to both psychosocial and direct health gains (Andrews, 2001; Vogel et al., 2009). In regards to cardiovascular improvements, moderate intensity and long-term frequency of exercise is essential in producing metabolic changes that increase high-density lipoproteins (HDLs) and increases in cardiorespiratory fitness (King, Haskell, Young, Oka, & Stefanick, 1995). In a meta-analysis focused on the benefits of aerobic exercise on lowering blood pressure, researchers Whelton, Chin, Zin, and He (2002) determined that aerobic exercise reduces systolic blood pressure by 3.84mm Hg and diastolic blood pressure by 2.58mm Hg. In a study conducted by Thompson, Crouse, Goodpaster, Kelley, Moyna, and Pescatello (2001) one session of exercise can provide glucose control for a Type II diabetic and improve insulin resistance. Exercise was discovered to have acute affects on blood lipids, blood pressure, and glucose homeostasis.

Exercise can also significantly lower fall risk and the physical risk factors (i.e. limb strength and balance) for falls in older adults (Rose, 2008). Research conducted by Kujala, Kapiro, Kannus, Sarna, and Koshenvuo (2000) found an inverse relationship between baseline physical activity and future hip fracture risk: the more frequent and the more intense the older adult exercised the lower the risk of breaking a hip in the future. In a 12-year prospective study conducted by Feskanich, Willet, and Colditz (2002), women's risk of a hip fracture decreased as their level of moderate physical activity increased. In a study by Stevens, Corso, and Finkelstein (2006), falls and the costs of falls increases with age. Specifically, fatal and non-fatal injuries from falls increased with age and cost $19.2 billion in medical expenses: two-thirds of the injuries required hospitalization, while the other injuries were treated in emergency departments and outpatient settings. Medical expenditures for falling injuries were 20 percent higher for women than for men; moreover, there was a 40 percent increase in the incidence of injuries in older women between the age groups of 65-74 to 75-84. Exercise to improve strength, balance, and gait was recommended to reduce fatal and non-fatal falls in older adults and thus reduce medical expenditures incurred by older adults. Chronic conditions usually result in activity of daily living (ADL) or instrumental activity of daily living (IADL) limitations. In a study by Miller, Rejeski, Reboussin, Thoman, Ten Have, and Ettinger (2000) physical activity resulted in a slower development of ADL and IADL limitations. The researchers found that over a six year follow-up older adults who walked one mile weekly were significantly less likely to have functional limitations or disability than their sedentary counterparts.

Regarding the neuropsychological benefits of exercise, a population-based, longitudinal study covering 6.2 years involving the Adult Changes in Thought (ACT) cohort of 2500 individuals ages 65 and up, researchers Larson, Wang, Bowen, McCormick, Teri, Crane, and

Kukull discovered that older adults who exercised three or more times a week had a 32 percent reduction in risk for dementia with the greatest risk-reduction found in older adults who had poor physical functioning at baseline. In a review of articles, the authors found several studies that reported an inverse relationship between regular physical activity and the risk of having a stroke (Vogel et al., 2009). The authors also found much evidence supporting the role of regular physical activity in maintaining cognitive performance.

Another benefit of exercise includes an increase in aerobic fitness. Researchers Lepretre et al. (2009) were interested in discovering whether a short interval cycling training session could improve exercise efficiency in older adults. Participants (n=35) were composed of 19 women and 16 men with a mean age of 65 years. Data was collected at baseline and at 9 weeks on two incremental exercise test (IETs) to determine maximal tolerated power and ventilatory (VT_1 and VT_2) thresholds. The intervention involved cycling twice a week for 30 minutes of cycling aerobic exercise: the 30 minute cycling consisted of six stages of 5 minutes with four-minutes of cycling at VT_1 (base) and one-minute cycling at VT_2 (peak). Findings of this study show that short exercise interval training sessions weaken the age-affect by increasing aerobic fitness in older people. This research shows that even a brief exercise session can improve the health of an older adult. Physical exercise was also found to have a small but significant affect on improving immune function in older adults ("Exercise," 2001). Researchers Nied and Franklin (2001) outlined that the benefits of exercise for older adults included decreases in the risk of colon, breast, prostate, and rectal cancer.

Exercising was also related to longevity and independence (Bath & Morgan, 1998). Increases in mortality were significantly related to physical activity levels, specifically walking for more than 10 minutes per day. Research by Stessman, Hammerman-Rozenberg, Cohen, Ein-

Mor, and Jacobs (2009) focused on exercise and its effects on survival among older adults. The study sample was drawn from the Jerusalem Longitudinal Cohort Study a study of citizens of Jerusalem born between June 1, 1920 and May 31, 1921. Data collection included demographic information, self-report measures of physical activity, measurement of depression using the Brief Symptom Inventory, self-rated health score, Mini-Mental State examination score, measures of functional status, BMI, smoking habits, chronic joint and musculoskeletal pain, medication list, falls within the past year, fractures in the past 7 years, and a list of chronic medical conditions. The study outcomes included death, change in functional status, health measures, and new disease onset. Participants (n= 1861) had a follow up at ages 70, 78, and 85.

Results of the Stessman et al. study show a decline in physical activity with increasing age. At each age group, men were found to be more active than women. Physical activity was associated with better survival as compared to being sedentary; moreover, whether continuing or just starting to engage in physical activity in later life was associated with better survival rates. Maintaining functional independence was associated with engaging in physical activity and participants who engaged in physical activity deteriorated less from ages 78 to 85 compared to their sedentary counterparts; in fact, functional independence could be determined by participants physical activity levels at age 70 for both ages 78 and 85. Regarding health measures, adults who stayed physically active reported less loneliness and better self-rated health their sedentary counterparts. Falls, fractures, and chronic joint or musculoskeletal pain had a lower frequency among the physically active participants as compared to their sedentary counterparts. This study encourages that even sedentary older adults who engage in physical activity in later life will reap benefits for their health and independent functioning. Researchers Fiatrone et al. (1994) ascertained that older adults can have significant gains in muscle strength and size and improvements in mobility and an increase in unstructured physical activity from participation in a high-intensity, progressive strength training exercise program.

2.4 Existing Community Exercise Programs

Exercise is important to maintaining health and independent functioning for healthy and frail older adults and is available within an older adult's community. The results of a multisite survey conducted by researchers Hughes et al. (2005) most exercise programs enacted within communities nation-wide include aerobic, strength, flexibility, or balance exercises. These exercise programs failed to identify factors that lead older adults to adhere to a long-term exercise regimen. Researchers McDermott and Mernitz (2006) discovered that long-term exercise adherence is attributable to support networks within the home and community. Moreover, researchers Wallace et al. (1998) discovered that older adults have a high enthusiasm for exercise programs that are initiated within their community senior centers. A multi-site survey of 2,100 sites within seven diverse geographic areas was completed by researchers Hughes et al. (2005) to determine the community support available for promotion of exercise for older adults. The results of the study determined that 326 of the sites did not provide exercise programs for older adults based mainly upon perceived lack of interest from older adults in participating in exercise programs, lack of knowledge about older adults, and lack of funding. Of the sites that offered exercise programs for older adults, aerobic programs were offered most frequently followed by flexibility and strength training with 31 percent of sites offering multi-component exercise programs. The most popular programs attended by older adults were aerobics and flexibility. Of the aerobic programs, the most popular were aerobic exercise (unspecified), stationary equipment, chair-based activities, walking, and dance. YMCAs, senior centers, park and recreation centers, and senior housing facilities accounted for 90 percent of the exercise programs offered for older adults.

Although there are quite a few exercise programs available in certain areas for older adults, it is not clear as to what types, intensity, and duration of exercise are best suited for this age group (i.e. 65+). Before describing the results of many different types of programs, one must consider the typical measurement tool used to denote differences in an older adult's physical functioning at these exercise sites. Researchers Rikli and Jones were on a mission to discover the best field test of battery performances to be used to assess older adults' functional fitness ("Development," 1999). The test selection criteria were based upon test and retest reliability and validity and that the test items be easy to administer (p. 134). The test items that were selected were 30-s chair stand (lower body strength measure), 30-s arm curl (upper body strength measure), chair sit-and-reach (lower body flexibility measure), back scratch (upper body flexibility measure), 6-min walk (aerobic endurance measure), 2-min step test (alternative aerobic endurance measure), 8-ft up-and-go (motor agility/dynamic balance measure), and weight and height (Body mass index measure). To test the criteria, 82 older adults (48 women, 34 men) around the age of 72 were recruited from a local senior housing complex and a university-based exercise program. The results of the study find that all of the tests selected were able to discriminate between regular and sedentary older adults. The tests were considered user-friendly and an enjoyable motivating factor for participants engaging in exercise programs to see how they can improve their functional fitness. This battery of tests is now known as the Senior Fitness Test (SFT). Rikli and Jones followed up this study to see if there were any inherent flaws in the SFT when tested upon community-residing older adults ("Functional," 1999). The researchers found a significant gender effect related to the SFT. Older men scored significantly better on the chair stand, arm curl, 6-minute walk, 2-min step test, and the 8-ft up-and-go, while older women scored significantly better on the chair sit-and-reach and the back scratch.

In regards to the types of exercises that help improve functional fitness in older adults, each study represented took a different intervention approach (i.e. one exercise strategy versus multiple exercise strategies). Researchers Jette, Harris, Sleeper, Lachman, Heislein, Giorgetti, and Levenson (1996) intervention approach took on the form of a home-based resistance program. The study revealed that older subjects (i.e. 73+) in the exercise group had a significantly higher increase in social functioning as compared to the young-old adults in the exercise group and the waitlist control group.

The next two research studies looked at the combination of two exercise programs. Bird, Hill, Ball, and Williams (2009) combined resistance and flexibility interventions in their study. Results of the study showed that balance can be improved in older adults who partake in either a resistance training program or a flexibility training program. The improvement in balance was associated with a lower risk factor for falls. Wood et al. (2001) combined resistance with aerobic exercises. Finding of the study affirm that the combination of resistance and aerobic exercise shows beneficial effects on adults 60 and older; moreover, the cardiovascular exercise does not reduce the gains made in strength from the resistance exercises.

Research conducted by DiBrezzo, Shadden, Raybon, and Powers (2005) implemented an intervention looking at combining resistance, flexibility, and balance exercises to discover a cost-effective intervention for community-dwelling older adults. Nineteen regular attendees from two rural senior centers were recruited with 3 being dropped later for less than 50 percent attendance rate during the exercise program. Thirteen of the participants were women and the remaining three were men. The age range of the participants was between 60 to 90 years with a mean age of 74.9 years. Most reported previous exercise engagement whether in a group or individual setting. Authors used the Rikli and Jones Senior Fitness Test (SFT) for pre- and post-test evaluation to gauge improvement based upon exercise attendance. Participants also completed the Mini-Mental State Examination (MMSE), a health survey, and 10 participants completed a blood screening. The intervention was a 10-week, 3 times per week exercise class lasting approximately one hour in length consisting of a warm-up, stretching, balance, and strengthening exercises. All exercises were performed for one set of 20 repetitions. Results of the study show that participants completed 77 percent of the thirty exercise sessions with significant improvement in the 8-ft up-and-go, the chair stand, the arm curl, and the back scratch. Feedback from participants was positive for the exercise class and instructors noted the social benefits of the participants attending. Limitations of this study included the lack of a control group and the relative brevity of the intervention so that long-term compliance and cost effectiveness could not be measured.

Only one study actually tested each intervention strategy separately to determine the effects of each intervention on older adults' functional fitness (Takeshima, Rogers, Rogers, Islam, Koizumi, & Lee, 2007). The different exercise programs being tested were a walking-based aerobic program, a band-based resistance program, a stretching-based flexibility program, a customized balance program, and a Tai Chi program. The quasi-experimental, nonequivalent control group study obtained 117 healthy, sedentary older adults around 73 years of age to participate in one of the five exercise groups: aerobic (N=13) , resistance (N=17), balance (N=15), flexibility (N=16), and Tai Chi (N=31) with the remaining 25 participants assigned to a wait-list control group. Fifty-five percent of the participants were men and the other 45 percent were women. To measure functional fitness, researchers obtained participants height, weight, body mass index (BMI), arm-curl test, chair stand test, 8 ft up-and-go, functional reach test, back-scratch test, chair sit-and-reach test, and a 12-minute walk. The exercise intervention was supervised two days a week for 12 consecutive weeks for an hour and a half. For the aerobic intervention, participants wore an accelerometer on their waist band to monitor daily step count and intensity. Elastic bands were used in the resistance intervention. Every couple of weeks participants were informed to increase the strength of the band that they used during the exercise program. The balance intervention included 34 exercises that challenged visual, vestibular, and somatosensory systems. After week four, the balance exercises moved from the participants standing on the floor to standing on a balance pad. The flexibility intervention included 15 static stretching exercises being held for 15-20 seconds with the choice of performing the exercises while sitting or lying down on exercise mats. A 24-form Yang-style Tai Chi exercise was performed by the Tai Chi exercise group with an authentic Tai Chi master leading the class through the movements.

Results from the Takeshima et al. study show that significant gains in upper and lower body strength and balance/agility were outcomes of the resistance, balance, and Tai Chi exercise interventions, while cardio-respiratory fitness gains were a result of the aerobic exercise intervention. Flexibility measures yielded no significant results from any of the exercise intervention groups although this result is not applicable to all studies on exercise interventions (Yan, Wilber, Aguirre, & Trejo, 2009). Limitations of the study are the nonrandomized design, self-selection of individuals to the different exercise interventions, the participants' chronic health conditions and medication usage, the use of the SFT to measure functional fitness, and a small sample size that limits the ability to generalize the study's outcomes to all older adults.

2.5 Self-Monitoring Strategies

Since it seems that any intervention is better than none at all and the combination of aerobic, resistance, and balance is the best of all, the following studies reviewed different tools used for self-monitoring in combination with the multi-faceted intervention approach. Researchers Anshel and Seipel (2009) looked at self-monitoring via an exercise checklist. The purpose of the study was to examine the effectiveness of self-monitoring on measures of fitness and exercise adherence among unfit university faculty and staff in the southeastern U.S. Sixty-five healthy participants (i.e. 23 men, 42 women) were recruited for the study: the majority were Caucasian and had a mean age of 44.6 years. Participants were randomly assigned to a group that did (intervention group) or did not (control group) have to complete a 60-item Exerciser Checklist that included five sections including lifestyle habits, day of exercise, pre-exercise activity, during exercise session, and after exercise section in order for the participants to adhere to exercise behaviors. Pre and post-test evaluations included a single-stage treadmill test, push-ups, blood pressure, skinfold, and exercise adherence. The intervention involved a 3 hour seminar where information was given out and a performance coach was assigned; pre-intervention blood and fitness tests; exercise program prescription based on the results of the test; engaging in an 8-week aerobic exercise intervention three times per week on their own and strength training two times per week while completing the Exerciser checklist; meeting weekly with their performance coach; receiving post intervention blood and fitness tests.

Results of the Anshel and Seipel study was that the experimental group showed gains in strength and VO_2 max that were significant compared to the control group. Adherence level was significantly higher for the intervention group than the control group. The results supported that self-monitoring does increase measures of fitness (aerobic and strength only) and exercise adherence; however, long-term adherence is sketchy given that the main limitation of the study was its short intervention period of eight weeks.

Koizumi, Rogers, Rogers, Islam, Kusunoki, and Takeshima (2009) researched the use of an accelerometer for self-monitoring instead of a checklist. The purpose of the study was to evaluate if accelerometer-based feedback would increase DPA and cardiorespiratory endurance in healthy, community-dwelling older women. Sixty-eight older women were chosen for the study and divided into two groups: 34 participants engaged in the lifestyle physical activity intervention group (LIFE) and 34 participants engaged in the control group (CON). The women had a mean age of 67 and lived in N. Iida city in Japan. A Kenz Lifecorder accelerometer was used by both study groups to determine DPA and intensity of physical activity. Only the LIFE group was instructed to accumulate 9000 steps per day and engage in 30 minutes of moderate-intensity physical activity. During the 12-week intervention, researchers only made contact with the LIFE and CON group to download accelerometers every 2 weeks. The CON group wore an accelerometer that was locked and told to continue their regular daily routine of physical activity, while the LIFE group did not have a locked accelerometer and were provided with feedback on how to meet the target DPA goal. DPA was assessed using the accelerometers while cardio-respiratory endurance was measured using a 12-minute walk. Results of the study demonstrate that the accelerometers were successful in producing the desired outcomes proposed by the researchers to increase the quality and quantity of DPA and to increase cardio-respiratory endurance in older women.

Tudor-Locke, Jones, Myers, Paterson, and Ecclestone (2002) researched the effects of both pedometers and an exercise log to promote DPA in older adults. The purpose of the study was to describe the physical activity and exercise lifestyle of a convenience sample of independent older adults who were regular attendees of a structured exercise program at the Canadian Center for Activity and Aging (i.e. exercise participants within the program on average 5.4 years). Also, the authors were interested in examining the contributions of formal and informal exercise on DPA. Two-thirds of the small sample study (N=18) were women and one-third were men roughly around the age of 70 with around three-fourths of participants reporting having a college education. The majority of participants rated their health as excellent or good and the most frequently reported chronic health conditions reported were arthritis, high blood pressure, high cholesterol, and heart trouble. The structured exercise program contained 15 minutes of warm up (e.g. stretching), 20-25 minutes of aerobic activity, 20 minutes of resistance training, and a 15 minute cool-down. For this study, participants wore a pedometer and kept a daily physical activity log book for nine days (i.e. 2 weekends, 4 weekdays) in the month of November. Pedometers could only be removed during sleeping hours or during any water-based activity. The activity log was split into morning hours, afternoon hours, and evening hours and participants were instructed to record their pedometer steps at the end of each of the nine days. Participants were instructed to engage in their normal day-to-day routine without increasing activity.

Results of the Tudor-Locke et al. study revealed that the adults daily step average was 6,559 with the class being the primary source of vigorous activity throughout the intervention period. Attendance for exercise class during the 9 days was between 78 and 89 percent with steps taken during exercise class equaling 3,729 steps on average. Walking for 30 minutes resulted in an average of 3,411 steps and participants walked outside of class roughly five out of the nine days for around 40 minutes. Other physical activity reported in the logs included heavy cleaning, gardening, and home repair for an average of one hour a day. Pedometer recording error was found in driving in a car with an average of 166 steps being recorded. DPA was highest on exercise program days and lowest on weekends. Limitations of the study include low generalizability and pedometer recording error for persons with gait abnormalities (i.e. slow or shuffling gaits). Overall, the exercise program was the only vigorous activity recorded and the only source of resistance and flexibility training the older adults got within the nine day period.

Even though the Tudor-Locke et al. 2002 study revealed that a pedometer does have recording error, a later study by Le Masurier and Tudor-Locke (2003) revealed that both accelerometers and pedometers are reliable in measuring DPA in healthy older adults. In a systematic review of pedometers and their effect on DPA in a study of adults conducted by Bravata et al. (2007), pedometers were acknowledged to be cost-effective instruments that were discovered to increase DPA to about 1 mile or 2,000 steps daily. Providing step goals and a step dairy were recommended as being useful in increasing DPA along with a pedometer (p. 2302). To increase DPA in sedentary individuals over the long-term, small step goals are more successful than large step goals ("Realistic," 2005). Specifically, an intervention group that was given a goal of increasing 2500 steps over baseline had consistent increases in steps that surpassed the set goal than was another intervention group given a target goal of 10,000 steps daily and a control group that was given no goal during an 8-week intervention.

Exercise programs involving aerobic, strength and balance training along with a tool that promotes self-monitoring is important in guiding the older adult to sustain regular DPA; however, it is not quite clear at what intensity level that maximal health benefits are obtained. A study by King, Haskell, Taylor, Kraemer, and DeBusk (1991) found that low-intensity and high-intensity home-based exercise programs showed comparable increases in fitness and exercise adherence rates that are linked to important health outcomes in older adults. Another area to clarify is the program duration at which benefits gained in functional fitness are significant. Researchers Toreman, Erman, and Agyar (2004) conducted an experimental study that revealed that an exercise program involving aerobic, strength, and flexibility exercises can demonstrate improvement in functional fitness as measured by the SFT in as little as 9 weeks. Overall, the best intervention in order to obtain functional fitness and DPA significant results involves a 9 week, multi-faceted, moderate-intensity exercise program provided in a community-setting with the use of a pedometer for self-monitoring and providing small, obtainable goals.

CHAPTER 3

METHODOLOGY

3.1 Participants

Eighteen women (X= 73 ± 7 yrs) were recruited from local community centers, senior centers, retirement communities, other senior-based programs and media publications. Individuals voluntarily chose to participate in the Well-Rounded Exercise Program (WellREP). A control group (CONTROL) of 15 women (X= 75 ± 6 yrs) was drawn from a waiting list for a similar program at a second area senior center.

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 A). In the event where the EASY screening suggested a physician referral participants received written permission from their personal physician (Appendix B).

3.2 Screening

To determine the appropriateness of participation, potential participants were screened using the EASY (Exercise And Screening for You) Screening (Resnick, et al., 2006) tool (Appendix C). This tool was developed by an expert panel of interdisciplinary researchers and clinicians with experience establishing physical activity programs for older adults. The tool provides recommendations for safe and appropriate activities in light of known risk factors. If the screening indicated the older adult should consult their healthcare provider, a physician consent was required for program participation.

3.3 Intervention Protocol

The multi-component physical activity class was conducted twice a week for 12 weeks at Senior Services, Inc. Downtown Senior Center. The intervention incorporated the *Well-Rounded Exercise Program (WellREP)* which provides a simple 4-step routine to increase physical activity. The program includes four components: cardio-respiratory, flexibility, strength, and balance. Flexibility, strength and balance were addressed during class sessions, while cardio-respiratory was addressed on an individualized basis outside of class. Instructors progressed through the program at a pace deemed appropriate for participants. Program progression involved the addition of new fitness components and additional exercises during each class session until participants were performing all 3 components during each class session. Participants begin with flexibility and strength and progressed to balance activities. Balance activities were started at approximately the 2 week mark. Participants began balances exercises on the floor and progressed to the Thera-band stability trainers. As an added safety measure, chairs were position near participants to provide stability, if needed, during balance exercises. All training sessions were led by a certified instructor who had completed a certification program through the Center for Physical Activity and Aging at Wichita State University.

Strength

To enhance muscular strength, participants performed a series of exercises using elastic bands. One band exercise was chosen to work each of the major upper body muscles groups: back, biceps, chest, and triceps. The following leg exercise were performed during each session: seated leg press, seated leg extensions, hamstring curls, toe raises, heel raises, toe abduction, hip rotation, glut squeezes, squats, and side leg lifts. Band exercises were performed for 12 to 15 repetitions. These exercises were performed in both sitting and standing positions. In addition, band exercises were performed while standing on the Thera-Band stability trainers. Simultaneously performing strength and balance exercises increased the challenge of the exercise program for the participants. To progressively overload the muscles during the strength exercises, the following Thera-Band exercise bands, listed in increasing resistance, were available to the subjects: yellow (easiest), red, green, blue, black, gray, and gold (most difficult). Participants were encouraged to progress to a higher resistance Thera-Band exercise band when they could complete 12 to 15 repetitions of an exercise easily. Most participants used two different resistance levels of bands for their upper and lower bodies and progressed accordingly. The order in which exercises were performed was varied.

Balance

The balance portion of the program incorporated balance training using Thera-Band stability trainers (a 16" × 9" × 2" elliptical- shaped foam pads). As participants stood on the stability trainers they were instructed to close their eyes and/or to extend the neck or rotate the head from side to side. To increase the difficulty of these exercises, participants performed them while standing with the feet in various positions (e.g., feet together, single leg, semi-tandem, and tandem positions), advanced to using less stable trainers (Thera-Band stability trainers were available in two different levels of firmness: green trainers are firmer foam and blue trainers are more compliant and thus, more difficult), and finally advanced to stacking one Thera-Band stability trainer on top of another.

Cardio-respiratory

Participants wore a pedometer during all waking hours (taking it off to bathe or swim) and recorded their daily step counts in an activity log once per week before or after the physical activity class. To enhance cardiovascular fitness, participants were asked to incorporate more physical activity into their daily lives. Strategies to increase daily physical activity were discussed with participants during class sessions. The cardio-respiratory program was an individualized approach of goal-setting and self-monitoring. To achieve an individualized prescription, baseline physical activity was obtained. A 1-week baseline was established as participants perform their normal daily activities while wearing a pedometer. Based on these values, program assistants calculated physical activity goals by increasing baseline values 10% with a subsequent 10% increase every 2 weeks until an overall physical activity goal of at least 6,000 steps was achieved. Physical activity was monitored by pedometers. Participants recorded their daily step counts in an activity log once per week before or after the physical activity class.

3.4 Assessments

Physical characteristic measures, functional fitness, balance and a 1 week daily physical activity assessment was completed prior to implementation of the intervention and after approximately 12 weeks. Assessments were conducted at the Senior Services, Inc of Wichita's Downtown Senior Center. Time required to administer assessments was approximately 90 minutes. Participants were verbally encouraged to do their best, but not to push to the point of over exertion or beyond what they feel is safe for them. In addition, pedometer step counts were measured for 1 week prior to program implementation. A basic questionnaire was administered. Details of the assessments and questionnaires are as follows:

Demographics

A demographics questionnaire was administered to each participant to assess 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.

Physical Characteristics

- Height and Weight: Body weight was measured using a standard medical scale and height will be measured using a stadiometer.
- Blood Pressure: Blood pressure was measured using standard procedures.
- Body Mass Index: A commonly used tool that can be used to indicate obesity is the Body Mass Index (BMI). The BMI is a quick and easy method of determining the appropriateness of a client's body weight in relation to his or her height. BMI was calculated by dividing body weight in kilograms by height in meters squared.

3.5 Functional Fitness Assessments

30-Second Chair Stand

The purpose of this assessment was to measure lower body strength. The test began with the participant seated in the middle of the chair, back straight, and feet approximately shoulder width apart and flat on the floor. Arms were crossed and held against the chest. At the signal "go" the participant rose to a full stand (body erect and straight) and then returned back to the initial seated position. The participant was encouraged to complete as many full stands as possible within a 30-second time limit. Participants were given two or three practice repetitions.

The score was the total number of stands executed correctly within 30 seconds. If the participant was more than halfway up upon completion of the 30 seconds, it counted as a full stand.

30-Second Arm Curl

The purpose of this assessment was to measure upper body strength. The participant was seated on a chair, back straight and feet flat on the floor, and with the dominant side of the body close to the edge. The weight was held at the side in the dominant hand. The test began with the arm in the down position beside the chair, perpendicular to the floor. At the signal "go" the participant curled the arm through a full range of motion, and then returned to the fully extended position in a controlled manner. The participant repeated this movement as many times and as quickly as possible in 30-seconds. The score was the total number of curls made correctly within 30 seconds. If the participant's arm was more than halfway up at the end of 30 seconds, then it counted as a completed curl. An 8-lb dumbbell was used for males, while a 5-lb dumbbell was used for females.

Chair Sit and Reach Test

The purpose of this assessment was to assess lower body (primarily hamstring) flexibility. The test began with the participant sitting on the front edge position of a chair. Keeping one leg bent and foot on the floor, the other leg (the preferred leg*) was extended straight in front of the hip, with heel on the floor and foot flexed. With the extended leg as straight as possible, the participant slowly bent forward at the hip joint sliding the hands (one on top of the other with the tips of the middle fingers even) down the extended leg in an attempt to touch the toes. The reach was held for two seconds. A ruler was used to measure the number of inches (nearest ½ inch) a person is short of reaching the toes (minus score) or reaches beyond the toes (plus score). The participant was given two practice trials. The score was the best measure of two trials. * The preferred leg is defined as the one that results in the better score.

<u>8’ Up and Go</u>

The purpose of this assessment was to measure physical mobility involving speed, agility, and dynamic balance. The test began with the participant fully seated in the chair, hands on thighs, and feet flat on the floor. The participant was allowed to push off the sides or arms of the chair to aid in getting up from the chair. On the signal “go”, each participant was instructed to stand up from the chair as quickly as possible, walk around a cone placed 8 feet in front of the chair, and return to a seated position in the chair. The participant was told the test was timed and that the object was to walk around the cone as fast as possible (without running) and return to a seated position. A timed score was recorded from moment the signal “go” was given until the participant returned to a seated position on the chair. The participant was allowed to walk through the test for practice. The participant's score was recorded as the best of the two most consistent times measured.

<u>Scratch Test</u>

The purpose of this assessment was to assess upper body (shoulder) flexibility. In a standing position, the participant placed the preferred hand* over the same shoulder and reached as far as possible down the middle of the back, palm down and fingers extended. Hand of other arm was placed behind back, palm up, reaching up as far as possible in an attempt to touch (or overlap) the extended middle fingers of both hands. The distance of overlap, or distance between the tips of the middle fingers was measured to the nearest ½ inch. Minus scores (-) were given to represent the distance short of touching middle fingers; plus scores (+) represent the degree of overlap of middle fingers. The "best" score was used to evaluate performance. *The preferred hand is defined as the one that results in the better score.

<u>12-Minute Walk</u>

The purpose of this test was to assess aerobic endurance. The test involved assessing the maximum distance that can be walked in 12 minutes along a 50-meter course, marked into 5-meter segments. Participants continuously walked around a measured lap throughout the 12-minute period, trying to cover as much distance as possible. On the signal "go", participants were instructed to walk as fast as possible (not run) the marked distance around the cones as many times as they can within the time limit. If necessary, participants could stop and rest, sit on chairs provided, then resume walking. The score was the total number of yards walked in 12 minutes to the nearest 5 meter indicator.

<u>Daily Physical Activity Assessment</u>

Participants were asked to wear a pedometer during all waking hours (taking it off to bathe or swim) for 1 week prior to program implementation (baseline). The protocol for pedometer measurement was as follows: worn at the waistline, clipped to a belt or clothing and centered over the dominant foot. To prevent feedback during baseline acquisition, pedometers were locked in the closed position.

3.6 Balance Assessment

A force platform (Balance Master Platform, NeuroCom International) was utilized to obtain the postural dynamics of Limits of Stability for each participant. The data acquisition system consists of a digital converter and computer software. Participants were familiarized with all postures and procedures. Participants wore wear a gait belt. For all stances, participants were asked to stand in bare feet on the force platform, facing forward, eyes fixed straight ahead, and arms at the sides in a neutral position.

Limits of Stability (LOS)

The LOS assessment quantifies the maximum distance a person can lean in a given direction without stepping, losing balance, or reaching for assistance. Each participant's theoretical limits of stability were calculated based on height and were set at 100% of the maximum LOS. Four targets, appearing in a circle around a center target, were displayed on the computer screen at 0, 90, 180, and 270 degrees. The participants' center of gravity appeared as a human-shaped cursor on the computer screen, which moved freely with the participants as they shifted their weight. To initiate each trial, the participant was instructed to adjust and then maintain the human-shaped cursor in the center box until the computer beeped. Upon hearing an auditory signal from the computer, the subject was instructed to move toward the highlighted target in a straight line, as fast as possible, and to hold the position for 10 seconds. Targets were highlighted sequentially in a clockwise manner. Participants were given a practice trial for each target in order to ensure maximum performance. Each trial measured reaction time, sway velocity, directional control, endpoint excursion, and maximum excursion.

- Reaction Time (RT): the time in seconds between the command to move and the patient's first movement.

- Movement Velocity (MVL): the average speed of COG movement in degrees per second.
- Endpoint Excursion (EPE): the distance of the first movement toward the designated target, expressed as a percentage of maximum LOS distance. The endpoint is considered to be the point at which the initial movement toward the target ceases.
- Maximum Excursion (MXE): is the maximum distance achieved during the trial.
- Directional Control (DCL): is a comparison of the amount of movement in the intended direction (towards the target) to the amount of extraneous movement (away from the target).

3.7 Data Analysis

Sample size was determined based on published (Islam, Nasu, Rogers, Koizumi, Rogers, & Takeshima, 2004; Rogers, Sherwood, Rogers, & Bohlken, 2002) and unpublished functional fitness data. Training effects indicated a sample size of 12 subjects was required for a power of 0.80. Absolute values were used for statistical analysis. However, when discussing differences between groups, relative change is used to normalize differences as each functional fitness and balance measure utilizes a unique scale and results would be difficult to interpret. 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. Each variable was examined for normality using the Kolomogorov-Smirnov test. Assumptions of homogeneity of variance and sphericity were evaluated. Baseline group mean comparisons were performed using two-tailed independent t-tests. Evaluating functional fitness and balance measures utilized more than one testing instrument, and therefore a multivariate ANOVA was initially used as an omnibus test. Subsequent repeated measures ANOVA procedures were conducted for each instrument contingent upon the multivariate ANOVA reaching statistical significance (ANOVA, Wilk's criterion). Group (WellREP, CON) served as the between-subject factor, while Time (Pre-test and Post-test) served as a within-subject factor. Change in the WellREP group weekly step rate (STEPS) was evaluated by paired samples t-test. A probability value of less than 0.05 was considered statistically significant and a Bonferroni adjustment was used to correct for multiple comparisons.

CHAPTER 4

RESULTS

4.1 Normality and Assumptions

Non-significant Kolomogorov-Smirnov tests, indicated all variables, excluding the STEPS, were normally distributed. To correct for non-normality, STEPS were transformed using a Log10 transformation. Conducting a second Kolomogorov-Smirnov test on the transformed daily step variable revealed a successful transformation, with STEPS 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 Baseline Comparison

An analysis of pretest physical characteristics, Functional Fitness, Balance, and STEPS was completed to determine if differences existed between the groups. No differences were found between the WellREP group and CON group prior to the start of the intervention.

4.3 Adherence to Intervention

Of the 18 participants who entered the study, 18 completed both Pre and Post testing, thus the program experience no attrition. The average adherence of the WellREP group participants was 92%.

4.4 Changes in Functional Fitness

Table 4.1 presents the relative change of functional fitness measures both groups following the 12 weeks of intervention**.** All functional measures, excluding flexibility, in the WellREP group exhibited an 8% to 46% significant increases as compared to a -3% to 8% change in the CON group (-3% to 8%). The multivariate ANOVA revealed a significant interaction ($F = 14.07$, $p \leq 0.01$, $\eta^2 = .82$), necessitating subsequent repeated measures ANOVAs. Univariate analysis of the functional measures revealed a significant interaction effect for all measures, excluding the upper and lower body flexibility measures (Figure 4.1). Differences were noted for arm curl ($F = 8.34$, $p \leq 0.01$), chair stand ($F = 22.70$, $p \leq 0.01$), up and go ($F = 16.10$, $p \leq 0.01$), 12-min walk ($F = 16.87$, $p \leq 0.01$), as well as the physical characteristics of weight ($F = 15.86$, $p \leq 0.01$) and BMI ($F = 15.09$, $p \leq 0.01$). Upper body strength, as measured by arm curls, increased 25% for the WellREP group and 8% for the CON group (Figure 4.2). Lower body strength, as measured by chair stand, increased 46% for the WellREP group and 1% for the CON group (Figure 4.2). Time to complete the Up and Go decreased 8% for the WellREP group and increased 2% in the CON group (Figure 4.3). A 13% improvement in cardio-respiratory fitness, as measured by the 12-min walk, was demonstrated by the WellREP group as compared to a -.03% change in the CON group (Figure 4.3). Furthermore, the WellREP group experienced a 1.4% reduction in weight and a similar 1.4% reduction in BMI, compared to a 0.6% increase in both weight and BMI in the CON group.

TABLE 4.1

FUNCTIONAL FITNESS MEASURES

	Pre	Post	% Change
30s Arm Curl (reps)			
WellREP	16.72 ± 2.68	20.61 ± 3.65	26% *
CON	14.87 ± 4.52	15.67 ± 3.81	8%
30s Chair Stand (reps)			
WellREP	11.56 ± 3.35	16.28 ± 3.91	46% *
CON	12.67 ± 2.44	12.80 ± 3.12	1%
Back Scratch (cm)			
WellREP	-5.44 ± 10.66	-4.59 ± 9.77	8%
CON	-1.30 ± 7.42	-.87 ± 6.24	11%
Sit and Reach (cm)			
WellREP	1.14 ± 6.29	1.46 ± 7.11	14%
CON	2.41 ± 6.24	2.56 ± 5.60	6%
8 ft up-and-go (sec)			
WellREP	6.67 ± 1.35	6.06 ± 1.11	-8%
CON	6.66 ± 1.72	6.81 ± 1.78	2%
12-min Walk (m)			
WellREP	816.67 ± 131.17	905.28 ± 98.18	13% *
CON	794.00 ± 127.49	790.33 ± 121.84	0% *

Values are Mean ± SD

TABLE 4.2

PHYSICAL CHARACTERISTICS

	Pre	Post	% Change
Weight (kg)			
WellREP	71.58 ± 12.07	70.49 ± 11.88	1.74 %
CON	67.36 ± 7.71	67.77 ± 7.67	.87 %
BMI			
WellREP	27.33 ± 5.13	26.92 ± 5.06	1.74 %
CON	25.27 ± .86	25.43 ± .79	.87 %

Values are Mean ± SD

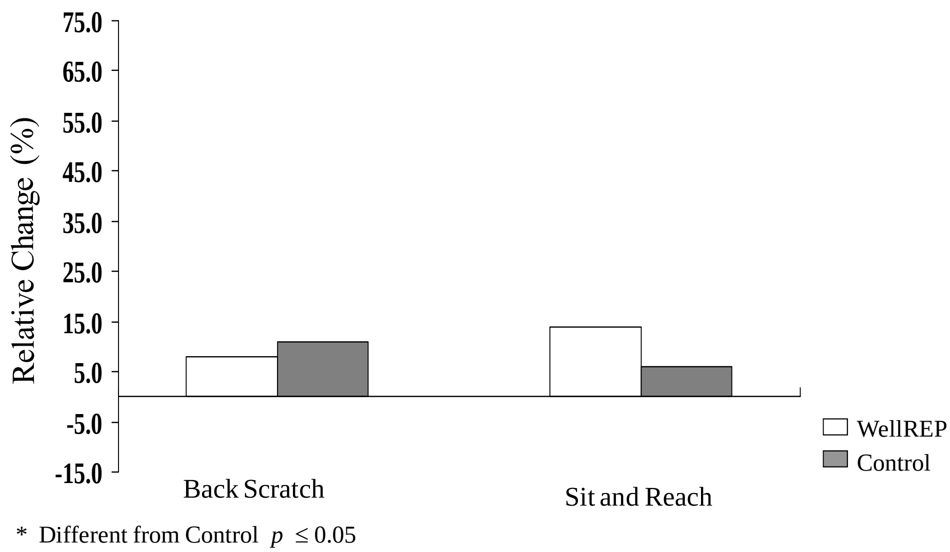
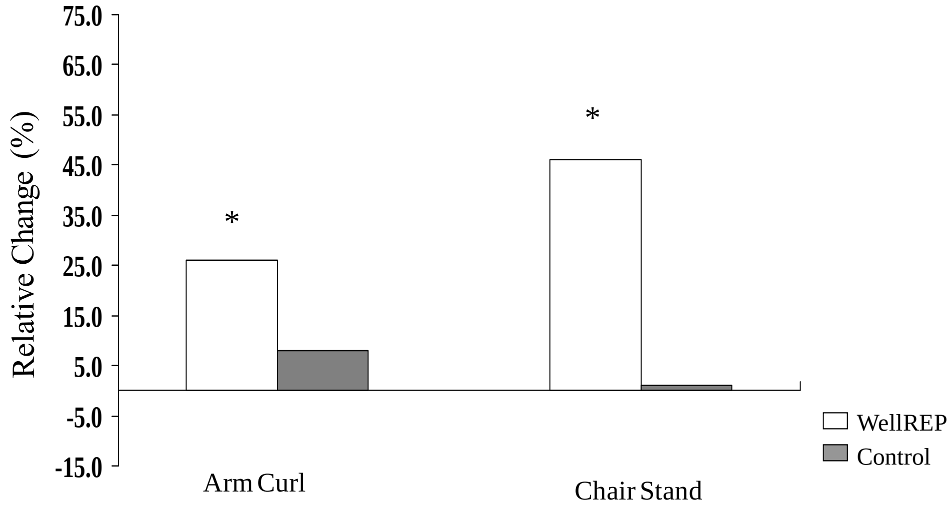
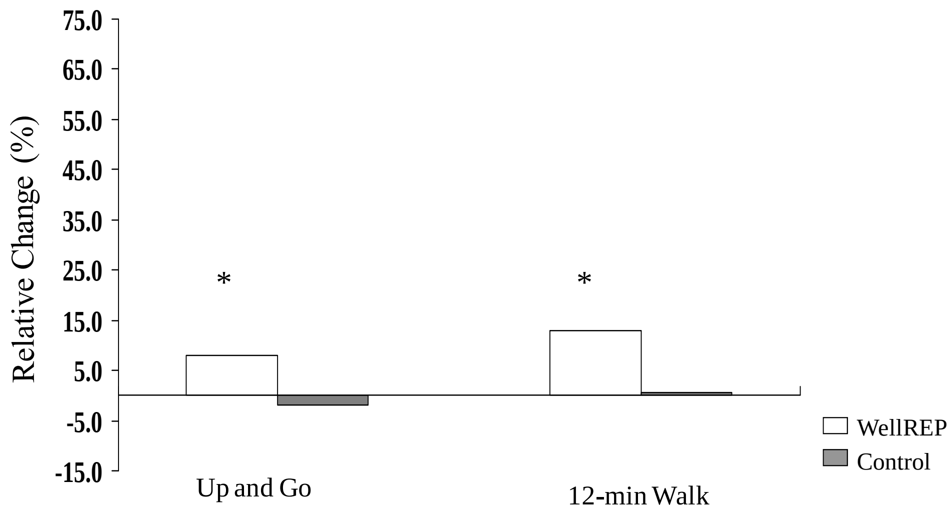


Figure 4.1 Flexibility



* Different from Control $p \leq 0.05$

Figure 4.2 Strength



* Different from Control $p \leq 0.05$

Figure 4.3 Mobility

4.5 Limits of Stability

Reaction Time

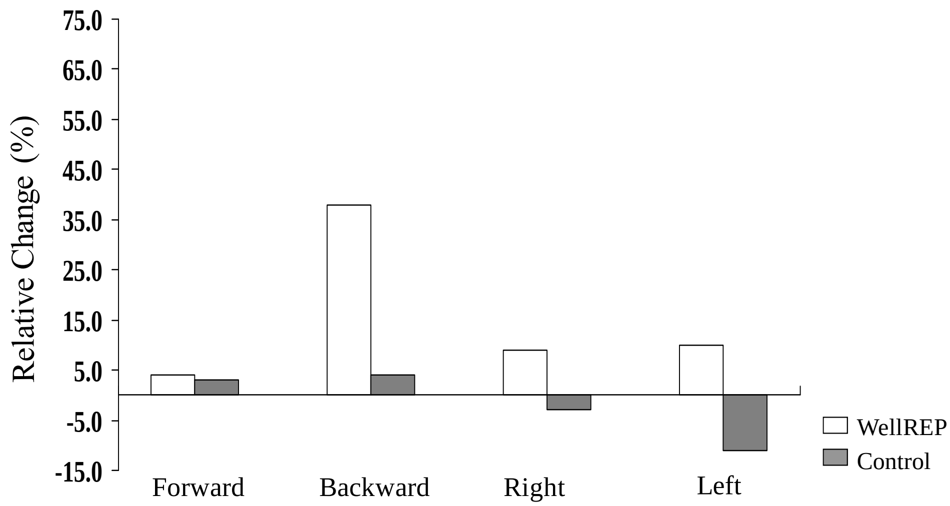
The multivariate ANOVA was not significant for ($F = .92$, $p \geq 0.05$) for the Reaction Time measures, and did not necessitate subsequent repeated measures ANOVA analyses. Table 4.3 presents the Reaction Time percent change for all four directions. Although not significant, measures of the WellREP group Reaction Times do show a trend toward improvement in the backward, right, and left directions, compared to smaller changes and often poorer performance by the CON group (Figure 4.4).

TABLE 4.3

LIMITS OF STABILITY

	Reaction Time (s)			
	N	Pre	Post	% Change
Forward				
WellREP	17	.70 ± .32	.66 ± .38	4 %
CON	15	.95 ± .35	.88 ± .27	3 %
Backward				
WellREP	17	.62 ± .25	.75 ± .37	38 %
CON	15	.82 ± .22	.81 ± .22	4 %
Right				
WellREP	17	.72 ± .35	.69 ± .32	9 %
CON	15	1.02 ± .35	.90 ± .34	-3 %
Left				
WellREP	17	.81 ± .33	.80 ± .30	10 %
CON	15	1.06 ± .30	.95 ± .26	-11 %

Values are Mean ± SD



* Different from Control $p \leq 0.05$

Figure 4.4 Reaction Time

Movement Velocity

The multivariate ANOVA was not significant for ($F = .67$, $p \geq 0.05$) for the Maximum Velocity measures, and did not necessitate subsequent repeated measures ANOVA analyses. Table 4.4 presents the Movement Velocity percent change for all four directions. Although not significant, measures of the WellREP group Movement Velocities do show a trend toward improvement in the front, backward, and left directions, compared to smaller changes and often poorer performance by the CON group. (Figure 4.5).

TABLE 4.4

LIMITS OF STABILITY

		Movement Velocity (degrees • second^{-1})		
	N	Pre	Post	% Change
Forward				
WellREP	17	4.51 ± 1.92	4.47 ± 1.92	9%
CON	15	3.29 ± 1.99	2.62 ± .87	-9%
Backward				
WellREP	17	2.21 ± .60	2.98 ± .92	43%
CON	15	1.99 ± .81	2.23 ± .65	21%
Right				
WellREP	17	5.04 ± 2.33	5.32 ± 2.24	-11%
CON	15	3.68 ± 1.26	3.14 ± .88	24%
Left				
WellREP	17	5.38 ± 2.32	5.27 ± 2.58	10%
CON	15	3.88 ± 2.00	3.23 ± .89	-7%

Values are Mean ± SD

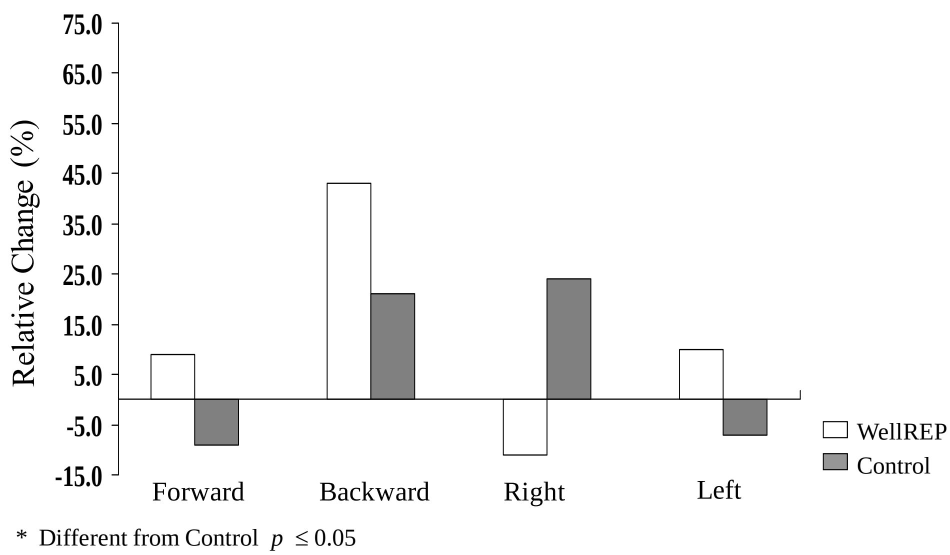


Figure 4.5 Movement Velocity

Endpoint Excursion

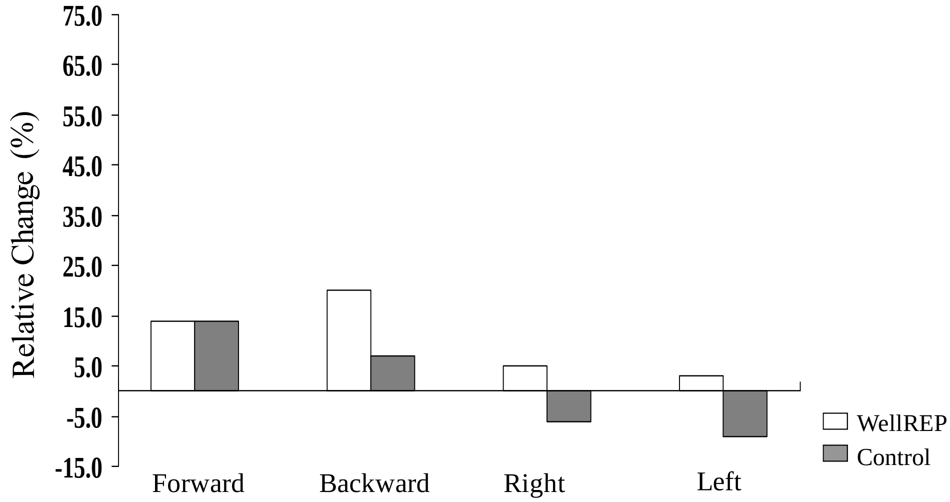
The multivariate ANOVA was not significant ($F = 2.76$, $p \geq 0.05$) for the Endpoint Excursion measures, and did not necessitate subsequent repeated measures ANOVA analyses. Table 4.5 presents the Endpoint Excursion percent change for all four directions. Although not significant, measures of the WellREP group Endpoint Excursions do show a trend toward improvement in the backward, right, and left directions, compared to smaller changes and often poorer performance by the CON group (Figure 4.6).

TABLE 4.5

LIMITS OF STABILITY

	Endpoint Excursion (% of Predicted)			
	N	Pre	Post	% Change
Forward				
WellREP	17	67.82 ± 14.98	74.06 ± 16.82	14%
CON	15	128.36 ± 251.33	60.54 ± 17.20	14%
Backward				
WellREP	17	54.24 ± 18.91	59.88 ± 15.26	20%
CON	15	48.21 ± 16.05	49.40 ± 12.48	7%
Right				
WellREP	17	75.35 ± 13.29	77.53 ± 9.70	5%
CON	15	76.40 ± 12.63	70.67 ± 13.63	-6%
Left				
WellREP	17	78.88 ± 12.31	80.24 ± 13.02	3%
CON	15	77.86 ± 12.74	69.80 ± 11.57	-9%

Values are Mean ± SD



* Different from Control $p \leq 0.05$

Figure 4.6 Endpoint Excursion

Maximum Excursion

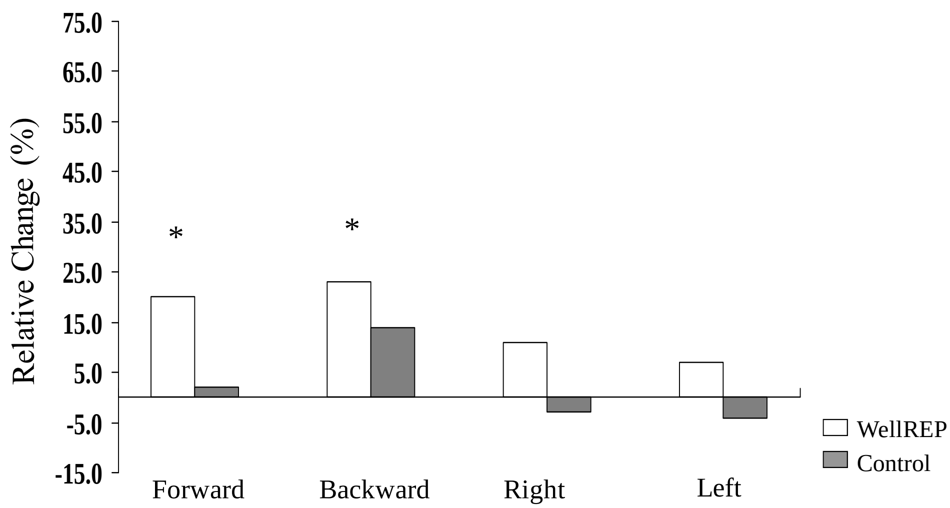
The MANOVA for the LOS MXE revealed a significant multivariate Group X Time interaction, ($F = 6.03$, $p \leq 0.01$), necessitating subsequent repeated measures ANOVAs. Univariate analysis of the functional measures revealed a significant interaction effect for two (*forward and backward*) of the four movement directions. Table 4.6 presents the percent change for all four directions. For the *forward* direction, WellREP increased 20% and CG increased 2% ($F = 6.63$, $p \leq 0.01$). For the *backward* direction, WellREP increased 23% CG increased 13% ($F = 14.60$, $p \leq 0.01$). There was no interaction effect for the *right* ($F = 1.33$ $p \geq 0.05$), or *left* ($F = 0.00$ $p \geq 0.05$) directions. (Figure 4.7).

TABLE 4.6

LIMITS OF STABILITY

	N	Maximum Excursion (% of Predicted) Pre	Post	% Change
Forward				
WellREP	17	77.59 ± 13.64	91.06 ± 11.22	20%
CON	15	145.07 ± 246.01	80.46 ± 12.73	2%
Backward				
WellREP	17	68.29 ± 12.18	81.88 ± 9.62	23%
CON	15	61.54 ± 14.35	68.07 ± 11.36	14%
Right				
WellREP	17	82.35 ± 11.58	89.94 ± 6.96	11%
CON	15	88.33 ± 13.40	84.93 ± 12.49	-3%
Left				
WellREP	17	87.53 ± 11.97	92.41 ± 7.48	7%
CON	15	89.15 ± 12.30	83.57 ± 10.32	-4%

Values are Mean ± SD



* Different from Control $p \leq 0.05$

Figure 4.7 Maximum Excursion

<u>Directional Control</u>

The multivariate ANOVA was not significant ($F = 2.76$, $p \geq 0.05$) for the Directional Control measures, and did not necessitate subsequent repeated measures ANOVA analyses. Table 4.7 presents the Directional Control percent change for all four directions. (Figure 4.8).

TABLE 4.7

LIMITS OF STABILITY

	Directional Control (% Within Linear Path)							
	N	Pre			Post			% Change
Forward								
WellREP	17	87.41	±	5.32	87.35	±	5.97	0%
CON	15	147.71	±	245.19	82.85	±	5.05	2%
Backward								
WellREP	17	76.29	±	10.94	74.71	±	14.78	-2%
CON	15	71.17	±	14.29	71.39	±	10.85	6%
Right								
WellREP	17	81.82	±	8.57	80.77	±	8.51	-1%
CON	15	80.62	±	4.41	81.23	±	6.83	1%
Left								
WellREP	17	84.71	±	7.01	86.94	±	6.51	3%
CON	15	81.67	±	5.07	81.31	±	5.15	-1%

Values are Mean ± SD

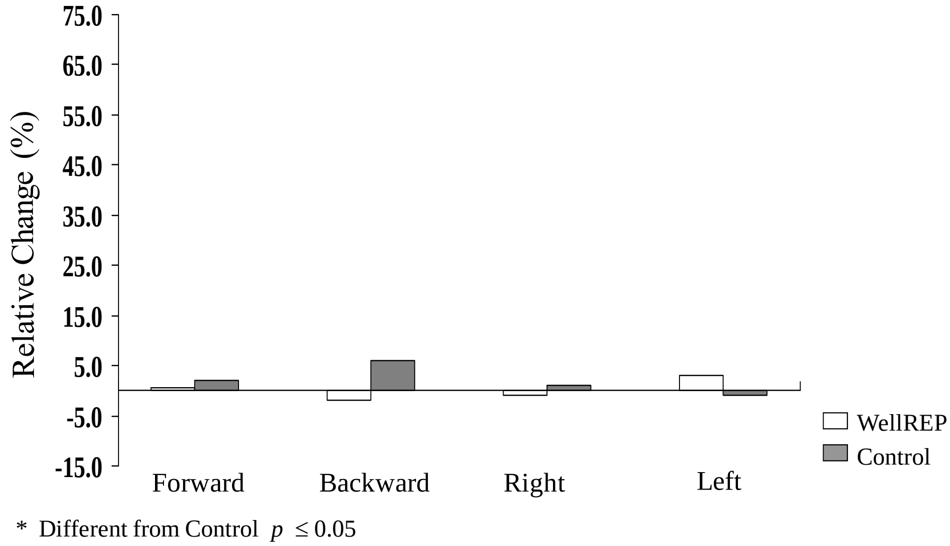


Figure 4.8 Directional Control

4.6 Daily Physical Activity

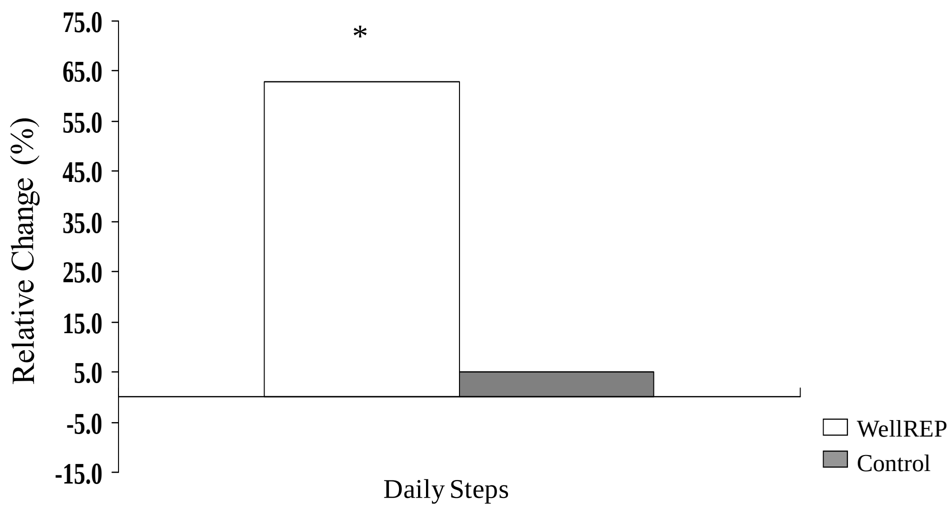
Average steps/day at baseline for the WellREP was 3,108 ± 840 (range 1,455 – 2385) and for the CONTROL was 3310 ± 704 (range 2634 – 4812). Table 4.8 presents the daily physical activity percent change for STEPS. A repeated measures ANOVA revealed a significant interaction for STEPS ($F = 25.87$, $p \leq 0.01$) that resulted from the WellREP increasing their weekly step average 63% (3108 ± 840 to 5076 ± 1795 steps) while no change was observed in the STEPS of the CONTROL (3309 ± 704 to 3487 ± 900 steps) (Figure 4.9).

TABLE 4.8

DAILY PHYSICAL ACTIVITY

	Directional Control (% Within Linear Path)			
	N	Pre	Post	% Change
Forward				
WellREP	17	87.41 ± 5.32	87.35 ± 5.97	64% *
CON	15	81.67 ± 5.07	81.31 ± 5.15	5%

Values are Mean ± SD



* Different from Control $p \leq 0.05$

Figure 4.9 Daily Physical Activity

Examining individual weekly step counts for the WellREP (Figure 4.10), a significant (t=-2.42, $p \leq 0.004$) increase in steps/day occurred at Week 6 (4,568 ± 1533 steps). The next significant (t=-5.47, $p \leq 0.004$) increase occurred at Week 12 (5076 ± 1795 steps). The only significant (t=-3.15, $p \leq 0.004$) increase from week to week occurred between Weeks 5 and 6

(3569 ± 1311 to 4568 ± 1533 steps) (Figure 4.11). Additionally, the following weeks STEPS were significantly different from baseline: Week 6, Week 7, Week 8, Week 9, Week 11, and Week 12 (Figure 4.12).

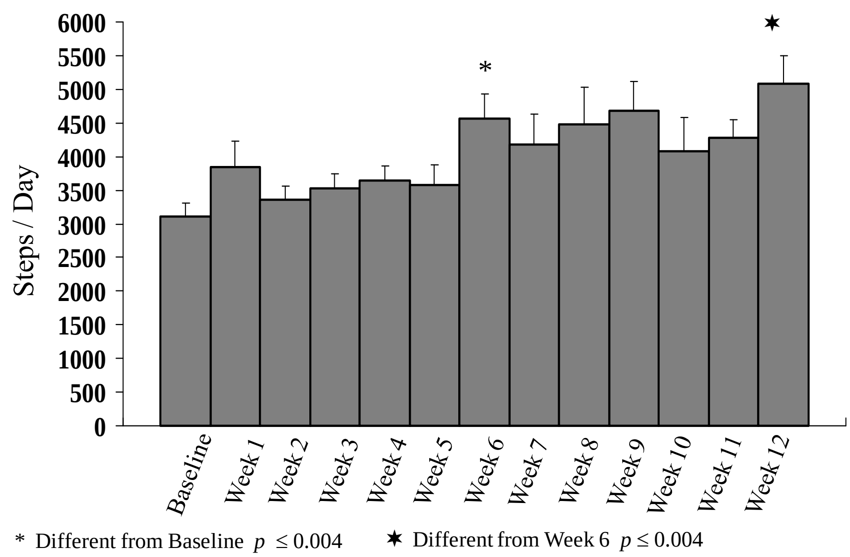


Figure 4.10 WellREP daily physical activity: Comparison to most recent significant increase

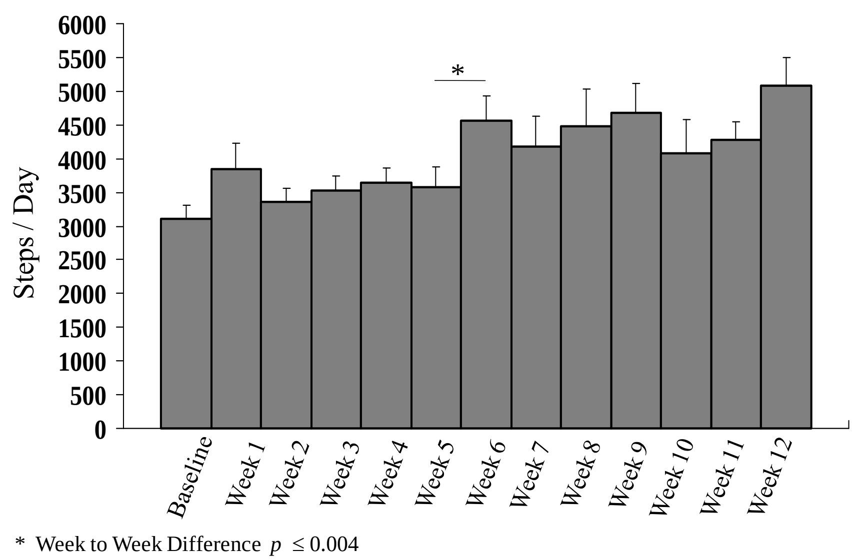


Figure 4.11 WellREP daily physical activity: Week to week comparison

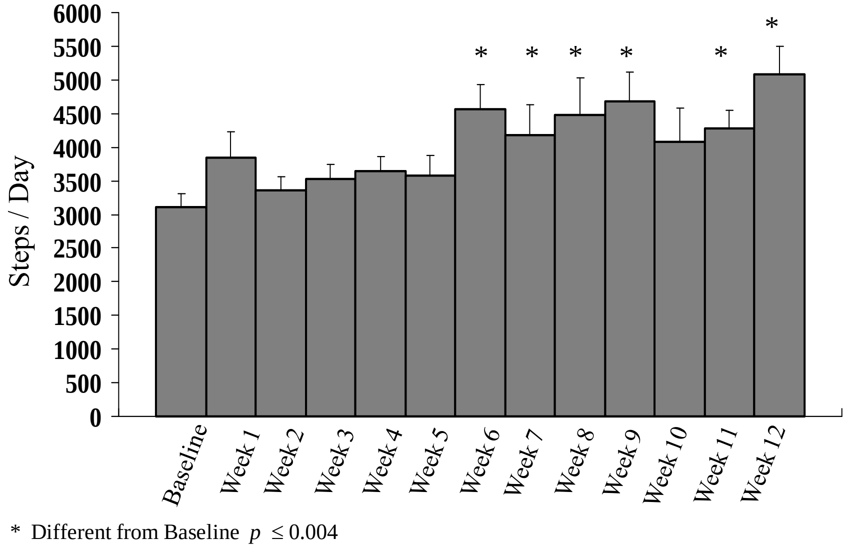


Figure 4.12 WellREP daily activity: Comparison to baseline

CHAPTER 5
DISCUSSION

This study was designed to determine the efficacy of participating in a 12-week WellREP intervention designed to meet the goals of the ACSM and CDC with respect to appropriate physical activity programming for older adults with respect to improvements in functional fitness, balance, and daily activity. The ACSM and CDC recommend older adults participate in a well-rounded exercise program consisting of four components (cardiovascular, resistance, balance, and flexibility), rather than a single mode, to improve overall fitness and in turn, prevent or ameliorate age-associated declines in function (ACSM, 1998b; Cress, Buchner, Prochaska, 2004). The results of this study suggest that the four components that make up the framework of the WellREP intervention can improve the functional fitness measures of strength and mobility, but may not be as effective for the flexibility component.

5.1 Functional Fitness

Significant improvements were achieved in the function fitness measures of arm curl, chair stand, 8 ft up-and-go, and 12-min walk. Participants in the WellREP group increased their upper body strength by 26% and their lower body strength by 46%. With respect to mobility, WellREP participants saw an 8% reduction in time to complete the 8 ft up-and-go and a 13% improvement in the distance walked in 12 minutes.

The strength results are in agreement with other studies that have used elastic bands. Aniansson et al., 1984 reported significant increases (7-13%) in strength in 63-86 year old women who participated in a 10 month strength training program using elastic resistance bands. Another study reported a 10% increase in lower extremity strength in adults aged 65+

years following a 12 to 15 week home-based strength training program using elastic resistance bands (Jette et al., 1996). A 10 to 16% increase in strength was reported by Chandler et al. (1998) who enrolled older adults in a 10-week elastic resistance band strength-training program.

The improvements observed for strength and mobility have important consequences for the older adult. The ability to physically move is based on the strength of muscles and cardio-respiratory fitness. Although many ADLs require minimal levels of strength and mobility, performing house work, shopping, using public transportation, carrying groceries, climbing stairs, and standing from a chair are only a few examples of activities that may be impossible to perform when physical function is compromised. When the older individual can no longer rise from a seated to a standing position, they have lost a significant portion of their autonomy. When the older individual can no longer walk long and short distances, they will lose their ability to shop, and participate in activities they may have once enjoyed (i.e visiting the zoo, dancing, visiting friends, bowling, etc.). Losing the ability to perform these tasks may lead to increased levels of dependency, increased social isolation, and reduced quality of life. Furthermore, enhancing muscular strength and mobility will allow individuals to remain independent and result in an increase in their quality of life.

No significant changes were noted in the WellREP group for upper or lower body flexibility. Flexibility is important for the performance of activities of daily living as well as in the avoidance of falls. It is also possible that the back scratch and sit and reach used for the indexes of flexibility in the current study were not sensitive enough to detect changes in flexibility or the training stimulus was insufficient to promote improvement.

5.2 Limits of Stability

Significant improvements in limits of stability measures were only observed in the maximum excursion measure. Maximum excursion increases were documented for the forward (20%) and backward (23%) directions. Although not significant, a number of trends were reported for the limits of stability measures of reaction time, movement velocity, and endpoint excursion.

The authors believe the lack of significance was due in part to the large variation in the performance of participants, a hallmark of aging. Additional factors could be attributed to the length of balance training. Using the model of progression, balance training did not commence until the 3rd week of the program, after participants were comfortable with the flexibility and strength exercises. Participants also began their balance training on the floor and gradually progressed to the stability trainers based on their confidence while performing the exercises, as well as the prompting and support provided by the instructor. This may have resulted in a slow progression to more challenging exercises and adversely impacted performance on the balance assessments. It may be important to note that the only improvement was observed for the maximum excursion measure. The authors hypothesize that this measure is more of a gross motor skill as compared to a measure such as directional control, a measure that may be considered a more fine motor skill. To improve on maximum excursion, participants only needed to lean as far as possible, without taking step. More motor control and balance may be required for endpoint excursion, movement velocity, and directional control. With respect to reaction time and movement velocity, given the lack of emphasis on time to initiate movement and movement speed during the intervention, it is not surprising that these two measures did not improve. The authors would also like to note that for safety reasons, movements were generally taught using slow movements. Interestingly, results from a recent 8 week pilot study examining the use of the Wii gaming system to improve balance, did result in improvements in reaction time and movement velocity. It was suggested that these results were due to the large emphasis placed on quick, controlled movements and were obtainable because the participant's movements were displayed on a screen where the movements could be specifically observed and monitored.

5.3 Daily Physical Activity

Significant improvements were observed in daily physical activity. Participants in the WellREP group increased their STEPS by 64% compared to a 5% increase in the CON group. Over the course of 12 weeks, WellREP participants increased their daily steps from 3,108 to 5,076 steps, while no change was observed for the CON group. Looking solely at the WellREP group, the first significant improvement occurred at Week 6, with a second improvement occurring at Week 12. Comparing each week to baseline alone, WellREP participants did engage in more daily physical activity during Weeks 6, 7, 8, 9, 11, and 12. Comparing week to week, there was only one significant increase during Week 5 to Week 6. Such a slow progression, with few significant increases between weeks, is indicative of a slow manageable progression of steps, one that is likely to be better maintained.

The result of our study confirm that our small step increase of 10% of the older adult's weekly average was sufficient in producing significant results in increasing daily physical activity. Another study confirms our results ("Realistic," 2005) in which small step goals were found to be more successful than large step goals. Specifically, the group given a small step goal had consistent increases in steps that surpassed the set goal than was another intervention group given a large step goal and a control group that was given no goal during an 8-week intervention.

Wearing a pedometer is a simple method for older adults to increase awareness of daily activity and can lead to increased physical activity. The pedometer appears to have served as a good motivator by providing a tangible method to monitor daily activity. These findings are encouraging, since walking is a highly accessible activity that is readily adopted, inexpensive, and rarely associated with exercise-related injury.

5.4 Adherence

The authors believe that the high adherence rates experienced by the WellREP group are an exact result of the use of self-monitoring via a pedometer. Another study has shown that adherence rates for exercise programs are directly related to the use of self-monitoring tools (i.e. pedometers, accelerometers, checklists, etc.) (Anshel & Seipel, 2009). An additional key to our adherence results are the socialization benefits between the older adults and the research staff provided within the context of the exercise class. Other studies support this finding (McDermott & Mernitz, 2006; Wallace et al., 1998).

5.5 Limitations

When interpreting results, it is important to consider the limitations inherent to this translational community-based study. Foremost is the nonrandomized design in which participants were recruited specifically to the WellREP intervention. Although this quasi-experimental, nonequivalent design has been reported to be an acceptable alternative when randomization is not possible, such a design is less than optimal. Additionally, the use of field tests to assess the components of functional fitness may also limit study outcomes. Although these tests have been shown to be reliable and valid assessments, they are not as sensitive as more sophisticated laboratory measures in detecting change.

Applying the results of a study to other populations is dependent on the degree in which the sample is representative of the comparison. In the current study, samples of community-dwelling older adults were recruited. As in most exercise and aging studies, all participants in this study volunteered. The reliance on volunteer participants in itself creates a selection bias and distinguishes the sample population from the larger population, because the population as a whole consists of both potential volunteers as well as individuals unwilling or uninterested to participate (Chodzko-Zajko et al., 1996). In addition, the method of advertising the study, newspapers, senior center newsletters, may have also created a selection bias towards those participants who receive and read newspapers and those who live in certain locales in community.

The method of recruitment in the present study is not unlike other studies in the exercise and aging research. However, caution is warranted when comparing the results of the current study to the broader population. Although the results of this study are useful and informative, and are likely to apply to other similar groups of independently living seniors, the extent to which the present findings generalize to the greater older adult population is unclear.

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APPENDICIES

APPENDIX A

INFORMED CONSENT DOCUMENT

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

You are invited to participate in a study to improve your functional fitness. We hope to determine how a multi-component physical activity program affects functional ability, balance, strength, flexibility and heart and lung fitness in older individuals. We want to do this because it will help improve your fitness and your ability to complete everyday tasks. 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 30 people to participate in this program.

If you decide to participate, you will be asked to perform a series of assessments and then to repeat the same assessments after approximately 12 weeks and again after 6 months. These assessments are designed to measure your ability to maintain your balance and to measure your functional ability. The assessments will be done at Senior Services, In. Downtown Senior Center – 200 S. Walnut in Wichita.

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” pedometer. We will explain when and where to wear the pedometer. One week after the assessments, we will meet with you at the Downtown Senior Center to “unlock” your pedometer and record step counts for that week.

You will also participate in a physical activity class to improve your fitness. The physical activity class will be conducted once a week at the Downtown Senior Center at 200 S. Walnut in Wichita. This class will be taught by two experienced instructors. The program will consist of the following activities: (a) strength training, using 6 inch wide elastic resistance bands; (b) balance training while standing on the floor, foam mats, and other training devices; and (c) flexibility activities. You will also be asked to increase your physical activity outside of class. Based on your typical daily activity, program instructors will calculate physical activity goals by increasing your typical activity level 10% with a subsequent 10% increase every 2 weeks until an overall physical activity goal of at least 10,000 steps is achieved. Non-translatory activity (swimming, biking) will be converted to steps and added to daily step counts. Physical activity will be monitored by your pedometer. You will be asked to record your daily step counts and other non-translatory activities (biking, swimming, etc.) in an activity log once per week before or after your physical activity class.

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. For this reason, you will perform stretching exercises and a warm-up exercise before each test and each exercise training session to prevent this from occurring. 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. This program is being implemented to see if it will improve your functional ability, balance, strength, flexibility and heart and lung fitness and if this improvement will lead to a more independent lifestyle. To determine if this program is performing its purpose, we are asking you to participate in the functional fitness and balance assessments. By participating in this program you will gain valuable insights into your functional fitness and balance.

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 associated with 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

______________________________ _______________

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___

Exercise Program: The level of intensity of the this program is based on the individual capabilities of each participant. The program will incorporate the *First Step to Active Health™* programing which provids a simple 4-step routine to increase physical activity. The well-rounded fitness program includes four components: cardio-respiratory, flexibility, strength, and balance. Flexibility, strength and balance will be addressed during class sessions, while cardio-respiratory will be addressed on an individualized basis outside of class. The multi-component physical activity class will be conducted twice a week for 24 weeks at Senior Services, Inc. Downtown Senior Center. Instructors will progress through the program at a pace deemed appropriate for participants. Program progression will involve the addition of new fitness components and additional exercises during each class session until participants are performing all 3 components during each class session. To enhance cardiovascular fitness, participants will be asked to incorporate more physical activity into their daily lives. A 1-week baseline will be established. Based on these values, program instructors will calculate physical activity goals by increasing baseline values 10% with a subsequent 10% increase every 2 weeks until an overall physical activity goal of at least 10,000 steps is achieved. Physical activity will be monitored by pedometers. Participants will record their daily step counts and other non-translatory activities (biking, swimming, etc.) in an activity log once per week before or after the physical activity class.

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

APPENDIX C

Exercise And Screening for You

www.easyforyou.info

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

www.easyforyou.info

Revised 11/15/2007

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