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The Impact of Balance Training on Balance, Confidence, and Functionality in Assisted Living Adults

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The Impact of Balance Training on Balance, Confidence, and Functionality in Assisted Living Adults

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Abstract

Assisted living adults are at a great risk for falls, which can negatively impact their life. Confidence may be related to balance, as older adults may discontinue physical activity due to a fear of falling. Balance training may mitigate the prevalence of falls and increase confidence. The purpose of this study was to determine the effects of a balance training program on balance, confidence, and functionality in assisted living older adults. Recruiting was done at two different retirement communities. The control group (*n*=4) was conducted at one facility. Participants completed stretches for each muscle group on an ergonomic disk 45 minutes a day, twice a week for eight weeks. The intervention group (*n*=5) completed a warm-up, strength training for the upper and lower body, balance training and a cool down for 45 minutes. The Berg Balance Scale (BBS) and 8-foot-up-and-go (UPGO) were used to measure balance. The KATZ ADL and chair stand (CS) were utilized to measure functionality. The Modified Falls Efficacy Scale (MFES) and Balance Efficacy Scale (BES) examined confidence. A repeated measures ANOVA was conducted to analyze results. The intervention group experienced a significant improvement in balance on the BBS (p=.006) from 40±3.39 points to 47.6±2.88 points. No other significant improvements were seen. However, large effect sizes were seen in the control group on the BES (d=1.026), UPGO (d=1.301), and MFES(d=.088). The intervention group possessed large effect sizes on the BBS (d=2.24) and moderate effect sizes on the MFES (d=0.51) and CS (d=0.46).

Researchers concluded that confidence may be improved by any increase in physical activity, but a balance training program may be most effective in improving balance. Future research should focus on a comparison of groups participating in no physical activity and those doing a comprehensive program to include walking, strength training, and balance.

CHAPTER ONE: Introduction

Significance

As older adults become an increasingly larger part of the population, much interest and concern within the field of research has emphasized this population's health, well-being, and functionality (Kaneda, Sato, Wakabayashi, Hanai & Nomura, 2008). Falls have become one of the most debilitating accidents for the elderly, by impairing their ability to perform their daily activities (Cyarto, Brown, Marshall, & Trost, 2008). Moreover, of the incidents that cause hip fractures, 12%-20% prove to be fatal in many individuals (Riggs & Melton, 1986). According to the Centers for Disease Control and Prevention (2001), this is significant because falls have been estimated to cost between 75 to 100 billion dollars per year. Due to a decrease in physical activity and an increase in dependence, assisted living adults are at even greater risk for these accidents, making it necessary to develop intervention strategies (Mihalko & Wickley, 2003). While any exercise may be beneficial, balance training may be the most appropriate intervention for this population because this specific type of activity may improve their ability to perform basic tasks, such as getting up from a chair (Buckwalter, 1997).

The main reason falls occur in this population is loss of physical function attributed to decreases in balance, muscular strength, cardiorespiratory endurance, and flexibility (Edelberg, 2001). The fear of falling limits activities and decreases function, but balance may provide the postural control to prevent accidents, as well as the self-assurance to keep up certain life behaviors (Kaneda et al., 2008). While financial burdens could be greatly reduced, as stated above, exercise has been shown as a way to intervene in this population and cause improvements. In a study involving home exercise programs, Campbell et al. (1997), reported a 58% decrease in falls in women who began the intervention which included balance training exercises, though its primary focus was strength. However, when the dependent variable is balance, strength training alone has provided insufficient evidence to cause improvement while combined strength and balance programs resulted in even greater benefits (Orr, Raymond, & Fiatarone, 2008). As a result, it may be important to shift the focus to balance training as the sole intervention in order to determine the specific effects of this type of program for this population.

Purpose

The purpose of this study was to determine whether a balance training program improved confidence, functionality, and balance in assisted living older adults. The independent variables in this study were the group assignment, intervention or control group, and time, while the dependent variables were confidence, functionality, and balance. This study is significant because confidence promotes continued use of the body to perform physical activity, thereby keeping functionality up and falls down (Cumming, Salkeld, Thomas, & Szonyi, 2000). Staying active in older adults could be the difference in a life changing fall or just going through daily with the ability to perform basic activities without fear (Cumming et al., 2000)

Background

Older adults who require a greater amount of care, such as the assisted living, have the majority of their chores performed for them, causing a great risk of loss of function due to a lack of physical activity (Schroeder, Nau, Osness, & Potteiger, 1997). These individuals seek to have their needs fulfilled at assisted living residencies, which have become the most demanded facilities across the country (Mezey, Dubler, Mitty, Btody, & Aizer, 2002). Programs which may provide a positive impact on their balance and functionality are important in order to fight against the declines associated with the effects of aging, as well as the lack of confidence which accompanies these factors (Cumming et al., 2000). Balance training alone has been a principal predictor of falls and is also related to the ability to perform daily activities (Shumway-Cook, Ciol, Gruber, & Robinson, 2005). In a study conducted by Schroeder, Nau, Osness, and Potteiger (1997), assisted living adults performed significantly worse than those individuals who resided in an independent living facility on the Physical Performance Test (PPT), a test utilized to measure functionality. Greater increases in flexibility, the speed of walking, and total body strength were seen in those individuals who were considered to be independent living senior adults as well. These results imply the meaningfulness of balance interventions for those older adults which require assistance (Schroeder et al., 1997).

Hypothesis

The researcher has hypothesized, based on the aforementioned studies of Schroeder et al. (1997) and Shumway et al. (2005), that the participants will improve their balance, confidence, and functionality due to the balance training intervention. The following hypotheses were made to predict that the intervention group would see a greater effect than the control group with:

- improved scores on the Balance Efficacy Scale (BES);
- an increase in the number of chair stands performed in 30 seconds;
- a reduction in the time taken to complete the 8-foot-up-and-go;
- improved Berg Balance Scale (BBS) performance;
- improved performance on the Katz Activities of Daily Living Scale (Katz ADL).
- improved scores on the Modified Falls Efficacy Scale (MFES)

Operational Definitions

Operational definitions are further defined below.

- Balance has previously been defined as the capability of an individual to maintain equilibrium while undertaking static and dynamic tasks (Melzer, Benjuya, & Kaplanski, 2004).
- Functionality definitions are not all in agreement. The author of this study has determined functionality to mean the ability of an individual to perform a basic task without assistance by a device or person (Gosman-Hedstrom & Svensson, 2000).
- Confidence, or self-efficacy, is defined as the level of assurance an individual has that they will not fall or lose balance when performing basic tasks (Powell & Myers, 1995).
- Activities of Daily Living (ADL) are those activities which involve a person's care for themselves, such as eating, dressing, and bathing (Klein, Stone, Phillips, Gangi, & Hartman, 2002).
- Assisted-living are those individuals who have become dependent on other people or instruments because of a lack in cognitive, physical, or social functionality (Klein, Stone, Phillips, Gangi, & Hartman, 2002).

Limitations and Delimitations

The goal of this program was to assess changes in balance, confidence, and functionality in older adults assigned to an intervention or control group following an eight week balance training or stretching program. The limitations of this study include:

- the researcher's ability to recruit a sufficient sample size due to Mini Mental State Exam (MMSE) requirements, lack of ability, and lack of interest in physical activity in this group;
- the inability to decipher between improvements made by the strength or balance exercises;
- participant drop-out rates in this population due to injury, disinterest, or death.

The delimitations of this study include

- that individuals must be older adults over the age of 70;
- individuals must reside in an assisted living community;
- individuals must pass the MMSE with a score of 24 or above;
- the short length of the study at eight weeks.

Some difficulties did arise, as mobility and cognition may suffer in this selected group. It is for this reason a well thought out program was implemented in order to fulfill the purpose of providing substantial gains within this community throughout the duration of the eight week study. If successful, this program could impact assisted-living communities by providing a method for reducing falls risk, while promoting physical activity and social interaction.

CHAPTER TWO: Literature Review

Numerous different research studies have been conducted to provide information on the benefits of balance training. Much focus has been placed on the fears associated with falling, methods of improving balance, effects of balance training, and the associations of balance training with physical activity. It is significant to understand each aspect of the process of a balance training study, as well as areas of focus, and the interpretation of different results which have been found presently. A broad collection of knowledge has been presented and thoroughly examined in order to provide future direction of research in the following literature review.

Fear of Falling

The different aspects of fear of falling in older adults may be beneficial to focus on as a first step in enhancing balance and preventing falls. In one such study on community-dwelling older adults over the age of 65, researchers examined lower extremity strength, balance performance, and confidence in the older adult population (Binda, Culham, & Brouwer, 2003). The inclusion criteria of this study included an affirmed fear of falling, score of over 50 on the Berg Balance Scale (BBS), and no fall history. A control group (n=27) consisting of individuals not fearful of falling were then recruited for comparison with the fear of falling group (n=13). A force platform was utilized to determine limits of stability in anterior, posterior, left, and right directions. An isometric dynamometer measured lower extremity strength, while a 10 meter walk was performed three times and averaged to determine speed. The Activities-Specific Balance Confidence (ABC) Scale was the tool used to measure fear of falling. Results showed the group who suffered from low confidence had significantly weaker knee flexors than the control group (p=.016). The control group also walked significantly faster than the fear of falling group (p<.0001). Furthermore, the individuals who stated they had a fear of falling did in fact score significantly lower (p<.05) on the ABC scale (M=65.0$\pm$26.3) than the control group

(*M*=94.8±4.6). While all subjects scored at least a 50 on the BBS, the researchers reported individuals in the fear of falling group scored three to four points lower on the BBS than the control group signifying that balance may actually be impacted by confidence level or vice versa. A statistical difference did occur between those with a fear of falling and those without, providing evidence that this fear impacts confidence, lower extremity strength, and decreased speed (Binda et al., 2003). This is imperative because future research should seek to develop an actual intervention to mitigate this low confidence through training as it has shown to impact the actual physical condition of the individual. Gaining more background knowledge is also important to understand what other variables may possess a relationship with fear of falling.

In other research, Kressig et al. (2001) sought to examine whether demographic, functional, and behavioral variables are associated with a fear of falling. Both the Falls Efficacy Scale (FES) and ABC scale were utilized to measure fear of falling in 287 subjects (*M*=80.9±6.2 years). Functionality was assessed via chair stands, 360 degree turns, picking up items, the functional reach test, and the one-legged stance. The Center for Epidemiological Studies Depression Questionnaire (CES-D) measured behavioral characteristics. Those who have had previous falls and passed the MMSE with a score of 24 or above were included in the study. Results showed African Americans were twice as likely to be fearful of falling as Caucasians ($p<.05$). While one-fourth of the participants were classified as depressed by the CES-D, this variable was also associated with fear of falling by the FES ($p=.007$) with an odds ratio (OR) of 2.1 and the ABC scale with an odds ratio of 2.6 ($p<.001$), Those who had an impaired balance or gait were two and a half more times as likely to have low confidence ($p<.05$), while slower walkers and those who commonly used a walking aid were also more likely to be fearful of falling ($p<.05$). Researchers concluded that fear of falling is more common among African

Americans, though conclusions are limited by the fact that only 20% of participants were of this ethnicity. Depressed populations, as well as those who need to use assistance to walk or walk slower, are also at greater risk. The authors found no matter what the age of the subject, fear of falling is an issue which plagues older adults. Further research would benefit by implementing a balance program to mitigate fear of falling in minority populations (Kressig et al., 2001). While researchers found this fear of falling to be established as an issue associated with balance, several various methods have been implemented to determine which training is best to use as an intervention to enhance balance.

Strength, Mental, and Functional Training Methods

A Placemat Strength Training Program (PSTP) was assessed for its practicality with assisted-living individuals. The study measured whether a balance-type program affected strength, balance, behavior, and self-efficacy in older adults (Pope et al., 2008). Participants (N=36) from two assisted-living communities were divided into an experimental group (n=15) and control group (n=21). Baseline data was collected. Activities of daily living (ADLs) were scored on a scale of 0 to 4, lower scores indicating independence. A theory of planned behavior questionnaire (TPB) was utilized to assess self-efficacy, and static balance was measured by participants' ability to stand alone and semi-tandem for 30 seconds with the average of three trials being taken. Subjects walked ten feet in a tandem line to assess dynamic balance, while researchers marked time and missed steps. Three trials were computed into an average. The timed-up-and go (TUG) required participants to stand, walk six meters, and sit down quickly while an average of two time trials were averaged. Leg strength was measured via 10 timed sit-to-stand repetitions, and the two sets were averaged. Hand dynamometers were used to analyze hand strength. A focus group was also implemented to gauge participants' feelings of exercise.

Individuals then participated in five chair and five standing exercises up to three times a week for 10 months. Only six participants in the intervention group and two in the control group were able to finish causing results to be inconclusive. However, meaningfulness was found when researchers noted participants reported standing up when they had not previously or standing with no hands. This research study is important because it attempts to implement a practical program to improve the physical function and quality of life of assisted-living older adults bringing the program to these less independent individuals. While the study was long, the amount of dropouts was detrimental to statistically significant results. The basis of results solely on time may have made it hard to quantify and compare analyses (Pope et al., 2008). This study focused more on a logical training method, whereas others have attempted to focus more on the effects of mental practice.

In order to compare the effects of solely physical practice and combined physical and mental interventions on balance, gait speed, and balance confidence in older adults, a research study was conducted on individuals of a retirement community (Batsman, Feltman, McBride, & Waring, 2006). Participants (*N*=6) were required to pass the MMSE and walk 20 feet alone. Individuals were divided into a mental practice group (MP) or an educational group (ED). Baseline tests included the BBS, the TUG, and the ABC scale. The ED group was provided encouragement, educational discussion, and music for the first 20 minutes, while the MP participants partook in kinesthetic awareness tasks for 20 minutes before joining the ED group. Following 10 minutes rest, both groups participated in physical activity. Warm-up, 10 repetitions of dynamic muscle movements for all major muscle groups, and stretching were conducted during this portion of intervention. The MP group was also given educational materials with the elimination of discussion time. Classes were performed twice a week, and post-testing was done at six weeks. Results showed significant improvements in gait speed in both groups (*p*=.028), but neither group individually. Authors concluded thata physical intervention alone was more beneficial than the combination of physical and mental activity since non-significant decreases were apparent in the confidence level of the MP group. This study is beneficial because community-dwelling older adults are plagued with balance and confidence issues which can impair them from having a good quality of life. Research was only done on African-American females, limiting generalization. Further researchers could focus on having a true control group and recruiting a larger, more diverse group of individuals (Batsman et al, 2006). Other research focused on whether the strength training aspects alone might help improve balance.

The purpose of a study by Brill et al. (2008) was to determine if a strength training program utilizing free weights had an effect on strength and functionality in assisted living adults. Participants (*N*=84) include 33 individuals in the control group and 51 in the experimental group. Demographic information was collected at baseline. Perceived health and sleep patterns were assessed using a Likert scale survey. Leg strength and power along with functionality were assessed utilizing the chair stand test and six meter walk. They did either one or five chair stands which were timed for two trials with the best time being recorded. Stances including feet together, feet instep, and feet tandem were utilized to assess balance by having participants hold these positions for ten seconds. Scores were based by seconds on a scale of 0 to 30. A 12 week training program was then used as an intervention. Classes were offered in 30 minutes sessions, twice a morning, five days a week, with subjects being told to attend three days a week. Dumbbell weights were used at 10% of their handgrip strength. Lower body was strengthened via eight exercises and upper body via six different exercises. Ten minutes were allotted for warm-up and cool-down. The chair stand and 6 meter walk were significantly decreased in exercisers (*p*<.05). Balance significantly increased in the intervention group based on participants' ability to perform stances for a longer period of time (*p*<.05). Though not significant, exercisers also reported better health perception than non-exercisers. This study is important because as older adults age, physical and cognitive characteristics are known to decline. It is beneficial to discover exercises and program which may negate the effects of aging. A major strength is the large sample size, and the ability to provide a cost-effective program to their community. Unfortunately, randomization was not included as subjects elected themselves into which group they wanted. More physical tests could have also been used to create a more generalized assessment (Brill et al., 1998). In order to delve further into the assessment of strength training as a method of improving balance, some researchers have compared it to flexibility.

To provide a basis for comparison, a study was conducted to determine whether resistance training or flexibility training has a more significant effect on balance performance. Sedentary individuals (*N*=32) who were not currently in training or previously done resistance training were recruited for this program (Bird, Hill, Ball, & Williams, 2009). Familiarization was done before baseline data was collected. Balance was assessed two different ways. Participants either stood on a foam pad that rested on an Advanced Medical Technology, Inc. (AMTI) force platform for 30 seconds or stood on the foam pad with eyes closed for 30 seconds. The AMTI force platform quantifies balance by measuring ground reaction forces. Range of excursion, sway path, and sway velocity were calculated. The TUG, step test, and 10-times sit to stand were also measurements utilized. An isokinetic dynamometer assessed lower limb strength maximum torque. Participants were randomly assigned to a home exercise and gym exercise intervention group. Exercises were performed three times a week for 16 weeks, followed by post-testing. After four weeks of no exercise to allow for the body to physiologically go back to previous conditions, the participants participated in 16 weeks of exercise in the alternate group from which they started. While the gym group used machine weights, the home resistance training group used body weight. Repetitions were done on each muscle group eight to 12 times at a rate of perceived exertion of 14-17 on the 6-20 point Borg scale. The flexibility group did 16-20 different stretches for 45 minutes total three times a week. Strength was significantly increased in the lower limbs due to resistance training, but not flexibility ($p<.001$). Neither group possessed significant changes in physical activity. The flexibility group showed significant improvements in mediolateral sway range with eyes closed ($p<.007$). Significance was found in both groups for all balance measures ($p<.05$). Authors concluded that both flexibility and strength training should be incorporated into a balance program, which is significant to the development of a balance training program. However, the sample size was rather small, and the four week break may not have been enough time to bring subjects back to their baseline either. Future researchers may benefit from incorporating non-sedentary adults (Bird et al., 2009). Perhaps of even more importance is the determination of whether strength or balance training provides the greatest benefits.

In an effort to determine if functional exercises enhance balance performance, researchers conducted a study on 32 individuals from a senior citizens hostel (Bruin & Murer, 2007). Participants were randomized into either a strength or balance training program. Both groups exercised for 12 weeks, with the strength training group participating in progressive resistance training and the balance group focusing mostly on dynamic balancing movements and games. Postural stability was assessed via the Biodex Balance System, and the Tinetti Assessment Tool was utilized for gait and balance measures. A tandem stand, chair stand, and timed walk were analyzed to determine functionality in each participant. While balance did not improve in the strength training group, a significant improvement was seen in the balance training group on the Tinetti Assessment tool from 14.3$\pm$1.9 to 15.3$\pm$1.1 points (*p*=.026). Dynamic balance improved significantly (*p*=0.009), as well as chair stand performance (*p*=.012). Though the sample size was relatively small, significance was found in certain variables. Authors suggested future research would benefit from providing a balance training only group to add to their study (Bruin & Murer, 2007). While these researchers speculated balance training to be most beneficial, others took it a step further by implementing home-based balance training programs.

Combination Training Methods

In a study by Ambrose et al. (2008), researchers examined the benefits of a resistance and balance training intervention on fall risk, functionality, and executive function. The Otago Exercise Program (OEP) consisted of a variety of strengthening exercises, as well as numerous balancing techniques, such as walking backwards, sit to stand, and heel-to-toe walking, to name a few. Participants (*N*=52) were older adults over the age of 70 who were considered at risk for falls or had already fallen and were recruited from two different referral-based falls clinics. All participants who participated in the falls clinic scored greater than a one on the Physiological Profile Assessment (PPA), performed the TUG in more than 15 seconds, or had a nonsyncopal fall within the previous year. The latter of these three is indicative of a greater falls risk. Exclusionary critieria included a Mini Mental State Exam to determine cognitive function with a score of less than 24, life expectancy of less than a year, or a neurological disorder. Subjects were randomly assigned to a control or experimental group and assessed at baseline and six months and included the Physical Activities Scale for the Elderly (PASE) to assess physical activity levels, the Geriatric Depression Scale (GDS) to measure depressive symptoms, the Functional Comorbidity Index, the Physiological Profile Assessment (PPA) to evaluate fall risk, a sway meter to examine postural sway, a light and computer mouse to assess reaction time, and the Melbourne Edge Test to evaluate edge contrast sensitivity. Other tests included the TUG, the Stroop Color-Word Test, and the verbal digits backward test. The intervention began with a visit by a physiotherapist to instruct the subjects on the program. The physiotherapist then made three more visits every other week to adjust for each individual. Participants were told to exercise three times per week for approximately 30 minutes each and to walk twice per week. The subjects were visited again around six months. Falls and adherence were recorded on calendars and mailed to researchers each month. Following six months, no significant differences were found on functional mobility and falls risk. However, response inhibition through the Stroop Color-Word Test was significantly different for the OEP group ($p<.05$). The authors found meaningfulness in the fact that a 5% improvement of PPA and a 47% reduction in falls occurred in the OEP group. Therefore, it was concluded that a home-based strength and balance program could help reduce falls and improve cognition through executive functions as well (Ambrose et al., 2008).

Another home based intervention sought to evaluate the effects of these types of physical activity on confidence, function, and daily activity level in older adults. Participants (n=102) were community-dwelling adults over 65 who had previously been admitted to a community hospital due to a hip fracture between the years 2004 to 2006 (Ziden, Frandin, & Kreuter, 2007). Those recruited for the study were then randomized into a home-rehabilitation group (n=48) and a conventional care group (n=54). Confidence was assessed utilizing the FES developed by Tinetti et al., which seeks to assess the individual's perceived ability to perform daily tasks on a scale from 0-130. The Functional Independent Measure (FIM) was used in order to examine the independence of each participant, utilizing 13 seven point items for a total of 91 points, with the higher scores equaling more independence. Independence was further measured by assessing eight different, more advanced activities to total a maximum of 56 points. Frenchay's Activity Index consisted of 15 items which determined the amount of time spent on social, leisure, and work activities. The TUG was used to assess functional mobility, while the sit-to-stand test was conducted to determine lower limb muscular strength. Each participant was evaluated at baseline, and a visit was scheduled by the physiotherapist to put the intervention in place. Conventional care took place inside the care unit and consisted of early mobilization, dressing, grooming, and transferring with help by staff, participation in the hospital rehabilitation program, and all necessary visits by the therapists. The home-based program was conducted by the same therapists and was implemented for three weeks. Therapists visited frequently, with the main goal to meet individualized needs and promote confidence and independence. According to results, the home-based intervention group scored significantly higher (p<.001) on the FES (M=117.4±12) than the conventional care group (M=85.5±30.5). The home-based group also spent significantly more time on outdoor activities (p=.0007) and household activities (p=.0119). The TUG was significantly faster in the home-based group (M=24.9±15.4 seconds) than the conventional care group (M=30.8±16 seconds) (p=.0139). This group also scored a significantly higher degree of independence (p<.001). Though the intervention was short for hip fracture rehabilitation, authors concluded that a home-based intervention might promote autonomy, functionality, and confidence which can be imperative in reducing falls. Future research could focus on the amount of falls which occurred following the two different treatments, but it is important to note the significance of educating patients on activities to promote independence as it could promote confidence and prevent falls (Ziden, Frandin, & Kreuter, 2007). Any minor feature which can be improved in decreasing the likelihood of falls is significant, as it can be the difference in life or death.

In a study on the effects of fall prevention, strength training, and balance training on mortality through the intervention of occupational and physical therapy, 319 community-dwelling older adults over the age of 70 were examined (Gitlin et al., 2009). Participants recruited included those who passed the Mini-Mental State Exam with a score above 23 and possessed one or more functional difficulties. Interviews were conducted from the year 2000 to 2003 at baseline and National Death Index (NDI) records were followed through the end of 2005 in order to monitor mortality rates. The Advanced Better Living for Elders (ABLE) program was utilized as the intervention, which consisted of four 90 minute occupational therapy sessions and one 90 minute physical therapy session per participant in the first six months. A personalized home-based strategy was then developed by occupational therapists, which focused on cognitive, environmental, and behavioral adaptations. Physical therapists intervened with balance and muscle strengthening exercises. Researchers hypothesized that those at moderate risk would experience the greatest effect. For months 6 to 12, participants only received three phone calls from the occupational therapist, and at the end of the 12 months received a safety education booklet. Participants were placed in risk groups based on gender, co-morbidities, and functional disability. Each participant accumulated points on a 1 to 15 scale based on these categories to determine risk stratification. By the end of the study, 24% of participants had passed away, with 42 having been in the control group and 34 in the intervention group. Following two years of the program, only 5.6% of the intervention group had died resulting in a significant survival effect (p<.02), while the control group experienced 13.2% of deaths and was

11 times as likely to pass away during the first two years of the program. However, no significance was found in either group at three and four years. Authors concluded that the benefits of the ABLE program far surpassed the six month intervention period. All of the aspects presented by the therapists in this study may add years to older adults, providing evidence that exercise, including balance, is a significant entity in a senior's life. However, this study failed to prove which part of the intervention held the most effect on mortality, and it may be important to delve further and pinpoint the most beneficial way to improve older adults' balance (Gitlin et al., 2009). More specifically, different classifications of older adults based on their level of functionality may necessitate different methods as their baseline functionality could vary greatly.

Differences Among Functionality Levels

For the purpose of assessing the difference between older adults of different residential care settings, researchers sought to determine the functionality, balance, muscular strength, flexibility, and life satisfaction of older adults living in an independent living, assisted living, or nursing home facility (Schroeder et al., 1998). Participants (N=69) consisted of 23 individuals from each type of care setting. Height and weight was recorded for each subject, and medication lists were collected. The Physical Activity Questionnaire for the Elderly was utilized to determine physical activity levels. This survey assessed household, sport, and leisure activities. The Satisfaction with Life Scale (SLS) measured the participant's satisfaction with life. The Physical Performance Test (PPT) was then used to measure functionality. The TUG was administered to determine dynamic balance performance, and a one-repetition maximum (1-RM) assessed muscular strength. The knee extension and leg press were utilized. Flexibility was analyzed via the Modified Sit-and-Reach test. Results showed a significant difference between physical activity levels and dynamic balance in the nursing care facility adults and both the assisted and independent living adults, but not between the latter two (*p*=.00). A significant difference also existed within the PPT, with independent living adults scoring the highest, followed by the assisted living, and then the nursing home residents (*p*=.00). The 1-RM knee extension and leg press, as well as flexibility were also significantly different among the nursing home residents and the other two groups (*p*=.00). Authors concluded differences existed between independent living, assisted living, and nursing home individuals in balance, strength, functionality, flexibility, and life satisfaction, specifically between nursing home residents and the first two groups. This study is significant because it is important to know baseline characteristics of individuals in these different facilities. It is also significant because it promotes the tailoring of individualized programs to promote functionality. There were some limitations to this study. Randomization was not involved, and the 1-RM measurement only assessed upper body strength and not lower body. Future research may prove to be more beneficial if more balance measurements are taken and upper body 1-RM can be assessed as well (Schroeder et al., 1998). Other benefits may be gained by acquiring knowledge on the assisted living individuals more specifically.

In a research study to measure confidence, the effects of balance training on self-efficacy in older adults in assisted-living facilities was assessed to determine the specific needs of this population (Southard, 2006). Participants included 35 assisted living residents. Balance was measured utilizing the Berg Balance Scale (BBS), and the Activities-Specific Balance Confidence Scale (ABC) evaluated confidence. The Quality of Life (QOL), a self-report survey, was used to assess health perception. Classes were conducted twice a week for 4 weeks, with testing taking place at baseline and the end of the program. Balance training took place at the first 20 minutes of each session, while self-efficacy treatments followed with 15 minute sessions. The control group only received balance instruction. Group fears, videotapes of other adults' recovery stories, posters, practice, safety checklists, and reviews were implemented into efficacy classes. Balance exercises included toe raises, mini squats, hip circles, breathing exercises, side stepping, marching, and other exercises. Neither the QOL nor ABC scores were found to show significant improvements in either group. Post-test scores of the BBS showed significant differences between groups, with the efficacy group showing greater improvements ($p<.004$). Authors concluded a relationship did exist between confidence and balancing ability. This study is significant because it investigates the importance of balance and confidence in older adults, which may prevent falls and reduce healthcare costs. However, the time span of the intervention was short, and efficacy data was self-reported. Future researchers should seek to provide longer interventions and assess more measurements such as functionality and activities of daily living which may provide practical information for this population (Southard, 2006). Specific groups which are considered more frail have been evaluated on their balance performance over the past few years as well.

Other researchers have sought to focus on older individuals who have been diagnosed with osteoporosis via the dual energy X-ray absorptiometry (DEXA) machine. This particular study sought to assess whether balance training had an effect on static balance, dynamic balance, and lower-extremity strength (Carter et al., 2002). The 80 participants were divided into an intervention or control group. The exercise group participated in an exercise program which focused on balance, gait, and coordination twice weekly for 40 minutes each session. Tests conducted included the Canadian Multicentre Osteoporosis Study questionnaire, a seven-day physical activity recall questionnaire, a posturography platform for static balance, a 20 meter walk for dynamic balance, and the knee extension to assess lower body strength. These assessments took place at baseline and 20 weeks. Though differences in static balance were greater for the intervention group, values were not significant. The dynamic balance improved significantly more in the exercise group than the control group (p=.044). The difference equated to a 4.9% greater improvement in the intervention group than the control group. Knee extension strength also saw significant improvements in this group (p=.047), with an improvement of 12.8% greater than the control group. Since poor dynamic balance and lower body strength have been considered risks for falls, the authors concluded balance training could be beneficial in reducing the risk factors for falls. While this program may have appealed to more fit individuals, researchers also concluded it may be beneficial to target less physically active older adults (Carter et al., 2002). However, the question still remains whether the means for evaluating balance is reliable or valid in predicting falls in any group.

Berg Balance Scale Validity

In order to determine whether the BBS is a valid predictor of falls, multiple falls, or injurious falls, researchers data was collected on 187 community-dwelling older adults (M=79.47 years $\pm$ 5.83 years). All subjects were given questionnaires and split into groups based on the number of modifiable risk factors they possessed (Muir, Berg, Chesworth, & Speechley, 2008). Participants were then randomly assigned to a geriatric care program or community-based primary care program. Those who did not have any risk factors were also placed in the geriatric care program. After one year, 39% of those who scored a 45 or above on the BBS fell, while 58% who scored below a 45 on the BBS experienced a fall. When examining the risk for a single fall, participants were only at a risk of 35% for scores of 55 and above, while the percentage increased to 63% for those scoring below 40 on the BBS. In the case of determining multiple falls risk, scores of 55 or greater represented only a 10% falls risk, while a score of 40 or below increased the risk more than five times to 54%. When scores were below 40, the participants had a 58% chance for an injurious fall, and those who scored 55 or above were at a 24% risk level. Due to the loss of information on healthy people in the follow-up, these percentages may have been inflated. The results also may not be generalized to other parts of the population. However, authors concluded that the BBS was a valid means of predicting falls and could be utilized in future studies to recognize risk and prevent falls (Muir et al., 2008). While the BBS is a valid predictor of falls, other methods such as tandem and one-legged stances have been utilized as a simple means of assessing balance.

Balance Training

In a short nine week study, researchers examined the benefits of balance training in 30 older adults with an average age of 73 (Kronhed, Moller, Olsson, & Moller, 2001). The subjects were divided evenly into a control and experimental group. Exercises were performed for 60 minutes twice a week for nine weeks. Balance board exercises, dance steps, foam pads, balance tasks, and balance balls were all utilized during these sessions for the experimental group. Static and dynamic balance tests were performed three times and averaged 14 days prior to the training program and seven days following the completion of the intervention. Significance differences were found for the experimental group following the intervention when examining standing on the right leg only with eyes closed (p=.0077), turning the head while standing on the right leg (p=.0016), turning the head while standing on the left leg (p=.0134), and the 30 meter distance (p=.0016). The control group showed a significant decline in the tandem walk (p<.0112). This study is important, as it strictly focused on balance and not the promotion of muscular strength as well. Functionality, such as walking speed, as well as the participant's ability to stand on one foot in balance measures, was significantly improved just through the implementation of a short study (Kronhed, et al., 2001). Other types of balance training programs have shown similar improvements in mobility and balance.

A study by Ullman, Williams, Hussey, Durstey, and McClenaghan (2010) utilized the Feldenkrais Awareness Through Movement (ATM) program to identify its effects on balance, confidence, gait, and mobility in older adults residing in a retirement community. Feldenkrais exercises are types of balance movements which utilize gentle movements involving the mind and body in a quiet environment. Participants were recruited and randomized to a control group and an experimental group. Tests were conducted at baseline and again at five weeks to assess changes in measurements. The timed-up-and-go was used to assess mobility, tandem stance to measure balance, and the GaitRITE walking system to evaluate the participants' gait. Confidence was examined via the FES and ABC scale. Subjects placed in the experimental group were asked to perform such exercises as sitting, transferring, reaching, walking, and turning, three times a week with the main focus being that of balance. Results showed the intervention group's balance improved significantly from 19.92$\pm$10.46 seconds to 21.83$\pm$9.67 seconds on the tandem stance (p<.05), while the control group showed no differences. In taking into account the group and time interaction, statistics also showed the experimental group's time to complete the timed up and go decreased from 11.7 seconds to 11.2 seconds, while the control group increased their time to complete this task from 10.4 to 11.4 seconds (p=.042). The FES also showed similar significant results with the control group showing no difference and the experimental group increasing their score significantly (p=.042). However, the ABC scale and participants' gait showed no significant changes in either group. Researchers used this data to conclude balance exercises may in fact improve the risks associated with falls in this population

(Ullman et al., 2010). While this study was relatively short, it has increased the evidence that balance exercises do improve confidence, functionality, and balance and may be utilized with older adults.

In 2002, 17 different organizations, 10 deemed experimental and seven deemed control, in Canada were utilized to recruit several individuals to participate in the StandUp! Program, which focuses on balance and leg strength in individuals who have a history of falls or have low confidence levels (Robitaille et al, 2005). Balance was measured utilizing a battery of tests on the three components of static balance, stability limits, and mobility. These exercises consisted of moves such as tandem stances and walks, along with one-legged stances, sit-to-stand, and functional and lateral reach tests. Lower extremity strength was measured via the sit-to-stand, while upper extremity strength was assessed by a handgrip dynamometer, and four meter walking speed was used to measure functionality. The exercise sessions were implemented twice a week for 12 weeks consisting of tai-chi, balance, and resistance band exercises, along with a 30 minute discussion on safety practices. Subjects were encouraged to perform home-based exercises once a week on their own as well. The experimental group participants included 89 who completed post-testing while the control group consisted of 88 people at the end of the study. Following 12 weeks, the control group showed declines on the one-legged stance with their ability to hold the stance going from 13.1 seconds to 10.7 seconds. With the exception of the lateral reach, the experimental group performed better on all static balance tasks ($p<.05$). This study is important because though not randomized, it collected data from several different organizations. A balance training program could be beneficial to all types of older adults in different environments. Authors concluded their research not only held the ability to generalize, but could help prevent falls in older adults (Robitaille et al, 2005). Other types of programs have been tailored to a select few individuals in order to examine more closely what occurs on a more personal level.

In a case study on balance training, three older adults were examined who were considered balance impaired (Silsupadol, Siu, Shumway-Cook, & Woollacott, 2006). Every individual had a history of falling, passed the MMSE with a score of 24 or above, and were able to walk 30 feet. The different impact of dual-task and single-task intervention methods was evaluated. To assess single-task conditions, the BBS, TUG, and Dynamic Gait Index (DGI) were utilized. Dual task conditions were measured with the TUG with the greater challenge of adding and subtracting while performing the test. Other single-task circumstances included obstacle crossing and narrow walking, while dual-task conditions added in counting backwards by threes or tone discrimination. Confidence was measured via the ABC scale. The intervention consisted of balance exercises three times a week, 30 minutes a session, and four weeks in duration. However, only participants two and three received dual-task condition exercises. Each participant increased their score on the BBS following the intervention, with participant three increasing greatly with a 15 point improvement. Calculations used by the researchers found participant one to decrease their fall risk by 20%, participant two by 24%, and participant three by 45%. The TUG was performed at a faster pace in all patients as well, though it should be noted participants two and three achieved greater improvements. This study shows balance training can not only improve balance, but dual-task condition training may be of even greater benefit. A limitation did occur as the first participant did not have as much room to improve with higher baseline scores in all measures. Though no significance could be found, it is meaningful to note the impact this could have on reducing falls in older adult individuals.

Further research may need to be developed on the intensity and frequency of training necessary to keep and maintain these improvements (Silsupadol et al., 2006).

Relationship between Balance, Confidence, and Functionality

In order to develope more generalized information about balance training programs, Hatch, Gill-Body, and Portney (2003), sought to examine the relationship between balance, confidence, and functionality. These researchers also wanted to determine what demographic and other fall-related variables might explain the level of balance confidence in older adults. Interviews were conducted on 50 older adults between the ages of 65 to 95 residing in a retirement community. Data collected included demographic information, fear of falling questions, fall history, activity level, medications being taken, sociodemographic data, and other health-related information. The different assessments utilized were the ABC scale to assess confidence, the BBS to measure balance, and the TUG to evaluate functionality. Each realtionship between these variables was found to be significant. The ABC scale possessed a significant relationship with the BBS (r=.752, p<.01) and the TUG (r=.698, p<.01), while the TUG and BBS held the strongest relationship (r=.810, p<.01). Authors also found evidence that the BBS accounted for 60% of the variance in the confidence scores on the ABC scale, and concluded the balance ability was the major determining factor for confidence. Associations were also found among those participants who expressed fear of falling and also had poor confidence. Researchers speculated that those who have fear of falling, may attempt to eliminate their risk for falls by decreasing the amount of physical activity they participate in, which could limit functionality (Hatch et al., 2003).

In order to determine whether the amount of physical activity holds a relationship with balance and functionality in older adults, Islam, Takeshima, Rogers, Koizumi, and Rogers (2004) evaluated these components in 53 Japanese older adults (*M*=70.2±5.2 years). The one-legged stance with eyes closed was utilized to measure static balance, while dynamic balance was assessed with the Functional Reach Test. From the Senior Fitness Test (SFT) battery, the chair-stand test, arm-curl test, 8-foot-up-and go, back scratch, and sit-and-reach were conducted to measure lower body, upper body strength, dynamic balance, upper body flexibility, and lower body flexibility, respectively. Additional assessments included the utilization of a hydraulic-resistance machine to measure leg power and the administration of the 12-minute walk test to assess cardiorespiratory endurance. Accelerometers were then programmed with each individuals' height, weight, age, and gender and given to participants to wear for two weeks, only to be taken off at night or when in water. This device monitored the time spent in moderate and high intensity activities, energy expenditure from high intensity activity, and total energy expended. Records of activity were also kept by subjects daily. Results showed a significant, positive relationship between static balance and the chair stand for women (r=.38, p<.05) and men (r=.44, p<.05) and leg power for women (r=.54, p<.01) and men (r=.37, p<.05). The back scratch test held a relationship with dynamic balance for men (r=.44, p<.05) and women (.34, p<.05). In accounting for gender, women with better static balance performed better on the arm curl (r=.31, p<.05), while those who were better at dynamic balance had a reduced 8-foot-up-and go (r=-.45, $p<.05$) and 12 minute walk time (r=-.37, p<.05). Men, on the other had showed positive correlations between the 12 minute walk and static balance (r=.65, p<.01), with the latter of the two holding a negative relationship with the 8-foot-up-and-go (r=.37, p<.05). Dynamic balance was also associated with leg power (r=.47, p<.05). The amount of total energy expenditure, energy expenditure from activity, steps taken, and leisure time activity was significantly correlated with static balance (p<.05). With both static and dynamic balance holding a relationship between the several different components of functionality assessed here, researchers concluded there was a relationship between balance, physical activity levels, and strength. These results are significant because they highlight the need to implement physical activity in older adults to promote balance and strength.

As a means of evaluating several different variables associated with fear of falling, McCauley, Mihalko, and Rosengren (1997), examined the perceptions of older adults on efficacy, balance, and fear of falling based on physical activity levels. Relationships among balance, efficacy, and confidence were determined, as well the examination of each variable independently in individuals. Participants (M=70.97$\pm$6.25 years) included 58 older adults recruited from a physically active program for older adults consisting of swimming, walking, and strength training. While prior physical activity participation was collected, the FES and a 10-item gait efficacy scale which focused mainly on mobility and some aspects of balance were used to determine confidence in the older adults. The Perceived Physical Ability (PPA) Scale was also a 10-item questionnaire which sought to assess the individuals' perception of their ability to perform activities related to strength and speed. Fear of falling was classified via one Likert-type question. The BBS was used to determine the balance ability of each participant. The three measures of efficacy held a significant relationship with fear of falling and balance. A positive relationship existed between balance and falls efficacy (r=.49, p<.01), gait efficacy (r=.47, p<.01), and physical efficacy (r=.21, p<.05). McCauley et al (1997) also reported a negative relationship existed between fear of falling and falls efficacy (r=-.56, p<.01), gait efficacy (r=-.56, p<.01), and physical efficacy (r=-.26, p<.01). This is meaningful, as it shows the importance of the reduction in fear of falling when individuals are physically active or confident in their ability to perform certain activities. It is imperative to implement these programs which will keep older adults more physically active to prevent falls.

In another study to determine the relationship between balance, confidence, and physical activity while taking into account the fall history of different elders, Zisi, Theodorakis, Skondoras, and Natsis (2006) examined 70 community-dwelling older adults over the age of 60. These individuals were then separated into a group of non-fallers (n=48) and fallers (n=22). Fallers had one fall or more within the year prior to the study. The ABC scale was utilized to examine confidence in the subjects, while the BBS measured balance. The number of steps participants took each week was the criteria for determining physical activity levels. The researchers found significant differences between the two groups on all three variables. The highest relationship found was in the group of fallers between the BBS and ABC scale (r=0.58, p<.01). Non-fallers experienced a weaker correlation between the BBS and ABC scale (r=0.44, p<.01). Physical activity held no correlations with confidence, causing researchers to infer the two variables may have no bearing on one another. Authors concluded an association existed between balance ability and confidence. However, it is unclear whether confidence poorly affected the balance performance or if balance ability decreased confidence (Zisi et al., 2006). It may be important to delve into the associations between the perceived health of these individuals and the aspects of balance and falls.

Balancing ability, gait speed, fall history, balance, and health perception effects on walking activity in older adults was specifically examined in a large sample in 2008 (Talkowski, Brach, Studenski, & Newman). Participants (n=5,888) were made up 5,201 individuals from the 1989-1990 Cardiovascular Health Study and 687 African Americans recruited from 1992-1993. Health and balance perception were assessed via one question each. The questions asked individuals to rate their balance or health as poor, fair, good, or excellent. Subjects were then separated into a good, discordant, or poor perception group for each variable. The good group had good perception in both areas, the discordant group had good perception in one area, and the poor group had good perception in neither area. Individuals were divided into a slow or normal group for gait speed based on the time (m/s) it took them to walk 15 feet. Balance performance was based on a ten second tandem stance. Fall history was measured by asking participants if they had experienced a fall in the past year. Walking activity was measured by asking subjects how many city blocks they had walked outside in the past week. After controlling for health status, demographics, and cognitive function, health perception, balance perception, and walking speed were significantly related to walking activity for the good group as compared to the discordant group (p<.001), and similar results occurred between the good group and the poor group (p<.010). Additionally, normal speed walkers spent more time walking than the slower group, and the good perception group walked ten blocks further a week on average (p<.001). The good perception group had the highest average gait speed (M=0.93m/s), followed by the discordant group (M=0.78 m/s) and the poor group (M=0.65 m/s). While fall history and balance performance did not affect walking activity, there was a relationship between health and balance perceptions and walking speed (r=.331, p<.001). This study is important because it portrays the significance of older adult’s perception of themselves and how often they partake in physical activity. It also incorporated a different population other than Caucasian and took place over several years. It utilized a large sample size, which gave the authors the ability to generalize. Limitations included the measurements only being based on one aspect of the variable. Also, over several years many people may have passed away, leaving the healthier individuals for post-assessment (Talkowski et al., 2008). For this purpose, some researchers have attempted to strictly focus on individuals who had already experienced issues with injury-related falls.

In a study by Ingemarrson, Frandin, Hellstrom, and Rudgren (2000), patients with a hip fracture were evaluated to determine the relationship between efficacy, balance, and functionality. The FES assessed confidence, while fear of falling was measured via a four-point ordinal scale. The Chatanooga Balance System analyzed balance by manipulation of a moving platform or having patients perform movements with eyes open and closed. The Functional ReachTest examined functionality. Authors found those who dropped out were associated with poor FES scores (p=.028). The FES held a significant relationship with the Functional Reach Test (r=0.53, p<.001). Fear of falling also correlated with the FES (r=-.044, p<.001), providing evidence the greater the fear of falling, the lower the confidence. Authors concluded that the improvement of physical measures and confidence should be performed simultaneously (Ingemarrson et al., 2000). When these two aspects are developed and strengthened, functionality can experience great improvements.

Even the most basic of tasks, such as rising from a chair may improve functionality in older adults. In one such study, adults over the age of 65 from congregate housing facilities who scored greater than 23 on the MMSE and under four on the Geriatric Depression Scale (GDS) were allowed to participate in an intervention which focused on these aspects of mobility (Alexander et al, 2001). Participants (n=124) were then randomly assigned to the task-specific training group or the control group. Rising from the chair was assessed by placing the chair a certain percentage between floor and knee height. For instance, 140% and 120% angles were utilized to simulate a position between sitting and standing. To add more challenges, the researchers also placed the seat at a tilt as well as the backrest. In order to assess the ability of the individual to rise from a bed, subjects were required to sit up supine, sit up with hands as well as without, roll to their side and raise up to sitting, and transfer from supine to standing. Goniometers were also utilized to determine elbow extension, shoulder abduction, hip flexion, knee flexion, knee extension, ankle dorsiflexion, and ankle plantarflexion. Lateral flexion and lumbar sagittal flexion, and lumbar sagittal extension were measured via the Back Range of Motion (BROM) Instrument to determine lateral balance. Exercises such as the unilateral heel raise, lateral leg movement, chair raises, arm reach, and trunk lift were incorporated into the intervention. A trainer monitored three sets of each of the aforementioned exercises plus many more for the individuals. When the subjects needed more of a challenge, weighted vests and ankle weights were utilized to provide an additional load. The control group performed stretching and flexibility movements. After 12 weeks, researchers found the intervention group to perform tasks in a significanctly lower amount of time than the control group ($p<.0001$). They also found the performance time to complete tasks improved from 11% to 20% in the experimental group individuals. This study did show that those who are less functional at baseline also had greater room for improvements, which is one expectation of the assisted living adults recruited in the present study. Though changes were small, significance was found and the intervention may have proven to possess greater effects over a longer period of time. This study is important because it emphasizes the significance of functionality training and implementing exercises, such as those which train balance, in these more frail older adults. Future research would benefit by allotting a longer period of time to further the participant's mobility in more difficult tasks such as walking (Alexander et al, 2001).

As many results have been quantified statistically through several different studies conducted by researchers, it is vital to also take a look at the meaningfulness of such analyses.

The aforementioned studies have provided evidence that balance is an imperative portion of a program to prevent falls in older adults. Confidence along with physical performance have been investigated and determined equally important in improving fall risks. Perhaps most important is for older adults to remain physically active, so that efficacy is high, which will in turn promote a functional, more independent lifestyle. While many of these studies have looked at independently living older adults, it is important to also conduct research on those adults who are not as highly functioning in the assisted living population and rely greatly on others for their care. Each variable of confidence, functionality, and balance seem to be closely related to each other. Assessing the impact of a balance training program on each of these variables may play a significant role in determining the magnitude of their importance in this population.

CHAPTER THREE: Methodology

Subjects

With alpha set at .05 and desired power of 0.8, an estimated sample size of 100 participants was deemed necessary to provide significance according to a previous research study by Kronhed et al. (2001) which produced a 0.4 effect size when assessing balance using the walk speed test, as well as static and dynamic balance tests. The sample size in the present study was not feasible due to lack of help and resources. After receiving Institutional Review Board (IRB) approval (Appendix A), participants over the age of 70 were recruited from two assisted living communities. Participants (n=4) from one community were assigned to a control group. The intervention group (n=5) was recruited from a separate assisted living community. Participants were informed of the risks and benefits of their participation and assured their participation was voluntary. Once these individuals signed an informed consent (Appendix B), they were allowed to sign a photo release form (Appendix C). They were required to pass the Mini-Mental State Exam (MMSE, Appendix D) with a score of 24 out of 30 in order to partake in the study. Of those recruited, six participants did not meet the requirements to participate in this study. These subjects were still allowed to participate in class. Participants were also required to fill out a Physical Activity Readiness Questionnaire (PAR-Q, Appendix E). If they answered yes to any of the seven questions on the PAR-Q, physician's approval was required before individuals could participate in the study. Physician's approval was required for six out of nine participants.

Instruments

Mini Mental State Exam. The Mini Mental State Exam (MMSE) is a series of ten questions which seek to assess memory, orientation, comprehension of new information, language construction, and attention. The examination is scored out of a possible 30 points, with a score of 24 determining normal cognition in participants. A score of 17 to 23 indicates mild cognitive impairment, while a score below 17 suggests severe cognitive impairment (Conradsson et al, 2007).

Katz Index of Independence in Activities of Daily Living Scale. The Katz Index of Independence in Activities of Daily Living (ADL) Scale (Appendix F) is an assessment of functionality. The Katz ADL seeks to assess the individual's ability to perform bathing, dressing, toileting, transferring, feeding, and continence independently. One assessment of each of these topics is conducted, with the participant scoring zero points if the task cannot be completed and one point if it can. A score of six is determined as full functionality and independence, while a score of zero is deemed as completely dependent (Wallace & Shelkey, 2007).

Berg Balance Scale. The BBS (Appendix G) is a 14-item test of balance designed for older adults who exhibit impaired function in balancing activities. Each task is graded on a scale from zero to four points for a combined total of 56 points. Equipment needed for the test includes a ruler, stopwatch, step or stool, one chair with armrests, and one chair without arm rests. Berg, Wood-Dauphinne, Williams, and Gayton (1989) reported results of high interrater reliability of (r=0.98) and high intrarater reliability (r=0.99) on the Berg Balance Scale (BBS, Appendix E). Furthermore, after a study was conducted to compare it to the timed up and go and the Tinetti balance subscale, the BBS showed a larger effect size (ES>1) when discerning between older adults who did and did not use an assistive device (Berg, Maki, Williams, Holliday, & Wood-Dauphinne, 1992).

Chair Stand. The chair stand is part of the battery of the Senior Fitness Test (SFT) protocol and seeks to assess functional lower limb strength (Rikli & Jones, 1999). The only equipment needed for this assessment is a stopwatch and chair. The participant is required to keep their arms across their chest and start off seated at the edge of their chair with back straight. The chair must be placed against a wall to ensure safety. The subject will then perform as many chair stands as possible within 30 seconds. Research by Miotto, Chodzo-Zajko, Reich, and Suppler (1999) has shown an intraclass correlation coefficient, a quantitative measure of how similar individuals are related, for the chair stand to be high (r=.90, p<.001). A study by Rikli and Jones (1999) also showed the chair stand to be valid measure of lower extremity strength (r = 0.71-0.78)

8-Foot Up-and-Go. The 8-foot up-and-go is part of the Senior Fitness Test (SFT) battery which measures functional dynamic balance and agility (Rikli & Jones, 1999). The equipment needed for this assessment include a chair, a cone, a measuring wheel, and a stopwatch. The researcher must first place a chair securely against the wall and measure eight feet with a measuring wheel or other valid apparatus which will be marked with a cone. Upon the timer saying “go”, the participant will stand up and walk around the cone as fast as possible. Running is not allowed. Time will be stopped as soon as the participant’s body returns to the chair. A previous study by Miotto et al (1999) has shown an intraclass correlation coefficient (r=.86, p<.001). It has also been significantly related to the BBS (r=.81, p<.05), gait speed (r=.61, p<.05), and the Barthel Index of ADLs (r=.78, p<.05) by Rikli and Jones (1999).

Modified Falls Efficacy Scale. The Modified Falls Efficacy Scale (MFES, Appendix H) consists of 14 items which describe basic functional activities. Participants score their level of fear of falling on a scale of zero, for no confidence, to 10, for complete confidence, on each activity. A score of zero to 140 may be achieved. In a study conducted by Hill, Schwarz, Kalogeropoulos, and Gibson (1996), the MFES showed less skew than the original 10-item Falls Efficacy Scale. The study also showed a high test-retest reliability with intraclass correlation coeffecients of 0.93 (*p*<.05). Thus, the MFES has been deemed reliable via statistical evidence (Hill et al, 1996).

Balance Efficacy Scale. The Balance Efficacy Scale (BES, Appendix I) consists of 18 questions which assess how confident individuals are about keeping their balance while performing a certain task. Each question is scored on a scale from 0% to 100%. The scores are summed and divided by 18 to get a final percentage score. A score of below 50 is considered low confidence (Rose, 2003). While tests of validity or reliability have not been found in the literature, the test has been chosen as the primary investigator's key purpose is to evaluate confidence in older adults. Furthermore, its construct is similar to the Activities-Specific Balance Confidence (ABC) scale, which has shown a high test-retest reliability (*r*=0.92, *p*<.001) in a study by Powell and Myers (1995). The BES has been utilized less than the ABC scale, but was chosen by the researcher because it accesses concerns related to more basic and demanding daily activities, both physical and social.

Procedure

Control Group. The primary investigator began the research study by developing a stretching program specifically tailored to assisted living adults with limited functionality. Upon completion of the MMSE, participants from the control group (*n*=4) began with pre-testing. Tests were conducted over two different days and included the BBS, Katz ADL, BES, MFES, 8-foot-up-and-go, and chair stand. Stretches were then performed on ergonomic discs twice a week for 45 minutes at a time. Muscle groups consisted of the chest, back, shoulders, biceps, triceps, hamstring, quadriceps, and core in order to achieve a total body stretching workout. Stretching was utilized because a delayed intervention could not be completed, and it was thought unethical by the researcher to prevent the control group from receiving any physical activity. Stretching was considered the closest form of exercise to simulate a true control group which would have participated in no activity. Upon the completion of the eight week program, post- testing was conducted utilizing the same tests as in pre-testing over two days. A list of exercises may be viewed in table 1.

Intervention Group. A balance training intervention was developed for the experimental group (*n*=5) which specifically targets this population. Prior to training pre-tests were conducted over two days utilizing the BBS, Katz ADL, MFES, BES, 8-foot-up-and go, and chair stand. The program consisted of a five minute warm-up, 10 minutes of upper body strengthening, 10 minutes of lower body strengthening, 15 minutes of balance exercises, and a five minute cool down. Subjects participated in 45 minute sessions twice a week. Strength training exercises were done for the chest, back, biceps, shoulders, triceps, quadriceps, hamstrings, inner and outer thighs, and calves. Balance exercises included heel to toe rocks, toe taps, shuffles, stances with eyes closed, stances with eyes open, tandem walks, and balance beam walks. Leg strengthening exercises also doubled as balancing exercises since participants were challenged to balance on one leg at times while kicking out while rarely using their hands to balance themselves. All exercises for the intervention group are listed in Table 2. The exercise program was implemented for eight weeks, followed by post-testing using the same assessments as at pre-test over two days.

Design and Analysis. All tests were scored by the primary investigator. SPSS Version 18 was utilized to analyze the collected data. A 2 x 2 repeated measures ANOVA was utilized for the experimental and control group in order to determine whether the balance training had an effect on balance, confidence, and functionality in older adults. Each dependent variable was analyzed to determine group by time interactions, time effects, and group effects. Due to the small sample size, effect sizes were also calculated to assess change in each group. Alpha was set at .05. This value was inflated due to the utilization of multiple tests, which is normal for an exploratory study. The null hypothesis was that balance training would have no impact on balance, functionality, and confidence in older adults.

CHAPTER FOUR: Results

The purpose of this study was to determine whether a balance training program has an effect on balance, confidence, and functionality in assisted living older adults. A repeated measures ANOVA was utilized to determine whether a significant change occurred over time. Repeated measures ANOVA results within groups can be found in Table 3, while between groups effects are listed in Table 4. With the assumption of sphericity met, the Greenhouse-Geisser test was used to examine significance. A dependent *t*-test was conducted to further analyze significant results. Effect sizes were also calculated and displayed in Table 5 with pre- and post-testing results in each group.

Descriptive Statistics

Control Group. Descriptive statistics at baseline for the control group and intervention group are listed in Table 6, while post-testing values may be found in Table 7. The mean score for the MMSE was 26.50$\pm$1.29 points, with the minimum being 25 and the maximum 28 points. The KATZ (M=5.75$\pm$0.50) ADL lowest score was 5 and the highest value was 6. The skewness of this variable was significant at -2.00 and the kurtosis was significantly positive at 4.00. The mean BBS score was also higher than the total and intervention group at 48.00$\pm$3.56 points, the minimum being 44 and the maximum 51 points. The kurtosis was significantly skewed at -2.23. The fastest time on the 8 foot up-and-go (M=7.52$\pm$0.57 secs.) was 6.70 seconds, while the slowest time was 8.00 seconds. The skewness and kurtosis were -1.16 and 2.53, respectively. The mean MFES score for the total group was 114.75$\pm$19.07, with a minimum of 94 and a maximum of 140. The BES score was 68.75$\pm$18.00, ranging from 52.78 to 94.44. The skewness for the BES was 1.186 and the kurtosis was .280. The chair stand score achieved without using hands was 7.00$\pm$5.94 stands. The range of scores was large, from 0 to 14 stands.

All variables with the exception of the MMSE were higher in the control group than the intervention group.

Intervention Group. Descriptive findings for the intervention group at baseline can be found in table 6. The mean score for the MMSE was 26.60±2.51, with the minimum being 24 and the maximum 29, kurtosis was negatively skewed at -3.03. The KATZ (*M*=5.40±0.89) ADL lowest score was 4 and the highest value was 6. The mean BBS score was 40.00±1.51 points, with the minimum being 36 and the maximum 44 points. The kurtosis was significantly and negatively skewed at -2.23. The fastest time on the 8 foot up-and-go (*M*=12.72±3.92 seconds) was 8.68 seconds, while the slowest time was 17.69 seconds. The kurtosis was not normally distributed at -2.062. The mean MFES score for the total group was 100.20±20.95 points, with a minimum of 78 and a maximum of 130 points. The BES score was 64.22±20.93 points, ranging from 45.56 to 100 points. The kurtosis was positively skewed at 3.54. The chair stand score achieved without using hands was 1.40±2.91 stand. The minimum number of chair stands completed was zero while the maximum was five.

Post-Testing

Berg Balance Scale. A significant group by time effect was found for the BBS (*p*=.011). Though the BBS only approached significance (*p*=.069) in the control group (*n*=4), the score did increase from 48.00±3.56 to 49.75±0.50 points denoting a 3.65% change. A moderate effect size of 0.49 was calculated for the control group. The intervention group (n=5) achieved a significant improvement (*p*=.006) in balance on the BBS from pre-testing (*M*=40.00±3.39 points) to post-testing (*M*=47.60±2.88 points). This group experienced a 19% improvement with a large effect size of 2.24. A line graph of these results is represented in Figure 1.

Balance Efficacy Scale. The BES also possessed a significant group by time effect (*p*=.023), but not a time effect (*p*=.144). Results were not significant in the control group (*p*=.127), but produced a large effect size of 1.03 and a 26.87% change, respectively. The BES score approached significance (*p*=0.76) in the intervention group with a decline in confidence from 64.22±20.90 to 59.11±23.90 points, a 7.96% decline. A low effect size of 0.25 was produced in the intervention group. A line graph of these results is represented in Figure 2.

Modified Falls Efficacy Scale. The MFES approached a significant time effect (*p*=.086), though not a significant group by time interaction (*p*=.667). The control group did experience a 14.6% improvement from 117.50±19.10 to 131.50±9.68 points. Scores non-significantly improved from 100.20±20.90 to 110.80±20.20 points in the intervention group, a 10.58% change. Effect sizes were large at 0.87 and moderate at 0.51 in the control and intervention group, respectively. A line graph of these results may be found in Figure 3.

Chair Stand. Neither a group by time interaction (*p*=.632) nor a time effect (*p*=.374) was found for the chair stand. The CS showed no improvement in the control group with an effect size of 0 and a change from pre- to post-test of 7.00 ±5.94 to 7.00±8.12 chair stands. The CS improved from 1.40±2.19 to 2.40±4.34 stands in the intervention group. A moderate effect size of 0.46 was calculated for the intervention group. A line graph of these values may be found in Figure 4.

Katz ADL. Within both groups, the KATZ ADL scores showed no change or significance (*p*=1.000).

8-Foot-Up-and-Go. Neither a time effect (*p*=.27) or group by time interaction (*p*=.88) were achieved for the 8-foot-up-and-go. The 8 foot up-and-go time decreased from 7.52±0.571 seconds to 6.78±l.19 seconds, a 9.87% improvement in the control group. The 8 foot up-and-go time decreased from pre-testing (*M*=13.70±3.92 seconds) to post-testing (*M*=12.72±3.14 seconds) in the intervention group. The intervention group possessed a small effect size of 0.24, while the control group possessed a large effect size of 1.30. A line graph of these values may be found in Figure 5.

CHAPTER FIVE: Discussion

A lack of confidence and impairments in balance and functionality has been linked to an increase in falls risk. The assisted living population is at greater risk because of their dependence on others. The purpose of this study was to determine whether a balance training class would affect balance, confidence, and functionality in assisted living older adults. An intervention class was compared with a control group to further assess changes in these factors. However, the control group was active in that it performed stretches of each muscle group. The aforementioned variables were evaluated at baseline and at eight weeks in each group.

Control Group. The control group (*n*=4) experienced no significant changes from pre- to post-testing. However, when assessing baseline values, scores were higher in this group than the intervention group, showing these individuals to be more functional, well-balanced, and confident. For example, the 8-foot-up-and go was approximately six seconds faster in this group than the intervention group, quite a large mean difference. Though no significant differences were seen from pre- to post-testing, some large effect sizes were seen. The BES, MFES, and 8-foot-up-and-go experienced a large effect size of 1.03, 0.88, and 1.30, respectively. A moderate effect size of 0.49 was shown for the BBS, while the chair stand and Katz ADL experienced absolutely no effect size whatsoever.

Intervention Group. The intervention group experienced a significant change from pre- to post-testing in balance as demonstrated by the BBS score. The effect size for this variable was large at 2.24. This group experienced a moderate effect size of 0.51 and 0.46 on the MFES and CS, respectively. The 8-foot-up-and –go and BES experienced low effect sizes of 0.24 each.

Confidence. With such a limited number of participants, significance was difficult to attain. However, these results show improvements which may be meaningful. The control group, only consisting of four participants, showed a great increase in confidence, with an improvement of 26.87% on the BES and 14.6% on the MFES. Furthermore, each of the individuals who participated in the stretching class experienced an increase in confidence on both surveys, with the exception of one individual who scored a 140/140 at baseline and at the end of the study. This is contrary to the intervention group, in which each subject showed a decrease in confidence on the BES. However, four out of the five in this group showed increases on the MFES. This lead the researcher to believe these individuals may have misunderstood the concept of the confidence surveys, as these tests are similar. However, this does not explain the increase in both confidence surveys in the control group and a decrease in BES values in the group which received the intervention. There was no significant difference between groups in confidence levels. The intervention group did have lower confidence levels reported at baseline, which would have led researchers to believe there was a greater room for improvement. However, this was not the case. This increase in confidence in the intervention group may have been affected by a little over a 41 point increase of just one participant. It may have also had something to do with the interaction between the participants and the primary investigator. This group had a higher level of functionality, balance, and confidence, as well as a better understanding of the study. While not the intentions of the researcher, participant responses may have been intentionally increased out of loyalty to the primary investigator. Interrater reliability may have also impacted results, as different examiners were present between pre- and post-testing. The mean score on the BES, while a 7.9% decrease, could have been changed. A 12 point decrease in one participant in the control group may have played a primary role in the mean decrease of the BES score. These results may provide evidence that any physical activity, such as stretching on ergonomic discs, can help improve confidence.

Balance. The control group showed slight improvements in dynamic balance with an improvement of the 8-foot-up-and-go time, decreasing almost half a second from an initial mean of 7.52 seconds. The intervention group also improved their dynamic balance by almost a second, though these individuals were below average with an initial time of 13.68$\pm$3.92 seconds. The BBS score increased in each participant from both groups, with the exception of one who attained the same score, from pre- to post-testing. This is meaningful because in a study by Shumway-Cook et al (2005) a decrease in one point on the BBS when scores fall between 46 to 54 points is equal to a 6% to 8% increase in falls. With each point these individuals increased, they were decreasing their risk for falls tremendously. This also provides evidence that each program was beneficial in improving balance, but the balance training program may have been the most effective.

Though no significance was found within the chair stand test, improvements were seen in three out of four members of the control group. While one individual possessed the same score at baseline and post-testing, another subject completed six more chair stands than their baseline score while using their hands. The other two participants showed improvements of one and four greater chair stands in 30 seconds. The intervention group experienced notable improvements on the chair stand, as well. While two participants decreased by one chair stand or remained the same, two others showed increases from four to 10 and three to 12 while using their hands. Another individual increased from five to 10 chair stands without the utilization of their hands, an increase of 100%. These values could be considered meaningful in that a chair stand is a measure of functionality which these older adults participate in each day among their daily task as stated above in Islam, Takeshima, Rogers, Koizumi, & Rogers (2004) and Rikli and Jones (1999). The intervention group achieved the greatest improvements on the BBS, which held significance. These results provide evidence that while all activity could improve balance, a balance-specific intervention may be necessary to promote the greatest improvements in balance.

Functionality. Absolutely no changes were seen in the Katz ADL. However, this test may not have been a sensitive enough measure of functionality over a short period of time. The Katz ADL evaluates six basic functions which are not likely to change over an eight week period, such as the ability to feed or bathe oneself. Assisted living individuals are often in a routine of being taken care of and are not likely to begin taking on tasks to which they are not accustomed. This may have explained the lack of change. Each group started at similar functionalities, though the intervention group had a lower mean score on the Katz ADL.

Limitations. There were several limitations within this study. The initial intention was to have two randomly assigned groups from the same assisted living facility. However, due to a lack of recruited subjects, the groups were recruited from two different retirement communities and not randomly assigned. At the control group site, an initial nine subjects were recruited. Of these nine participants, two were moved to a nursing home facility within the first two weeks, and three were unable to pass the MMSE. The researcher was then forced to recruit from another community to obtain an intervention group following the completion of the control group. The small number of participants limited statistical power and the ability to find significance.

While the control group was initially not intended to receive any interventions, the participants had already been promised a balance training program. In order to appease this issue, the researcher added the ergonomic discs and stretching, which transformed this group from a true control to an active control group. This factor may have limited the ability to draw a conclusion whether balance training or any physical activity was the reason for changes in variables.

Student help was also utilized at pre- and post-testing. While these students arrived early to receive training, the interrater reliability may have been affected. Some aspects of the BES may be open to interpretation by the tester. Also, the confidence scales may be asked or explained in a different manner. Many of these questions pertained to activities no longer participated in by these individuals. This may have led them to be confused on what answer to give. However, as stated previously this test does have high test-retest reliability (r=0.92, p<.001) stated by by Powell and Myers (1995).

Absolutely no results were seen over time in the Katz ADL assessment of functionality. This survey, as seen in Appendix F, evaluates the six topics of feeding, continence, transferring, bathing, toileting, and dressing. These evaluations may not have been sensitive enough to change over an eight week period. The survey did not evaluate whether the individuals improved or declined in ability, but simply whether they could or could not complete the task. These individuals were also part of a dependent care community and did not attempt to do things more independently throughout this study as they were in their own routine (Wallace & Shelkey, 2007).

Another limitation is the factor of self-reported measurements. The confidence and Katz ADL surveys were self-reported, which may have skewed results. For example, a score of 140/140 on the MFES shows perfect confidence, but did not completely relate to that participant's ability to balance. Also, the fact that the MFES decreased and the BES increased within the intervention shows a lack in accuracy in the self-reported data.

Future Research. These results showed improvements in confidence in both the active control group, which consisted of stretching, and the balance training group. This may lead researchers to conclude that any sort of physical activity class could prove to be beneficial for confidence levels in assisted living older adults. However, balance was only significantly improved in the intervention group, providing evidence that a balance-specific program which consists of balance moves for the majority of the class, may be necessary if balance is the main objective. While any class may improve confidence and dynamic balance, a comprehensive balance training class seemed to promote the most well rounded improvements in subjects. Any form of exercise may create a training effect, specifically with participants who have had no previous training experience who have greater room for improvement. However, this does not fall into agreement with two other studies of Crilly et al (1989) and Lichtenstein et al (1989) who found that comprehensive balance training program which also focused on strength training did not improve balance. Judge, Lindsey, Underwood, and Winsemlus (1993) also found a combined training program, which included balance, walking, and stretching showed the greatest improvements in balance. This study supports an exercise time of two days a week for 45 minutes as an adequate training program. Future research should be conducted with a comprehensive program which lasts longer than eight weeks and possesses a greater number of participants. A longer program could be achieved by promoting a gradual progression of exercises and adding in a variety of equipment such as exercise balls and ergonomic discs on which to sit or stand. A different, more sensitive measure of functionality would be more beneficial to examine changes in this population.

Conclusions. Researchers have speculated that those who have fear of falling, may attempt to eliminate their risk for falls by decreasing the amount of physical activity they are involved in, which could limit functionality (Hatch et al., 2003). This study shows that those who participate in any type of physical activity have a chance to achieve improved confidence. However, a comprehensive balance training program is most beneficial to improve balance. A class which focuses on improving strength and balance for 45 minutes twice a week was effective to improve balance and may also contribute to other individual improvements in confidence and dynamic balance. Further research with great numbers is necessary to assess these changes more confidently.

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Table 1

List of Exercises for the Control Group

Control Group	
Muscle Group	Stretch
Chest	Arms at 90 degrees, pull back
Back	Interlace fingers, straighten arms forward, push out
Shoulder	Arm Pull Across Body
Tricep	Place arm over and behind back, pull
Bicep	Wrist Extension
Quadriceps	Pull Knees to Chest
Hamstring	Seated Toe Touch

Table 2

List of Exercises for the Intervention Group

Strength Exercises				
Muscle Group	Exercise	Sets	Reps	Comments
Chest	Fly Press	1 1	15 15	
Back	Bent Over Row Lat Pulldown	1 1	15 15	
Shoulder	Military Press Lateral Raise	1 1	15 15	
Tricep	Tricep Extension	1	15	
Bicep	B icep Curl			
Quadriceps with Hip Abductor	Half squat with side kick	1	12	Each leg
Gluteus Maximus	Glute Kickbacks	1	12	Each leg
Hamstring	Hamstring Curl	1	12	Each leg

Balance Exercises	
Heel/Toe Rocks	March in place
Toe Taps	Tandem stand (eyes open/eyes closed)
Stand on one leg (eyes open/eyes closed)	Tandem walk
Stand with feet together (eyes open/eyes closed)	Balance Beam Walk
Side to side shuffles (one and two step)	

Table 3

Repeated Measures ANOVA Results for Variability Within Groups

Variable	Sum of Squares	df	Mean Square	F	*p*
KATZ	0.00	1	0.000	0.000	1.00
BBS	38.03	1	38.03	11.59	0.011*
8 Ft.	0.05	1	0.05	1.43	0.88
MFES	42.03	1	42.03	0.20	0.67
BES	618.00	1	618.00	8.44	0.03*
CS	1.11	1	1.11	0.25	0.63

Note. KATZ = Katz Activities of Daily Living; BBS = Berg Balance Scale; 8 Ft. = 8 Foot Up-and-Go; MFES = Modified Falls Efficacy Scale; BES = Balance Efficacy Scale; CS = Chair Stand.
*Indicates significance (p<.05).

Table 4

Repeated Measures ANOVA Results for Variability Between Groups

Variable	Sum of Squares	df	Mean Square	F	*p*
KATZ	0.54	1	0.55	0.55	.000*
BBS	114.47	1	114.47	6.85	.035*
8 Ft.	162.85	1	162.85	12.59	.009*
MFES	1380.63	1	1380.63	2.93	0.13
BES	1183.66	1	617.97	1.72	0.23
CS	115.60	1	52.49	2.20	0.18

Note. DF = Degrees of Freedom, F= Variability Within Groups, KATZ = Katz Activities of Daily Living; BBS = Berg Balance Scale; 8 Ft. = 8 Ft. Up and Go; MFES = Modified Falls Efficacy Scale; BES = Balance Efficacy Scale; CS = Chair Stand.
*Indicates significance (p<.05).

Table 5

Pre- and Post-Testing Results on the Control and Intervention Groups Following an 8-Week Intervention

	Control Group (*n*=4)				Intervention Group (*n*=5)			
Variable	Pre-exercise	Post-Exericse	% Ch	ES	Pre-exercise	Post-Exercise	% Ch	ES
KATZ	5.75±0.50	5.75±0.50	0.00	0.00	5.40±0.89	5.40±0.89	0.00	0.00
BBS	48.00±3.56	49.75±0.50	3.65	-0.49	40.00±3.39	47.60±2.88*	19.00	2.24*
8 ft.	7.52±0.57	6.78±l.19	9.87	1.30*	13.70±3.92	12.72±3.14	7.02	0.245
MFES	114.80±19.70	131.50±9.68	14.6	-0.88	100.2±20.90	110.80±20.2 0	10.58	-0.51
BES	68.75±18.00	87.22±10.10	26.8	-1.03*	64.22±20.90	59.11±23.90	7.96	0.244
CS	7.00±5.94	7.00±8.12	0.00	0.00	1.40±2.19	2.40±4.34	0.71	-.456

Note. KATZ= Katz Activities of Daily Living; BBS = Berg Balance Scale; 8 Ft. = 8 Ft. Up and Go; MFES = Modified Falls Efficacy Scale; BES = Balance Efficacy Scale; CS = Chair Stand.
*Indicates a large effect size.
**Indicates significant time effect (p<.05).

Table 6

Descriptive Findings of Total Group, Control Group, and Intervention Group Participants Performance at Baseline

Total Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
MMSE	26.56	1.94	24.00	29.00	-0.11	-1.44
KATZ	5.56	.72	4.00	6.00	-1.50	1.47
BBS	43.56	5.32	36.00	51.00	0.11	-0.78
8 Ft.	10.94	4.29	8.68	17.69	0.85	-.94
MFES	106.67	20.36	78.00	140.00	.30	-1.38
BES	66.24	18.61	45.56	100.00	1.19	.28
Control Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
MMSE	26.50	1.291	25.00	28.00	.00	-1.20
KATZ	5.75	0.50	5.00	6.00	-2.00	4.00*
BBS	48.00	3.56	44.00	51.00	-.27	-4.48*
8 Ft.	7.52	0.57	6.70	8.00	-1.52	2.53*
MFES	114.75	19.07	94.00	140.00	0.70	1.44
BES	68.75	18.00	52.78	94.44	1.19	.28
CS	7.00	5.94	0.00	14.00	.00	-.59
Intervention Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
MMSE	26.60	2.51	24.00	29.00	-0.20	-3.03*
KATZ	5.40	.89	4.00	6.00	-1.26	.31
BBS	40.00	1.51	36.00	44.00	-0.19	-2.23*
8 Ft.	13.68	3.92	8.68	17.69	-0.15	-2.06*
MFES	100.20	20.95	78.00	130.00	0.85	-0.98
BES	64.22	20.93	45.56	100.00	1.74	3.54*
CS	1.40	2.19	0.00	5.00	1.53	1.75

Note. MMSE = Mini Mental State Exam; KATZ = Katz Activities of Daily Living; BBS = Berg Balance Scale; 8 Ft. = 8 Ft. Up and Go; MFES = Modified Falls Efficacy Scale; BES = Balance Efficacy Scale; CS = Chair Stand

*Indicates significant skewness or kurtosis and a lack of normal distribution

Table 7

Descriptive Findings of Total Group, Control Group, and Intervention Group Participants Performance at Post-Test

Total Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
KATZ	5.60	.73	4.00	6.00	-1.50	1.47
BBS	48.56	2.88	47.00	53.00	0.25	-0.60
8 Ft.	10.08	3.91	8.68	17.69	0.51	-1.38
MFES	120.00	6.31	93.00	140.00	-0.40	-1.52
BES	71.60	23.30	33.33	97.78	-0.36	-1.29
CS	7.00	8.12	0.00	15.00	0.97	-1.11
Control Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
KATZ	5.75	0.50	4.00	6.00	-2.00*	4.00*
BBS	49.75	2.75	47.00	53.00	0.32	-3.03*
8 Ft.	6.77	1.18	5.25	8.06	-0.55	0.34
MFES	131.50	9.68	120.00	140.00	-0.42	-3.51*
BES	87.22	10.10	73.89	96.11	-0.90	-0.75
CS	7.00	8.12	0.00	15.00	0.05	-5.67*
Intervention Group						
Variable	M	SD	Min	Max	Skewness	Kurtosis
KATZ	5.40	.89	4.00	600	-1.26	0.31
BBS	47.60	2.88	44.00	52.00	0.67	1.85
8 Ft.	12.72	3.14	9.37	16.03	-0.36	-2.95*
MFES	110.80	20.20	93.00	140.00	0.85	-1.10
BES	59.11	23.90	33.33	97.78	1.20	2.26*
CS	2.40	2.19	0.00	10.00	2.03*	4.15*

Note. MMSE = Mini Mental State Exam; KATZ = Katz Activities of Daily Living; BBS = Berg Balance Scale; 8 Ft. = 8 Ft. Up and Go; MFES = Modified Falls Efficacy Scale; BES = Balance Efficacy Scale; CS = Chair Stand

*Indicates significant skewness or kurtosis and a lack of normal distribution

Berg Balance Scale (BBS) Scores for the Intervention and Control Group

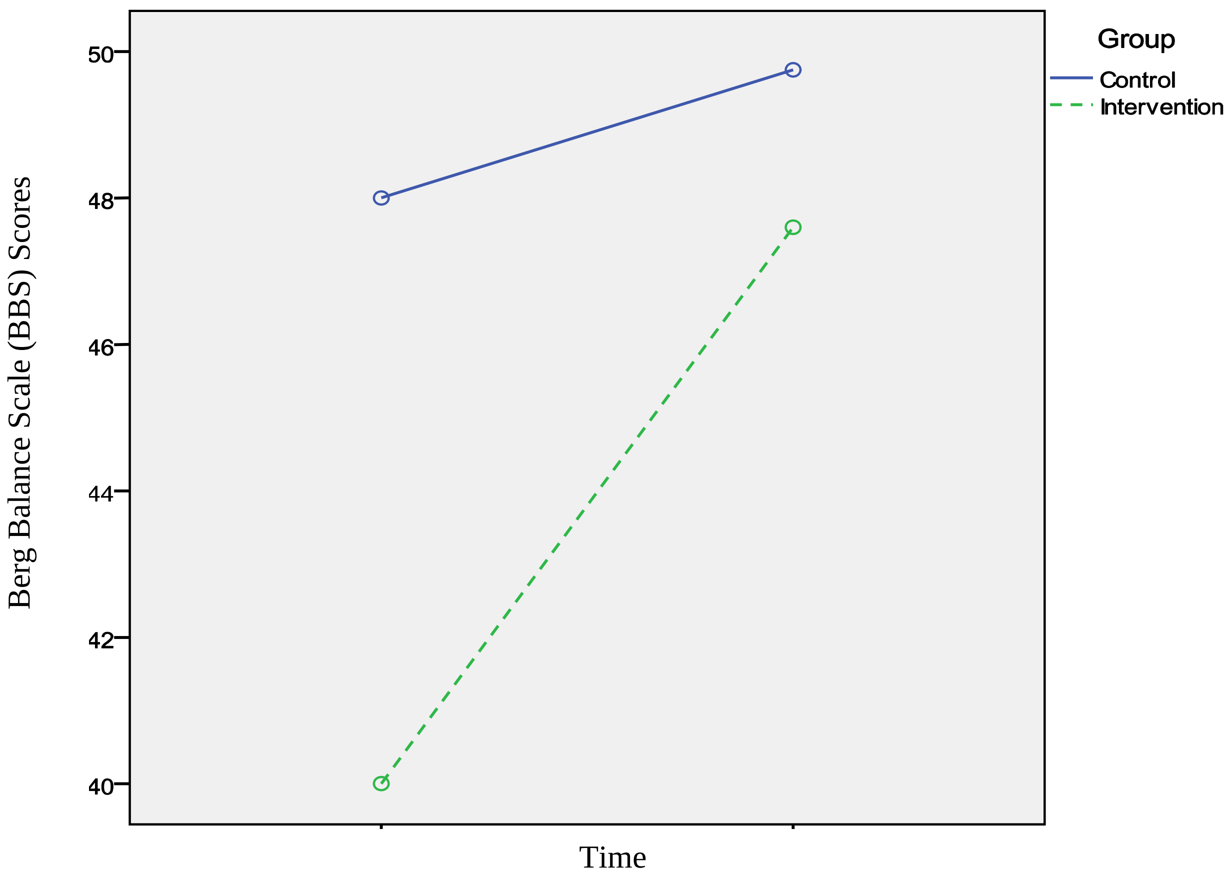

Figure 1. A line graph of the difference in BBS scores from pre- to post-test after eight weeks of training. The control group changed from 48.00±3.6 to 49.75±2.80 while the intervention group experienced a greater increase from 40.00±3.40 to 47.6±2.90.

Balance Efficacy Scale (BES) Scores for the Intervention
and Control Group

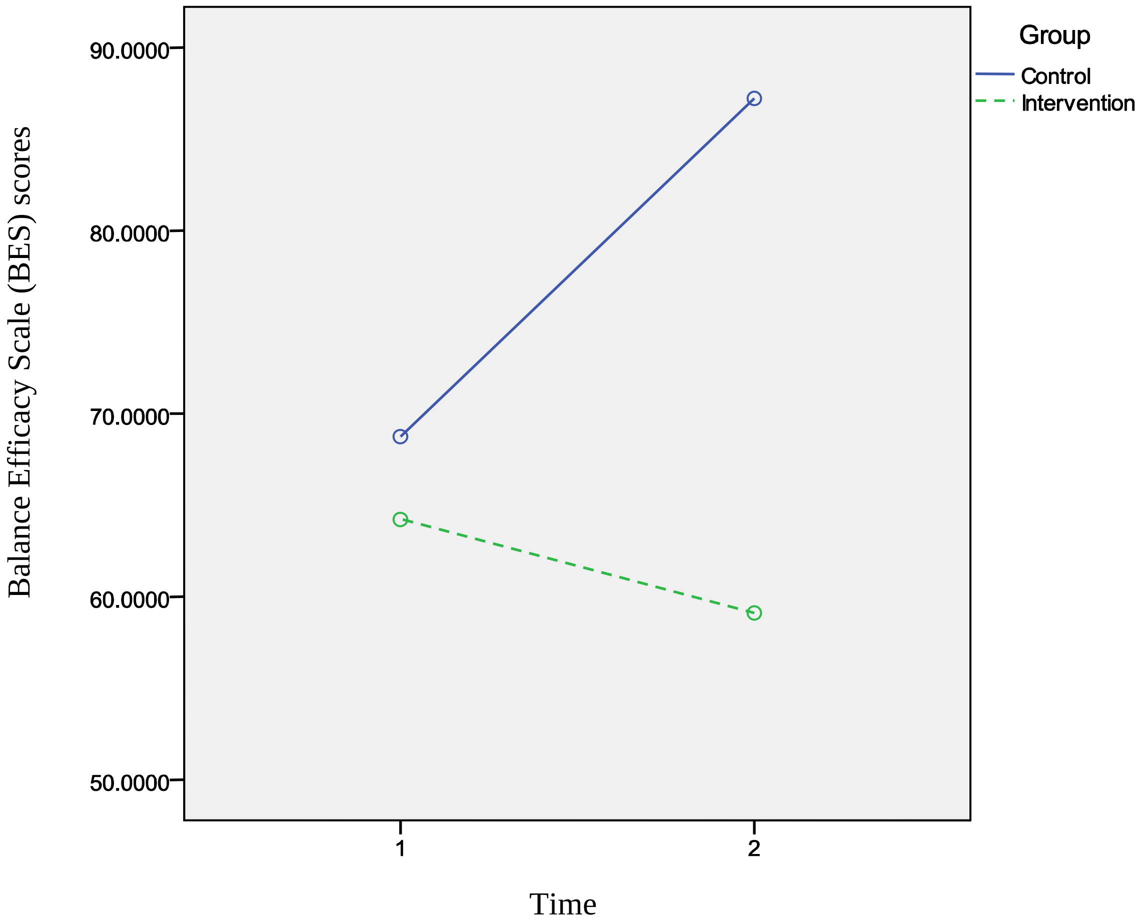

Figure 2. The difference in BES scores from pre- to post-test after eight weeks of training. The control group changed from 68.80±18.00 to 87.20±10.10 while the intervention group experienced a greater increase from 64.20±20.90 to 51.90±23.90.

Modified Falls Efficacy Scale (MFES) Scores for the
Intervention and Control Group

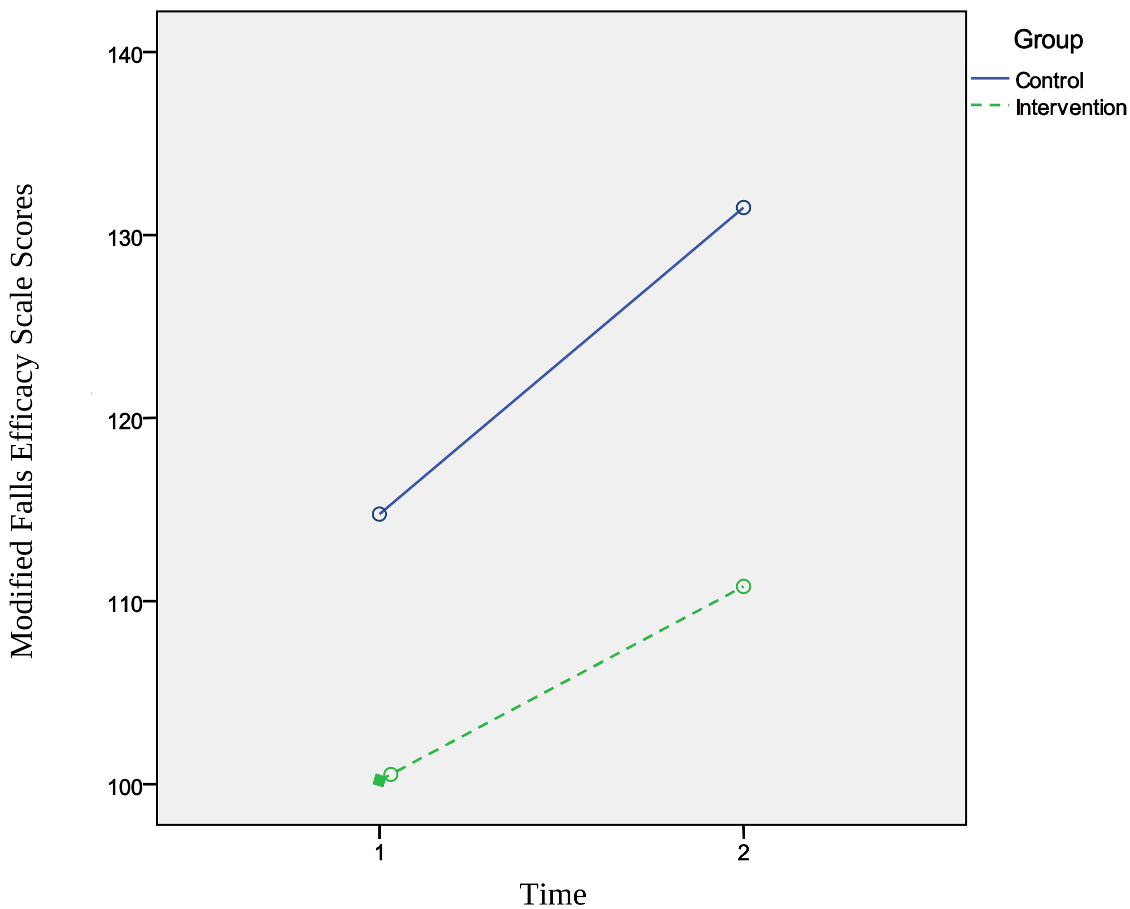

Figure 3. The difference in MFES scores from pre- to post-test after eight weeks of training. The control group changed from 114.75±19.10 to 131.50±9.70 while the intervention group experienced a greater increase from 100.20±20.90 to 110.80±20.20.

Chair Stand (CS) Scores for the Intervention and Control Group

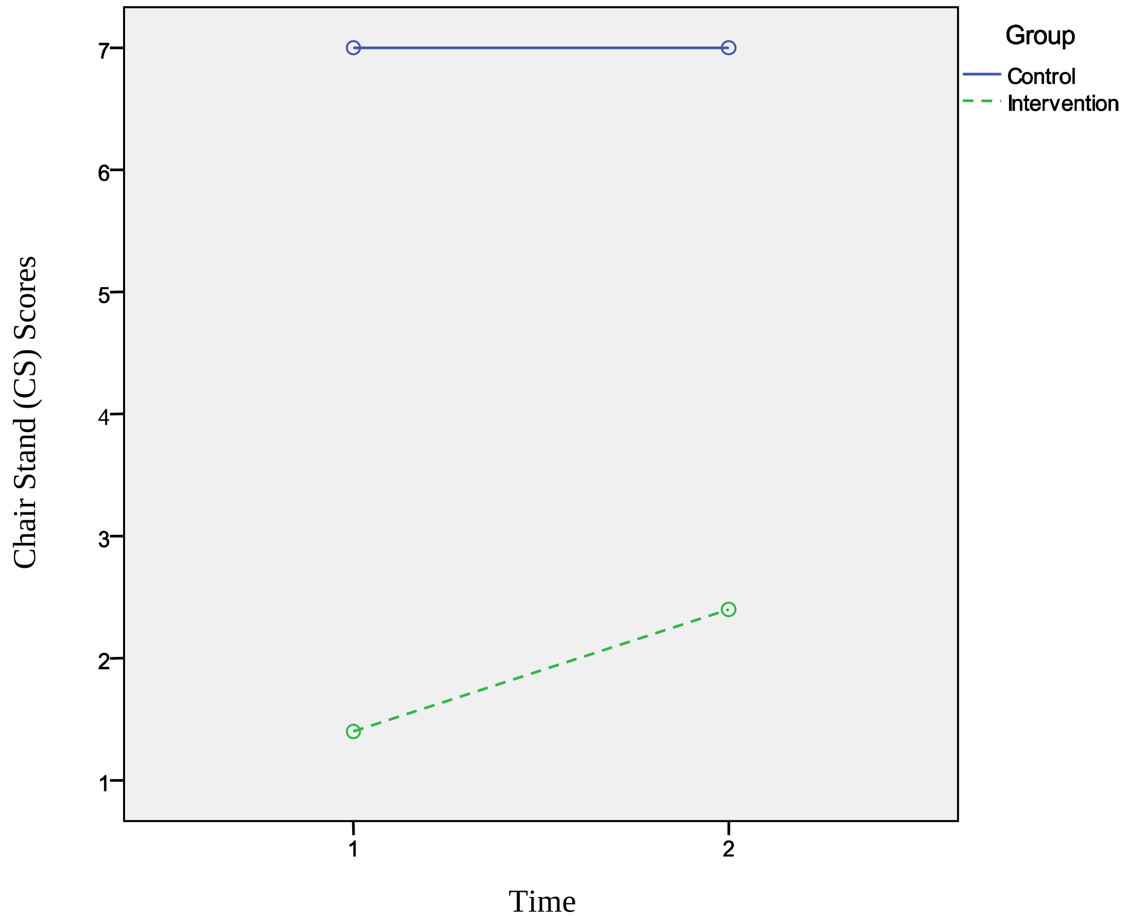

Figure 4. The difference in CS scores from pre- to post-test after eight weeks of training. The control group changed from 7.00±5.90 to 7.00±8.10 while the intervention group experienced a greater increase from 1.40±2.20 to 2.40±4.40.

8-Foot-Up & Go Times for the Intervention and Controlg Group

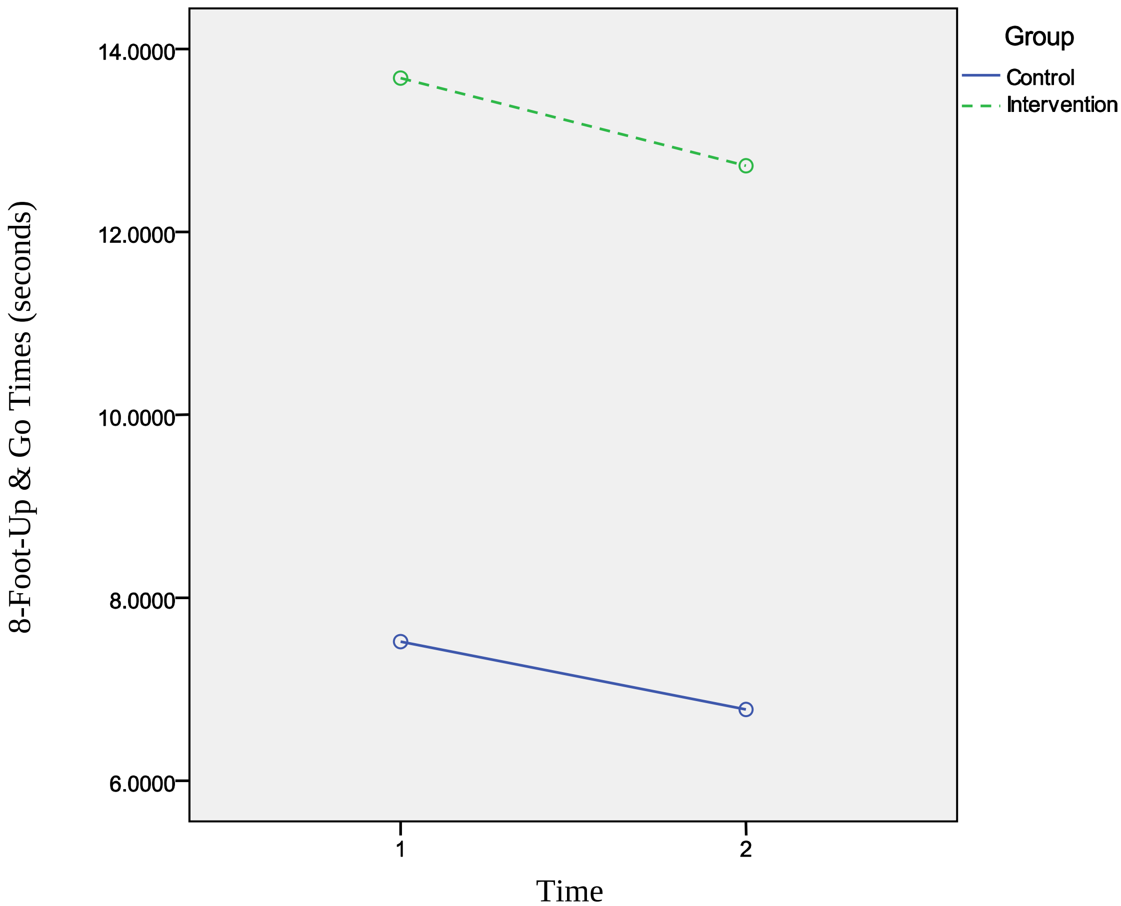

Figure 5. The difference in times on the 8-foot-up-and-go from pre- to post-test after eight weeks of training. The control group decreased their time from 7.52±0.57 to 6.78±1.19 seconds while the intervention group experienced a greater increase from 13.68±3.90 to 12.72±3.14.

Appendix A

IRB Approval

October 20, 2010 IRB Application #: 10128

Proposal Title: *Effects of a balance training class for older adults on balance, fitness, and mentality*

Type of Review: Full Board

Investigators:

Ms. Larissa Adams
Dr. Melissa Powers
Department of Kinesiology and Health Studies
College of Education and Professional Studies
Campus Box 189
University of Central Oklahoma
Edmond, OK 73034

Dear Ms. Adams and Dr. Powers:

Re: Application for IRB Review of Research Involving Human Subjects

We have received your revised materials for your application. The UCO IRB has determined that the above named application is APPROVED BY FULL BOARD REVIEW.

Date of Approval: 10/20/2010

Date of Approval Expiration: 10/19/2011

If applicable, informed consent (and HIPAA authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. A stamped, approved copy of the informed consent form will be sent to you via campus mail. The IRB-approved consent form and process must be used. While this project is approved for the period noted above, any modification to the procedures and/or consent form must be approved prior to incorporation into the study. A written request is needed to initiate the amendment process. You will be contacted in writing prior to the approval expiration to determine if a continuing review is needed, which must be obtained before the anniversary date. Notification of the completion of the project must be sent to the IRB office in writing and all records must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of the investigators to promptly report to the IRB any serious or unexpected adverse events or unanticipated problems that may be a risk to the subjects.

On behalf of the UCO IRB, I wish you the best of luck with your research project. If our office can be of any further assistance, please do not hesitate to contact us.

Sincerely,

Jill A. Devenport, Ph.D.

Chair, Institutional Review Board

Director of Research Compliance, Academic Affairs

Campus Box 159

University of Central Oklahoma

Edmond, OK 73034

405-974-5479

jdevenport@uco.edu

Appendix B

Informed Consent Form

UNIVERSITY OF CENTRAL OKLAHOMA

INFORMED CONSENT FORM

Research Project Title: The Impact of Balance Training on Falls Efficacy and Functionality in Assisted Living Adults

Researcher (s): Larissa Adams & Melissa Powers, PhD

Kinesiology and Health Studies
University of Central Oklahoma
100 N. University Drive, #189, Edmond, OK 73034
(405) 974-5309, lenoch1@uco.edu

IRB Contact: Jill Devenport, Chair, UCO Institutional Review Board
Office of Research & Grants, 216 ADMN
(405) 974-5479 OR -2526

Purpose: The purpose of this study is to evaluate the effectiveness of a balance training class at improving balance, confidence, and functionality.

Procedures: If you sign this form and agree to participate in the research study, your data from pre- and post-testing will be used in a research study. The data that will be used includes the results of your balance tests and surveys. These tests include: a chair stand test (the number of times you can rise from a hair in 30 seconds) and the 8-foot-up-and-go test (how long it takes you to stand up from a chair, walk 8 feet and return to the chair. The results of a balance test (Berg Balance Scale) will also be recorded and use. Tests of balance confidence (Modified Falls Efficacy Scale and Balance Efficacy Scale) will also be utilized. We will also ask you to provide medical and personal information through our demographic survey.

Expected length of participation: Your participation should take no longer than 1-2 hours before the balance training class (October) and 1-2 hour after the end of the balance training class (December). The balance training class will meet 2 days per week for 45 minutes at a time.

Potential benefits: The results of the research study will inform the development of future balance training classes for older adults. Participants will receive a copy of their fitness testing results. Benefits that may occur within participants include improved balance, confidence, fitness, and mental health. Increasing functionality and preventing falls could benefit you by prolonging years of life, as well as improving quality of life. Honing this type of program for future studies could provide society with preventative steps to falling and decreases in functionality.

Continued on the back side – please turn paper over to complete form

UNIVERSITY OF CENTRAL OKLAHOMA
INFORMED CONSENT FORM

Research Project Title: The Impact of Balance Training on Falls Efficacy and Functionality in Assisted Living Adults

Potential risks/discomforts: The risks associated with participation in the research study are minimal. Your complete confidentiality will be maintained as described below.

Risks associated with fitness testing may include muscle soreness and tiredness. Potential, but rare, risks include joint pain and muscle injury. We will teach you how to perform each test before you complete it. All these tests are safe and often used to test physical fitness in people over the age of 60 years. You will also be required to fill out a Physical Readiness Questionnaire (PAR-Q). If you answer yes to any of the questions on the PAR-Q, physician approval will be required. In the rare event that you are injured during testing, you will be referred to your primary care physician.

A mini-mental state exam (MMSE) will also be required, and passing score of 24 or above must be achieved to allow for participation in the study.

Explanation of confidentiality and privacy: Your privacy is important to us. The results of your testing will only be shared with you. For research purposes, your data will be assigned a code number. This code number will be used throughout for the duration of the research study. All information will be held in the strictest confidence. Hard copies of data will be stored in a locked file cabinet in Library 315-C. Electronic copies will be stored on a password protected computer.

Assurance of voluntary participation: Your participation in the research is completely voluntary. You are free to refuse to participate in the research and to withdraw from this study at any time. You may refuse to participate in the research, but continue to participate in the balance training class. You may also refuse to answer any question.

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

Research Subject's Name: ____

Signature: ____ Date__________________________

Appendix C

Photo Release Form

University of Central Oklahoma
Balance Training Study

PHOTO RELEASE FORM

The Balance Training Study research team requests permission to take and use your photograph during this research study. Photos may be taken at any time during the study period. The photos may be used for promotional purposes to showcase the study, the Department of Kinesiology and Health Studies, the College of Education and Professional Studies, and/or the university. Photos may be used in a variety of media, including newsletters, brochures, slide shows, multimedia presentations, display boards or web-sites. No compensation is paid to individuals or organizations for this use. If you have any questions or concerns, please contact Melissa Powers, Assistant Professor, 974-5309.

By signing below, I give permission for photographs to be taken of me during my participation in this study. I understand that these photos may be used for promotional purposes. I understand that signing this form is not required for participation in the balance training class or research study.

Name: ____

Phone/Email: _______________________________________

Signature: ____________________________ Date: ________________

Appendix D

Mini Mental State Exam (MMSE)

MMSE Code______________________

1. ORIENTATION – I'm going to ask you some questions. Answer them as accurately as you can.
   a. What is today's date? ______
   b. What is the year? ______
   c. What is the month? ______
   d. What day is today ______
   e. What season is it? ______
   f. What is the name of this facility? ______
   g. What floor are we on? ______
   h. What is the name of a street nearby (or near home)? ______
   i. What town are we in? ______
   j. What country are we in? ______

Score (0-10) ______

2. IMMEDIATE RECALL: I want you to repeat three words after I say them. Try to get them all on the first time through. (Note: allow 1 second per word in listing words. Allow up to 6 trials to say all three. However, only score the number scored after the first try.)

	1st	2nd	3rd	4th	5th	6th
Ball	___	___	___	___	___	___
Flag	___	___	___	___	___	___
Tree	___	___	___	___	___	___

Score (0-3) ______

3. ATTENTION and CALCULATION:
   a. Begin with 100 & count backwards by 7: 93___ 86___ 79___ 72___ 65___
   (note – correct is any response that is 7 less than previous number)
   b. Then spell the word "WORLD" backwards: D___ L___ R___ O___ W___

Score=best of the two tasks (0-5) ______

4. RECALL: Can you recall the words I said before?
   a. Ball ______
   b. Flag ______
   c. Tree ______

Score (0-3) ______

5. LANGUAGE:
   a. What is this?
      i. Watch ______ ii. Pen/pencil______
   b. Repeat after me: "No ifs, ands or buts" _________
   (Must be fully correct on first trial)

Score (0-3) ______

6. PRAXIS: Take this paper in your right hand, ______
   Fold it in half ______
   And put it on your knee ______
   (Avoid nonverbal cues)

Score (0-3) ______

7. LANGUAGE READING COMPREHENSION: Do as this says (separate sheet of paper)

Score (0-1) ______

8. PRAXIS:
   a. Write a sentence (use back of this sheet)
   b. Copy this picture (use back of this sheet)
   (must have 2 5-sided figures with central diamond)

Score (0-2) ______

TOTAL: ___/30 al

Appendix E

Physical Activity Readiness Questionnaire (PAR-Q)

Physical Activity Readiness
Questionnaire (PAR-Q)*

NAME OF PARTICIPANT ____________________

DATE ____________________

PAR Q & YOU

PAR-Q is designed to help you help yourself. Many health benefits are associated with regular exercise, and completion of PAR-Q is a sensible first step to take if you are planning to increase the amount of physical activity in your life.

For most people, physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them.

Common sense is your best guide in answering these few questions. Please read them carefully and check (✓) the ☐ YES or ☐ NO opposite the question if it applies to you.

YES	NO	
☐	☐	1 Has your doctor ever said you have heart trouble?
☐	☐	2 Do you frequently have pains in your heart and chest?
☐	☐	3 Do you often feel faint or have spells of severe dizziness?
☐	☐	4 Has a doctor ever said your blood pressure was too high?
☐	☐	5 Has your doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
☐	☐	6 Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
☐	☐	7 Are you over the age of 65 and not accustomed to vigorous exercise?

If You Answered

YES to one or more questions

If you have not recently done so, consult with your personal physician by telephone or in person BEFORE increasing your physical activity and/or taking a fitness appraisal. Tell your physician what questions you answered YES to on PAR-Q or present your PAR-Q copy.

programs

After medical evaluation, seek advice from your physician as to your suitability for:
- unrestricted physical activity starting off easily and progressing gradually.
- restricted or supervised activity to meet your specific needs, at least on an initial basis. Check in your community for special programs or services.

NO to all questions

If you answered PAR-Q accurately, you have reasonable assurance of your present suitability for:
- A GRADUATED EXERCISE PROGRAM – a gradual increase in proper exercise promotes good fitness development while minimizing or eliminating discomfort.
- A FITNESS APPRAISAL – the Canadian Standardized Test of Fitness (CSTF)

postpone

If you have a temporary minor illness, such as a common cold.

- Developed by the British Columbia Ministry of Health. Conceptualized and critiqued by the Multidisciplinary Advisory Board on Exercise (MABE).
  Reference PAR-Q Validation Report, British Columbia Ministry of Health, May, 1978.
- Produced by the British Columbia Ministry of Health and the Department of National Health & Welfare.

Appendix F

Katz ADL

KATZ BASIC ACTIVITIES OF DAILY LIVING (ADL) SCALE		
	Independent	
	YES	NO
1. Bathing (sponge bath, tub bath, or shower) Receives either no assistance or assistance in bathing only one part of body		
2. Dressing - Gets clothes and dresses without any assistance except for tying shoes.		
3. Toileting - Goes to toilet room, uses toilet, arranges clothes, and returns without any assistance (may use cane or walker for support and may use bedpan/urinal at night.		
4. Transferring - Moves in and out of bed and chair without assistance (may use can or walker).		
5. Continence - Controls bowel and bladder completely by self (without occasional "accidents").		
6. Feeding - Feeds self without assistance (except for help with cutting meat or buttering bread).		

LAWTON - BRODY
INSTRUMENTAL ACTIVITIES OF DAILY LIVING SCALE (I.A.D.L.)

A. Ability to Use Telephone		**E. Laundry**	
1. Operates telephone on own initiative-looks up and dials numbers, etc.	1	1. Does personal laundry completely	1
2. Dials a few well-known numbers	1	2. Launders small items-rinses stockings, etc.	1
3. Answers telephone but does not dial	1	3. All laundry must be done by others	0
4. Does not use telephone at all	0		
B. Shopping		**F. Mode of Transportation**	
1. Takes care of all shopping needs independently	1	1. Travels independently on public transportation or drives own car	1
2. Shops independently for small purchases	0	2. Arranges own travel via taxi, but does not otherwise use public transportation	1
3. Needs to be accompanied on any shopping trip	0	3. Travels on public transportation when accompanied by another	1
4. Completely unable to shop	0	4. Travel limited to taxi or automobile with assistance of another	0
		5. Does not travel at all	0
C. Food Preparation		**G. Responsibility for Own Medications**	
1. Plans, prepares and serves adequate meals independently	1	1. Is responsible for taking medication in correct dosages at correct time	1
2. Prepares adequate meals if supplied with ingredients	0	2. Takes responsibility if medication is prepared in advance in separate dosage	0
3. Heats, serves and prepares meals, or prepares meals, or prepares meals but does not maintain adequate diet	0	3. Is not capable of dispensing own medication	0
4. Needs to have meals prepared and served	0		
D. Housekeeping		**H. Ability to Handle Finances**	
1. Maintains house alone or with occasional assistance (e.g. "heavy work domestic help")	1	1. Manages financial matters independently (budgets, writes checks, pays rent, bills, goes to bank), collects and keeps track of income	1
2. Performs light daily tasks such as dish washing, bed making	1	2. Manages day-to-day purchases, but needs help with banking, major purchases, etc.	1
3. Performs light daily tasks but cannot maintain acceptable level of cleanliness	1	3. Incapable of handling money	0
4. Needs help with all home maintenance tasks	1		
5. Does not participate in any housekeeping tasks	0		

Appendix G

Berg Balance Scale

Berg Balance Scale

Description:

14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, 2 standard chairs (one with arm rests, one without)

Footstool or step, Stopwatch or wristwatch, 15 ft walkway

Completion:

Time: 15-20 minutes

Scoring: A five-point ordinal scale, ranging from 0-4. “0” indicates the lowest level of function and “4” the highest level of function. Total Score = 56

Interpretation: 41-56 = low fall risk

21-40 = medium fall risk

0 –20 = high fall risk

Criterion Validity:

“Authors support a cut off score of 45/56 for independent safe ambulation”.

Riddle and Stratford, 1999, examined 45/56 cutoff validity and concluded:

- Sensitivity = 64% (Correctly predicts fallers)
- Specificity = 90% (Correctly predicts non-fallers)
- Riddle and Stratford encouraged a lower cut off score of 40/56 to assess fall risk

Comments: Potential ceiling effect with higher level patients. Scale does not include gait items

Norms:

Lusardi, M.M. (2004). Functional Performance in **Community Living Older Adults**.

Journal of Geriatric Physical Therapy, 26(3), 14-22.

Berg Balance Scale

Name: ____________________________________ Date: ____________________

Location: __________________________________ Rater: ____________________

ITEM DESCRIPTION	SCORE (0-4)
Sitting to standing	________
Standing unsupported	________
Sitting unsupported Standing to sitting	________
Transfers	________
Standing with eyes closed	________
Standing with feet together	________
Reaching forward with outstretched arm	________
Retrieving object from floor	________
Turning to look behind	________
Turning 360 degrees	________
Placing alternate foot on stool	________
Standing with one foot in front	________
Standing on one foot	________

Total ________

GENERAL INSTRUCTIONS

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:

- the time or distance requirements are not met
- the subject's performance warrants supervision
- the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

Berg Balance Scale

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

( ) 4 able to stand without using hands and stabilize independently

( ) 3 able to stand independently using hands

( ) 2 able to stand using hands after several tries

( ) 1 needs minimal aid to stand or stabilize

( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

( ) 4 able to stand safely for 2 minutes

( ) 3 able to stand 2 minutes with supervision

( ) 2 able to stand 30 seconds unsupported

( ) 1 needs several tries to stand 30 seconds unsupported

( ) 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely for 2 minutes

( ) 3 able to sit 2 minutes under supervision

( ) 2 able to able to sit 30 seconds

( ) 1 able to sit 10 seconds

( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands

( ) 3 controls descent by using hands

( ) 2 uses back of legs against chair to control descent

( ) 1 sits independently but has uncontrolled descent

( ) 0 needs assist to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

( ) 4 able to transfer safely with minor use of hands

( ) 3 able to transfer safely definite need of hands

( ) 2 able to transfer with verbal cuing and/or supervision

( ) 1 needs one person to assist

( ) 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely

( ) 3 able to stand 10 seconds with supervision

( ) 2 able to stand 3 seconds

( ) 1 unable to keep eyes closed 3 seconds but stays safely

( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

( ) 4 able to place feet together independently and stand 1 minute safely

( ) 3 able to place feet together independently and stand 1 minute with supervision

( ) 2 able to place feet together independently but unable to hold for 30 seconds

( ) 1 needs help to attain position but able to stand 15 seconds feet together

( ) 0 needs help to attain position and unable to hold for 15 seconds

Berg Balance Scale continued…..

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently 25 cm (10 inches)

( ) 3 can reach forward 12 cm (5 inches)

( ) 2 can reach forward 5 cm (2 inches)

( ) 1 reaches forward but needs supervision

( ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is place in front of your feet.

( ) 4 able to pick up slipper safely and easily

( ) 3 able to pick up slipper but needs supervision

( ) 2 unable to pick up but reaches 2-5 cm(1-2 inches) from slipper and keeps balance

independently

( ) 1 unable to pick up and needs supervision while trying

( ) 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

( ) 4 looks behind from both sides and weight shifts well

( ) 3 looks behind one side only other side shows less weight shift

( ) 2 turns sideways only but maintains balance

( ) 1 needs supervision when turning

( ) 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

( ) 4 able to turn 360 degrees safely in 4 seconds or less

( ) 3 able to turn 360 degrees safely one side only 4 seconds or less

( ) 2 able to turn 360 degrees safely but slowly

( ) 1 needs close supervision or verbal cuing

( ) 0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.

( ) 4 able to stand independently and safely and complete 8 steps in 20 seconds

( ) 3 able to stand independently and complete 8 steps in > 20 seconds

( ) 2 able to complete 4 steps without aid with supervision

( ) 1 able to complete > 2 steps needs minimal assist

( ) 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject’s normal stride width.)

( ) 4 able to place foot tandem independently and hold 30 seconds

( ) 3 able to place foot ahead independently and hold 30 seconds

( ) 2 able to take small step independently and hold 30 seconds

( ) 1 needs help to step but can hold 15 seconds

( ) 0 loses balance while stepping or standing

14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding on.

( ) 4 able to lift leg independently and hold > 10 seconds

( ) 3 able to lift leg independently and hold 5-10 seconds

( ) 2 able to lift leg independently and hold ≥ 3 seconds

( ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently.

( ) 0 unable to try of needs assist to prevent fall

( ) TOTAL SCORE (Maximum = 56)

Appendix H

Modified Falls Efficacy Scale (MFES)

The Modified Falls Efficacy Scale

Adapted from Tinetti et al, 1990; Hill et al, 1996

On a scale of 0 to 10, how confident are you that you can do each of these activities without falling, with 0 meaning "not confident/not sure at all", 5 being "fairly confident/fairly sure", and 10 being "completely confident/completely sure"?

NOTE:

- If you have stopped doing the activity at least partly because of being afraid of falling, score a 0;
- If you have stopped an activity purely because of a physical problem, leave that item blank (these items are not included in the calculation of the average MFES score).
- If you do not currently do the activity for other reasons, please rate that item based on how you perceive you would rate if you had to do the activity today.

		Not confident at all 0	1	2	3	4	Fairly confident 5	6	7	8	9	Completely confident 10
1.	Get dressed and undressed	0					5					10
2.	Prepare a simple meal	0					5					10
3.	Take a bath or a shower	0					5					10
4.	Get in/out of a chair	0					5					10
5.	Get in/out of bed	0					5					10
6.	Answer the door or telephone	0					5					10
7.	Walk around the inside of your house	0					5					10
8.	Reach into cabinets or closet	0					5					10
9.	Light housekeeping	0					5					10
10.	Simple shopping	0					5					10
11.	Using public transport	0					5					10
12.	Crossing roads	0					5					10
13.	Light gardening or hanging out the washing*	0					5					10
14.	Using front or rear steps at home											

* rate most commonly performed of these activities

Average score/item rated = ……../…….

= ……..

1. Hill K, Schwarz J, et al. Fear of falling revisited. Archives Phys Med Rehabil 1996; 77:1025-1029.
2. Tinetti M, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontology 1990; 45:P239-43.

In 2005 the Department of Human Services funded the National Ageing Research Institute to review and recommend a set of falls prevention resources for general use. The materials used as the basis for this generic resource were developed by the National Ageing Research Institute and the North West Hospital Falls Clinic, Parkville (adapted from Tinetti et al., 1990). This and other falls prevention resources are available from the department's Aged Care website at: http://www.health.vic.gov.au/agedcare.

Appendix I

Balance Efficacy Scale (BES)

Form 3.8

The Balance Efficacy Scale

Listed below are a series of tasks that you may encounter in daily life. Please indicate how confident you are, ***today,*** that you can complete each of these tasks without losing your balance. Your answers are confidential. ***Please answer as you feel, not how you think you should feel.***

(Circle one number from 0 to 100%)

1. **How confident are you that you can get up out of a chair (using your hands) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

2. **How confident are you that you can get up out of a chair (*not* using your hands) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

3. **How confident are you that you can walk up a flight of 10 stairs (using the handrail) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

4. **How confident are you that you can walk up a flight of 10 stairs (*not* using the handrail) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

5. **How confident are you that you can get out of bed without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

6. **How confident are you that you can get into or out of a shower or bathtub (*with* the assistance of a handrail or support wall) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

7. **How confident are you that you can get into or out of a shower or bathtub (with *no assistance* from a handrail or support wall) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

8. **How confident are you that you can walk down a flight of 10 stairs (using the handrail) without losing your balance?**

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

   not at all confident — somewhat confident — absolutely confident

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(continued)

Form 3.8

(continued)

9. How confident are you that you can walk down a flight of 10 stairs (*not* using the handrail) without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

10. How confident are you that you can remove an object from a cupboard *located at a height that is level with your shoulder* without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

11. How confident are you that you can remove an object from a cupboard *located above your head* without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

12. How confident are you that you can walk across uneven ground (with assistance) when good lighting is available without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

13. How confident are you that you can walk across uneven ground (with *no* assistance) when good lighting is available without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

14. How confident are you that you can walk across uneven ground (with assistance) at night without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

15. How confident are you that you can walk across uneven ground (with *no* assistance) at night without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

16. How confident are you that you could stand on one leg (with support) while putting on a pair of trousers without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

17. How confident are you that you could stand on one leg (with *no* support) while putting on a pair of trousers without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident

Form 3.8

18. How confident are you that you could complete a daily task *quickly* without losing your balance?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

not at all confident — somewhat confident — absolutely confident