EFFECTIVENESS OF FALLPROOF™ HOME-BASED DVD PROGRAM IN IMPROVING BALANCE, SELECT FUNCTIONAL FITNESS PARAMETERS, AND BALANCE-RELATED SELF-CONFIDENCE AMONG COMMUNITY DWELLING OLDER ADULTS WHO HAVE BEEN IDENTIFIED AS MODERATE TO HIGH RISK OF FALLS

Kelly Ward
B.S., West Chester University, 1993

THESIS

Submitted in partial satisfaction of the requirements for the degree of

MASTER OF SCIENCE

in

SPECIAL MAJOR
(Therapeutic Aging)

at

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

FALL
2010
EFFECTIVENESS OF FALLPROOF™ HOME-BASED DVD PROGRAM IN IMPROVING BALANCE, SELECT FUNCTIONAL FITNESS PARAMETERS, AND BALANCE-RELATED SELF-CONFIDENCE AMONG COMMUNITY DWELLING OLDER ADULTS WHO HAVE BEEN IDENTIFIED AS MODERATE TO HIGH RISK OF FALLS

A Thesis

by

Kelly Ward

Approved by:

______________________________, Sponsor
Katherine Pinch, PhD

______________________________, Committee Member
Cheryl Osborne, EdD

______________________________, Committee Member
Greg Shaw, PhD

Date: __________________________
Student:  Kelly Ward

I certify that this student has met the requirements for format contained in the University format manual, and that this thesis is suitable for shelving in the Library and credit is be awarded for the thesis.

______________________________  Date ____________

Dr. Chevelle Newsome, Ph.D., Dean

Office of Graduate Studies
Abstract

of

EFFECTIVENESS OF FALLPROOF™ HOME-BASED DVD PROGRAM IN IMPROVING BALANCE, SELECT FUNCTIONAL FITNESS PARAMETERS, AND BALANCE-RELATED SELF-CONFIDENCE AMONG COMMUNITY DWELLING OLDER ADULTS WHO HAVE BEEN IDENTIFIED AS MODERATE TO HIGH RISK OF FALLS

by

Kelly Ward

Statement of the Problem: One third of adults over the age of 65 will fall each year and fifty percent of those falls could be prevented. Researchers agree that participating in a multidimensional exercise program, either at home or in the community, that includes strength, flexibility, balance and endurance training components can reduce fall risk among community-dwelling older adults. The purpose of this study is to investigate the benefits of participating in the FallProof™ at Home (FAH) balance and mobility program for older adults identified at moderate to high risk of falls and living in the communities of Sacramento, California.

Sources of Data: Eighty-one older adults were assessed for fall risk using the Fullerton Advanced Balance (FAB) scale. Measures of lower body strength and flexibility and self-
perceived balance confidence were also evaluated. Thirty-eight participants met eligibility requirements; twenty-three participants were assigned to the intervention group and participated in the 12-week FAH DVD program and fifteen participants were assigned to the usual activity control group. Data were analyzed with a paired sample t-test with a significance level set at p<.05. Repeated-measures ANOVA were performed, testing only the Group X Time interaction. Post-hoc t-tests were performed to compare the four mean differences.

**Conclusions Reached:** After the 12-week study period, the data showed that the intervention group improved significantly in FAB and BES scores but not significantly in lower body strength or flexibility. The control group did not improve significantly on any of the four test variables. This data suggests that participating in the progressively challenging FallProof™ at Home (FAH) balance and mobility DVD program can reduce fall risk and improve self-perceived balance confidence among older adults identified at high to moderate fall risk and living in the community. Future research might want to look at the efficacy of participation in FAH in addition to participation in the community-based FallProof™ program or test the effect of participating in FAH on different identified fall risk factors.

_________________________________________, Sponsor
Kathrine Pinch, PhD
ACKNOWLEDGMENTS

This thesis would not have been possible without the amazing support network that I am so blessed to have. Thanks first to my Lord and Savior, Jesus Christ. Without you, I am nothing. With you, everything is possible.

My deepest gratitude goes out to my mentor, Dr. Debra Rose. FallProof™ not only shaped the direction of my future but also improves the quality of life of each older adult I meet. Thank you for your positive influence in my life.

I would like to thank my advisor, Kath Pinch. Your guidance helped me stay focused on what was important throughout this journey. Thank you so much to my second reader, Dr. Osborne. Unknowingly, you planted a seed years ago and it’s finally come to fruition! Thank you, Greg Shaw for our gym talks and for reassuring me this could be done. I would especially like to thank my statistician, Dennis Wong. Words cannot express my gratitude for your guidance and feedback.

A special thanks to all my study participants! Your willingness to learn was admirable and dedication to finish was commendable. Thank you so much for touching my life.

Finally, I wish to thank my family for loving me and believing in me, especially when I didn’t. Mom, thank you for listening to me when I was stressed, sad, or happy and enabling me to complete this with (most of) my sanity. Carol, thank you so much for offering me a chance to start over. It took awhile but here I am! And Dad, this one’s for you!
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>vi</td>
</tr>
<tr>
<td>List of Tables</td>
<td>x</td>
</tr>
<tr>
<td>List of Figures</td>
<td>xi</td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Statement of Purpose</td>
<td>5</td>
</tr>
<tr>
<td>Delimitations</td>
<td>5</td>
</tr>
<tr>
<td>Operational Definitions</td>
<td>8</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>11</td>
</tr>
<tr>
<td>2. REVIEW OF LITERATURE</td>
<td>13</td>
</tr>
<tr>
<td>Cost of Falls to Society</td>
<td>14</td>
</tr>
<tr>
<td>Fall Prevention Legislation</td>
<td>16</td>
</tr>
<tr>
<td>Types of Fall Risk Factors</td>
<td>17</td>
</tr>
<tr>
<td>Perception-Action Cycle</td>
<td>18</td>
</tr>
<tr>
<td>Cognitive Changes</td>
<td>19</td>
</tr>
<tr>
<td>Sensory Input</td>
<td>20</td>
</tr>
<tr>
<td>Fall Prevention Exercise Components</td>
<td>24</td>
</tr>
<tr>
<td>Strength</td>
<td>24</td>
</tr>
<tr>
<td>Flexibility</td>
<td>26</td>
</tr>
<tr>
<td>Endurance</td>
<td>26</td>
</tr>
<tr>
<td>Balance</td>
<td>27</td>
</tr>
<tr>
<td>Evidence-based Fall Prevention Strategies</td>
<td>29</td>
</tr>
<tr>
<td>Multisensory Training</td>
<td>29</td>
</tr>
<tr>
<td>Postural Strategy Training</td>
<td>30</td>
</tr>
<tr>
<td>Balance and Gait Training</td>
<td>31</td>
</tr>
<tr>
<td>Individualized Programming</td>
<td>32</td>
</tr>
<tr>
<td>Appendix</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>A</td>
<td>Fulleron Advanced Balance (FAB) scale</td>
</tr>
<tr>
<td>B</td>
<td>Health History Questionnaire (HHQ)</td>
</tr>
<tr>
<td>C</td>
<td>Balance Efficacy Scale (BES)</td>
</tr>
<tr>
<td>D</td>
<td>FAH Compliance Chart</td>
</tr>
<tr>
<td>E</td>
<td>Falls Incidence Report</td>
</tr>
<tr>
<td>F</td>
<td>Human Subjects Consent Form</td>
</tr>
<tr>
<td></td>
<td>References</td>
</tr>
</tbody>
</table>
LIST OF TABLES

1. Table 1 Descriptive Statistics for Participants' Demographics……………….. 60
2. Table 2 Means and Standard Deviations for Participants' Scores on SFT……..63
LIST OF FIGURES

Page

1. Figure 1. Dynamic Equilibrium Model................................................................. 19
2. Figure 2. Study Participant Flow Chart ..................................................................... 59
3. Figure 3. Group by Time Interaction on FAB Scale................................................. 61
4. Figure 4. Group by Time Interaction on BES.......................................................... 64
Chapter 1

INTRODUCTION

Fall prevention exercise specialists are continually searching for ways to reduce the incidence of falls among the older adult population. The Centers for Disease and Control and Prevention (CDC, 2006) reported that falls are the leading cause of injury death among adults over the age of 65 as well as the most common cause of non–fatal injuries and hospital admissions for trauma. More than one third of community-dwelling adults over the age of 65 fall at least once per year; and 24% of those who fall report a serious injury and require hospitalization (Beattie, 2009, CDC, 2006). As a result, many falls result in the premature institutionalization of older adults due to the loss of independence, secondary complications, and a reduced quality of life due to the fear of falling again (Lord, Sherrington, & Mentz, 2001). By 2025, it is estimated that one in five Americans will be over 65 years old. In addition, the adult population over the age of 85 doubles every 30 years and is the fastest growing segment of the population (Hobbs, n.d.). As the number of aging baby boomers increases, the need for programs that empower individuals to make lifestyle changes to reduce the risk of accidental falls is undeniable.

Although physical falls are associated with growing older, they are not a normal part of the aging process; the risk of falling can be reduced. Regardless of the cause, a fall is an accident and an individual can reduce both intrinsic and extrinsic risk factors through increased awareness and physical activity (American Geriatrics Society, 2001; Rose, 2005; Rubenstein, 2007; Tinetti, Baker, McAvay et al, 1994). In the United States,
falls cost taxpayers more than $19 billion dollars in 2000. Unless action is taken to reduce the incidence of these falls, the direct cost of elderly falls is expected to more than double and could reach $43.8 billion by 2020 (CDC, 2006).

Numerous research studies demonstrate that participation in an exercise program reduces the risk of falling, whether participating in a community-based program or at home (Nitz & Choy, 2004; Rose, 2005; Rubenstein, 2006; Thomas, Mackintosh, & Halbert, 2010). Fall prevention researchers agree that older adults who follow a consistent exercise program that includes strength, flexibility, endurance, and balance training components are less likely to fall (Rose, 2005; Rubenstein, 2006; Tinetti et al, 1994). Although a sedentary lifestyle and the presence of chronic disease exasperate physical impairment, research demonstrates that it is never too late to benefit from consistent movement (Jette, Lachman, Giorgetti et al, 1999; Wescott, 1999).

Balance is an intricate messenger system that relies on sensory input, cognitive processing, and motor response to adapt to competing task demands and changes in the environment (Rose, 2010; Woollacott, 2000). The natural physiological decline associated with aging results in reduced quality sensory information, slowed central processing speeds, and delayed motor responses. These age-related factors increase the risk of falls among older adults. Research demonstrates that linking the sensory and motor systems and creating improved neural transmission between the muscles and senses results in an improved ability to anticipate and to react to life’s imbalances. The efficient transmission of information reduces the risk of a fall (Lord & Dayhew, 2001; Rose, 2010).
Postural control is an understated concept in the study of falls among the elderly and it has been identified as having a major influence on fall risk (Horak, 2006). The physical and sensory declines of aging impair an older adult’s ability to maintain postural control resulting in an increased fall risk. Evidence–based literature supports the efficacy of fall risk reduction exercise programs that incorporate postural strategy training (Gillespie, Gillespie, Cumming, Lamb & Rowe, 2001; Rubenstein, 2006; Woollacott, 2000).

Medical technology and scientific advancements are prolonging the life span and people are living longer. Three out of five people who live into the ninth decade of life are diagnosed with one or more hearing, visual, or physical impairments (Dejong & Lifchez, 1983). Fall prevention exercise programs that incorporate multisensory training will be in great demand as the number of older adults living with sensory impairment increases. It is imperative that individuals learn how to use the other sensory systems involved in balance before a fall occurs. Unless these sensory systems are progressively trained according to individual need, one’s balance and mobility skills can be expected to decline with age (Rubenstein, 2006; Woolacott, 2000).

Interventions that target the sources of balance-related problems and repeatedly expose older adults to changing task demands and environmental constraints have been effective in reducing the risk of falls (Buchner, Cress, & de Lateur, 1997; Shumway-Cook, Gruber, Baldwin, & Liao, 1997).

The community-based FallProof™ balance and mobility training program has been successful in the reduction of fall risk by targeting the source of underlying
impairments that contribute to postural instability thereby helping older adults remain independent (Rose, 2010). The FallProof™ program begins with a thorough screening of the older adult participant in order to identify health and physical activity patterns. In order to get a better understanding of each client’s ability level, professionally trained FallProof™ specialists administer assessments that are designed to measure functional ability and multiple dimensions of balance and mobility. Through the use of standardized assessment tools, the specialist is able to identify underlying impairments that may contribute to functional limitations. This comprehensive assessment process facilitates the development of a balance and mobility program that is designed to meet the client’s individualized needs (Pynoos, Rose, Rubenstein, Choi, & Sabata, 2006).

There are six major components of FallProof™: 1) center-of-gravity control training, 2) multi-sensory training, 3) postural strategy training, 4) gait pattern enhancement and variation training, 5) strength and endurance training, and 6) flexibility training. Fall risk reduction research indicates that a balance training program that challenges the visual, vestibular, and somatosensory systems is highly effective in reducing the incidence of falls among community dwelling older adults who are at risk of falls (Rose, 2005; Woollacott, 2000).

FallProof™ at Home (FAH) DVD series is the home version of the FallProof™ balance and mobility training program and there is currently no research examining its effectiveness in reducing fall risk. The present 12-week study evaluated how participation in the FAH program impacted fall risk, select functional fitness parameters, and balance-related self-confidence among community-dwelling older adults who were
identified as moderate to high risk of falls.

Statement of Purpose

The purpose of this study is to investigate the benefits of participating in the FallProof™ at Home (FAH) balance and mobility program for older adults identified at moderate to high risk of falls and living in the communities of Sacramento, California.

Delimitations

The results of this study cannot be generalized to the general population because the intervention targeted older adults with a history of falls. The results of the study represent the effects of a prevention program on a risk group and not all older adults are at risk of falls.

The following limitations were applied to restrict the scope of the study:

- The study targeted only healthy adults over age 65, who live independently in a home or apartment in local communities of Sacramento, California
- Participants could not use an assistive device for mobility
- Participants must have fallen at least once in the prior year and/or be identified at risk for falls
- No person could be living with cognitive impairment, heart disease, or a respiratory, circulatory, or neurological condition
- Participants were required to have a DVD player at home or access to one three times per week

Limitations

The following limitations were observed in this study:
Although Sacramento is one of the most ethnically diverse communities in the country, the intervention group did not reflect this cultural diversity (85.7% were White, 11.4% were Asian, and 2.9% were unknown). Also, females were disproportionately represented in the study (91.4%).

The sample size was small, which lowered statistical power to detect significant differences. There was missing data due to attrition (participant dropped out due to travel, sickness, or falls) of both the study and intervention groups.

The recruitment period was a short timeframe. The majority of participants learned about the study through the City of Sacramento’s 50+ newsletter. Thus, potential candidates were older adults who were already active in community programs or concerned about fitness and wellness. To obtain a more diverse group, the study could have been listed in the local newspaper, among local home health care agencies, and at local senior centers at least six months prior to beginning the study.

Participants may have been inaccurate and/or dishonest in recording their exercises. A person may want to be the ‘perfect’ study participant who engaged in the exercises as recommended when in fact she/he did not. The Hawthorne effect may motivate participants to adhere to the program due to desire to “please the researcher” and “not let her down”.

Participants may have lacked the social structure to adhere to the program for the entire study period. Research has found that home-based programs lack
social structure and accountability; two important factors to program adherence and motivation (Williams, Mustian, & Kovacs, 2002). Because the FAH program was originally intended to supplement a community-based exercise class, these factors were not addressed in the intervention.

- Research bias may have influenced the results. As a certified FallProof™ balance and mobility instructor, the researcher wholeheartedly endorses the program. These feelings could have been transmitted to participants during the study period.

- Participants may be familiar with the researcher, a fall prevention consultant in the Sacramento area and her enthusiasm for taking responsibility for one’s well-being in order to reduce the risk of a fall. Some older adults may want to please those in authority. The researcher presents fall prevention workshops in partnership with the City of Sacramento’s 50+ Wellness Program as part of a community-based grant program. There were three workshops offered to Sacramento residents during the summer. Attendance at one of the researcher’s workshops could have given some participants a slight advantage since the live presentation provided additional exercises and movement modifications that were not offered in the FAH program.

- It is conceivable that the control group would not decrease fall risk and the intervention group should improve scores on the FAB since evidence-based research clearly supports exercise as a key component to fall risk reduction among older adults (Rose, 2005). Thus, the effects of exercise versus no
exercise are predictable. However, the present study was a pilot program intended to provide support for the FAH program and not to validate the effectiveness of exercise and fall risk reduction.

Operational Definitions

Consensus is needed among researchers so that fall prevention research measures the same components in order to determine the effectiveness of fall prevention interventions. Thus, the following operational definitions were used in this study:

**Accidental fall:** an unexpected event in which the participant comes to rest on the ground, floor or lower level (Lord, 2003; Rose, 2010).

**Balance Efficacy Scale (BES):** an 18-item questionnaire designed to measure self-perceived confidence in a person’s ability to successfully perform a given task without losing her/his balance. Final score is computed by summing up the individual items and dividing by 18 to yield a mean BES (Rose, 2010).

**Center of Gravity Control Training (COG):** also referred to as center of mass (COM). In terms of gravitational forces that act on the body and the body’s motion, the COG/COM is the point at which all the mass of the body is concentrated (Rose, 2010).

**Chair Stand:** A reliable and valid Senior Fitness Test (SFT) item designed to measure lower body strength. This norm-referenced test demonstrates how an individual performed in comparison to her/his peers of same age and gender. The task is a timed test, and the greater the number of chair stands, the greater lower extremity strength (Jones, Rikli, and Beam, 1999).
**Community-dwelling older adult:** an adult over the age of 65 who lives in the community and does not need assistance with the activities of daily life. This person does not have any cognitive impairment and is not under the care of a primary physician for a condition or chronic, debilitating disease.

**FallProof™:** an evidence-based balance and mobility program designed to progressively challenge high functioning, older adults who have fallen or are concerned about falling. Eligibility requirements for the community-based program are: community dwelling, able to safely walk a distance of 200 feet without the use of any assistive device (cane or walker), no memory loss or cognitive impairment, no unstable medical condition (e.g., uncontrolled diabetes, cardiovascular disease, high blood pressure, or asthma). There are six components of training covered in the program: Center of Gravity Control training, Multisensory training, Postural Strategy training, Gait Pattern Enhancement Variation training, Strength & Endurance training and Flexibility training (Rose, 2010).

**FallProof at Home program (FAH):** a progressively challenging 3-level DVD series that can be done at home and requires minimal equipment. Each DVD includes the following segments: warm up, balance training, strength training, and flexibility exercises.

**Fullerton Advanced Balance (FAB) scale:** a 10-item fitness test designed to assess the musculoskeletal and sensory systems involved in balance and mobility. The FAB is appropriate for higher functioning community dwelling older adults. Trained instructors grade participants using an ordinal scale (4 is the best and 0 is the worst).
Highest possible score is 40 and those who score 25 or less are identified “at risk” for falls. The FAB includes two subscales, sensory reception and integration abilities and motor coordination skills. High test-retest, inter-rater, and intra-rater reliability has been shown on the FAB (Hernandez & Rose, 2008; Rose, Lucchese, & Wiersma, 2006; Schleiter, 2010).

Gait Pattern Enhancement and Variation Training (GPEV): application of balance activities such as center of gravity, multisensory, and postural strategy training. GPEV training helps older adults achieve a gait pattern that is efficient, flexible, and adaptable to changing tasks and the environment (Rose, 2010).

Health History Questionnaire (HHQ): an assessment tool used to identify current health status and need for assistance in activities of daily living.

High fall risk: a score of 25 or less on the FAB scale, BES score <50, history of falls, and/or <50th percentile on the Chair Stand and/or Sit and Reach test items per individual basis.

Multisensory training (MST): exercises designed to improve the three sensory systems involved in balance and mobility-vision, vestibular, and somatosensory (Rose, 2010).

Postural control strategies: the ability of an individual to maintain the position of the body, or more specifically, its center of mass within specific boundaries of space, referred to as stability limits (Horak, 2006; Lord, Clark, & Webster, 1991; Rose, 2010).
Stability limits: the maximum region of space one can move the center of gravity without changing base of support or losing balance (Rose, 2010; Woollacott, 2000)

Sit and Reach: a norm-referenced Senior Fitness Test item designed to measure lower body flexibility. Results of the test show how an individual is aging in comparison to peers of similar age and gender. Distance from/past toes indicates hamstring flexibility and the further one can reach past toes, the more flexible she/he is (Jones, Rikli, Max, & Nofall, 1998).

Hypotheses

11. Participation in FallProof™ at Home DVD program and fall risk:
   a) There would be no significant difference between the control group and intervention group on the pre-test measure of fall risk after completing the Fullerton Advanced Balance (FAB) Scale.
   b) The intervention group would lower fall risk as evidenced by post-study FAB measure.

11. Participation in FallProof™ at Home DVD program and lower body strength:
   a) There would be no significant difference between the control group and the intervention group on pre-test measure of lower body strength by performing the “Chair Stand” from the Senior Fitness Test (SFT).
   b) The intervention group would demonstrate greater lower body strength on the post-study Chair Stand measure.

3. Participation in FallProof™ at Home DVD program and lower body flexibility:
a) There would be no significant difference between the control group and the intervention group on the pre-test measure of lower body flexibility by performing the “Sit and Reach” from the SFT.

b) The intervention group would have greater lower body flexibility on the post-study Sit and Reach measure.

11. Participation in FallProof™ at Home DVD program and balance confidence:

a) There would be no significant difference between the control group and the intervention group on the pre-test measure of self-perceived balance confidence from completing the Balance Efficacy Scale (BES) score.

b) The intervention group would have higher self-perceived balance confidence on the post-study BES measure.
Chapter 2

REVIEW OF LITERATURE

As the number of older adults grows exponentially, falls among this population are quickly becoming a public health concern. An estimated 35-40% of adults over the age of 65 will fall each year and 20% of those falls result in serious injury (Beattie, 2008). The Center for Disease and Control (2006) reported that falls are the leading cause of injury death among adults over the age of 65 and the most common cause of nonfatal injuries and hospital admissions for trauma. As a result, many falls result in premature institutionalization due to loss of independence, secondary complications and a reduced quality of life due to fear of falling again (Lord & Dayhew, 2001).

The purpose of this literature review is to explain how costly a fall can be not only to an older adult but also to society in light of the aging baby boomer population. Although falls are associated with aging, they are not an inevitable part of growing older; the risk can be reduced (American Geriatrics Society, 2001). This review of literature will consider the different types of fall risk reduction programs and the legislation that supports a multifactorial approach to reducing the incidence of falls. Numerous fall prevention research studies have identified intrinsic and extrinsic fall risk factors as well as demonstrated the effectiveness of exercise in the reduction of these risks (Jette et al., 1999; Rose, 2005; Rubenstein, 2006; Shumway-Cook et al., 2007). A review of fall prevention literature will identify the physical causes that contribute to falls as well as evidence-based training programs that address the underlying impairments that increase
the risk of a fall. Finally, Dr. Debra Rose’s FallProof™ balance and mobility program will be discussed.

Cost of Falls to Society

Falls have come into the national spotlight with the explosion of the baby boomer population and the consequences of a fall being recognized. The demographic projections are startling but the sudden population growth after World War II and advances in medical technology have resulted in an exploding number of aging adults. By 2025, one in five Americans will be over 65, while the 85 and older population doubles every 30 years (Federal Interagency Forum on Aging-Related Statistics, 2010).

One in three Americans over the age of 65 who lives in the community falls each year and falls are the leading cause of accidental death and injury-related death among older adults (CDC, 2006). While an accidental fall can cost a person her/his independence, non-fatal fall services such as emergency response care, hospital-related medical services, and physician care cost society billions of dollars and the burden of these costs is passed onto taxpayers in society. In 2000, direct medical costs of falls totaled a little over $19 billion-$179 million for fatal falls and $19 billion for nonfatal fall injuries (Nishita & Choi, 2005).

Fall-related hospital admission rates increase with age. In 2000, 39% of older adults who were admitted to a hospital after a fall were over 85 years of age (Beattie, 2008). For those of ages 70-79 years, 27.7% of injury-related deaths are attributable to falling. This proportion increases to 46.4 and 64.8% for those aged 80-89 years and 90-99 years, respectively (Beattie, 2008). Among older Californians aged 60-64, the rate of
hospitalized fall injuries was 420 per 100,000 in 2000 and this rate jumped dramatically to 5,321 per 100,000 among those 85 years and older in 2004 (Trent, 2009). Falls are costly not only to society but also to individuals and families with fall-related hospitalizations averaging more than $40,000 (Trent, 2009). The graying of America will cause these costs to triple unless something is done to reduce fall incidence.

Although medical technology is enabling people to live longer, the cost to keep a person alive increases with age. Similarly, the cost of medical care for fall-related injuries increases with age (DeVito, Morgan, Duque, Abdel-Moty, & Virnig, 2003). Falls account for 87% of all fractures and the length of a hospital stay increases proportionately with age (DeVito et al, 2003). In 2001, Medicare paid over $4.7 billion for fall-related hip fractures and it is estimated that cost will reach $32.4 billion in 2020 and as much as $240 billion in 2040 (Beattie, 2008). Among Older Californians, 20% of older adults who fall die within one year after a hip fracture and 25% of hip fractures are still in a nursing home one year later (Beattie, 2008).

In 2008, the average annual rate for a private nursing home room was $76,460 and nursing home costs are increasing approximately four percent per year (Genworth Financial, 2008). Fortunately, baby boomers are more educated about the health benefits of a consistent exercise program and according to recent research, boomers want activities to be more active (Dudiak, 2009). A national preventative approach to fall risk reduction is necessary as the baby boomers age and the cost of healthcare continues to escalate.
Fall Prevention Legislation

The Elder Fall Prevention Act of 2002 was the first legislation to recognize the problem of falls among older adults and although the bill did not become a law, it recognized the importance of assessment and prevention of falls through education and demonstration projects (Tapas, 2002). Unfortunately without fall prevention legislation and community outreach, the number of older adults who fell and those afraid of falling continues to increase. The fear of falling can be paralyzing and detrimentally affect the quality of life for millions of older adults (Crane, 2002; Reelick, van Iersel, Kessels, & Olde Rikkert, 2009). As cited by Beattie (2002), a study by Gagnon and Flint indicated that 20-60% of community dwelling older adults are afraid of falling and 83% of those who have already fallen are living in fear of falling again. Those who fall become afraid of falling again and become trapped in what is known as the “Cycle of Fear”. Fear of falling causes the adult to limit physical activities, which can lead to social isolation, depression and accelerated physical deterioration (Brouwer, Walker, Rydah, & Culham, 2003; Lord & Dayhew, 2001). Older adults who fall lose confidence in their ability to function safely in their activities of daily living thereby increasing the risk of another fall.

In April 2008, the Safety of Seniors (SOS) Act was unanimously passed into law and called for a public-awareness campaign that combined education with strategies to reduce the risk of fall (Beattie, 2008). The SOS Act recognized the need for fall prevention programs at the community-level targeting healthy, independent older adults (Thobaben, 2009). The SOS Act was the first federal legislation that established funding for educational programs to increase awareness of fall risk factors, exercise programs to
reduce the risk of falling and home modification assistance to make sure the home is a safe environment. Due to recent economic turbulence, federal and state governments do not have money for these types of programs. This is problematic because there are increasing numbers of older adults living in their homes with greater amounts of leisure time as a result of retirement; either forced, early or planned (Federal Interagency Forum on Aging-Related Statistics, 2010). Until federal and state funding can provide these prevention-based programs, local communities must implement evidence-based programs that benefit the greatest number of residents in a cost-efficient manner. According to fall prevention researchers and experts, strategies such as community-based fall risk education and exercise training can reduce the incidence of falls among the aging population thereby improving quality of life by prolonging years of independent living factors are the home environment, footwear, nutrition, socialization patterns and activity (Nishita & Choi, 2005; Tinetti et al., 1994; Vaapio et al., 2007).

Types of Fall Risk Factors

One third of community-dwelling older adults fall each year and up to 50% of those falls could be prevented (NSC, 2009). No one intends to fall; a fall is an accident with numerous causes. Research has identified intrinsic and extrinsic fall risk factors, some modifiable and some not (Pynoos et al, 2006; Rubenstein, 2006). In order to reduce the risk of falling, a person must be aware of these factors. Extrinsic risk factors occur outside of the individual and are usually modifiable. Examples of extrinsic fall risk levels. Approximately 60% of falls occur in the home and the most common environmental issues are surface and lighting-related (Nishita & Choi, 2005). It is
recognized that fall prevention programs that include two or more of the following are identified as multifactorial approaches to fall risk reduction: education about falls, environmental safety, medication management, home safety modification, and/or an exercise component (CDC, 2007; Rose, 2005; Shumway-Cook et al., 2007; Thobaben, 2009). Programs that implement strategies that address two or more risk factors result in significant reduction of fall incidence among older adults living in the community (Tinetti, 2008; Tinetti, McAvay, & Claus, 1996).

Intrinsic risk factors are processes going on within the individual and include declines associated with advanced age, presence of medical conditions, number of and type of medications, quality of cognitive state, and general attitude (Rose, 2010; Rubenstein, 2006; Tinetti et al, 1994). Some intrinsic fall risk factors are not modifiable.

**Perception-Action Cycle**

Intrinsic risk factors are inevitable physical declines associated with the aging process. In order to maintain balance, information from sensory input is processed to plan actions, anticipate changes, and react to changes that have already occurred in the environment (Rose, 2010). Simply put, balance control is about senses and muscles. The ability of the sensory system to detect changes in the environment affects the motor system’s ability to react appropriately to these challenges (Lord, 2006; Lord & Dayhew, 2001; Rose, 2010). The intricate messenger system between the sensory and motor systems is referred to as the perception-action cycle (Lord, 2006; Rose, 2010) and is best described by Nashner’s dynamic equilibrium model (Figure 1 below).
The speed and accuracy of physical reaction is based upon the quality of sensory input and the ability to remember how to react in given circumstances (Tang & Woollacott, 1998). In other words, cognitive impairment or attention deficit affects appropriateness of response to imbalance (Dickin & Rose, 200; Shumway-Cook, Woollacott, Kerns, & Baldwin, 1997).

**Cognitive Changes**

Common cognitive impairments associated with aging process are a reduction in working memory, attentional demands, and fluid memory (Rose, 2010). This cognitive decline results in an inability to recall appropriate responses quickly, difficulty dividing attention between two or more tasks and an impaired ability to “think on the fly” or problem solve on the move (Rose, 2010; Shumway-Cook et al., 1997). These cognitive
delays affect anticipated and reactive postural control following disturbances to balance equilibrium (Tang & Woollacott, 1998).

There are research studies that indicate fall prevention programs are not effective in persons living with cognitive impairment due to slowed central processing speeds (Horak, 2006; Rubenstein, 2006; Gillespie, Gillespie, Cumming, Lamb, & Rowe, 2001; Vassallo et al., 2009). Slowed central processing speed affects individual response to changes in the environment or task demand, making it difficult to inhibit inappropriate responses as evidenced by over- or under-reacting following an imbalance (Rose, 2010).

On the other hand, a study by Lui-Ambrose et al. (2008) found that the Otago home-based strength and balance program improved the executive process of response inhibition by 12.8%. This is significant since current evidence suggests that response inhibition is highly relevant to falls prevention (Verghese et al., 2002).

**Sensory Input**

The sensory systems that provide input relative to balance are the vision, vestibular and somatosensory systems (Lord, Lloyd, & Li, 1996; Rose, 2010; Woollacott, 2000). Peripheral sensory receptors gather and relay information to the central sensory component where the information is processed to determine where the body is in space. This action-planning phase determines the appropriate reaction to the information received (Rose, 2010). The speed and accuracy of sensory input transmitted for central processing of musculoskeletal response determines ability to prevent a fall.

The inevitable changes that occur in the central and peripheral components of the sensory system due to aging negatively impact the ability to remain balanced (Rose,
The decline in the quality of sensory input to the central sensory system results in slower processing of input, poorer integration of sensory inputs, and altered perception of body position in space (Rose, 2010). This delayed transmission of sensory information results is a slower reaction time. Slowed reflexes coupled with decreased strength associated with aging detrimentally affects the ability to react in a timely manner to unexpected imbalances and a fall is the common consequence.

Studies by Lord (2006) and Tang and Woollacott (1998) estimate that half of slips, trips, and stumbles are due to delayed reaction time during the walking or standing position. Evidence supports the reversal of these age-related changes with specific balance training that is practiced often (Campbell, Robertson, Gardner, Norton, & Buckner, 1999).

Vision

Age-related changes in vision that affect balance include reduced acuity, depth perception, and contrast sensitivity as well as reduced peripheral vision (Lord, 2006; Rose, 2010; Steinman, Pynoos, & Nguyen, 2009). Researchers agree that reduced depth perception has the greatest impact on obstacle avoidance and fall risk (Lord & Dayhew, 2001; Weerdsteijn et al., 2006). This is important for the prevention of falls among older adults living in the community since an estimated 50% of falls are due to trips and slips, usually occur while walking (Berg et al., 1997).

Visual input provides information not only about body position in space but also spatial location of objects in environment (Lord & Dayhew, 2001; Rose, 2010). Higher functioning older adults must be able to negotiate obstacles in the environment in order to
reduce the risk of a fall. A study by Lord, Dayhew, & Howland (2002) demonstrated increased fall risk in older adults who wear multifocal glasses because the near-vision lower lens segment blurs floor-level objects at critical distances thus impairing ability to detect environmental hazards. This factor may represent a significant problem for older people, as they are more likely to fall over hazardous objects. Thus, older adults need to be aware of the increased fall risk associated with multifocal eyeglasses (Lord, 2006).

An estimated one in four adults over the age of 75 reports some form of visual impairment (Steinman et al., 2009). As the number of older adults living with vision impairment increases, the need for programs that increase knowledge of fall risk associated with specific eye diseases is imperative. Since humans rely mostly on input from vision for balance, it is necessary that older adults learn how to utilize input from other senses while still able to use vision in order to reduce fall risk (Bach-y-Rita & Kercel, 2003; Rose, 2010; Steinman et al., 2009).

*Somatosensation*

Receptors in the somatosensory system provide information about touch, temperature, pain, and body position (Bleyenheuft & Thonnard, 2009). Structural and functional declines of the somatosensory system occur with aging and potentially contribute to postural instability in older adults (Kenshalo, 1986; Shaffer & Harrison, 2007). As a result, older adults have a reduced ability to feel contact between the feet and the ground. This loss of sensation results in greater postural sway to determine body position in space. A study by Kristinsdottir, Fransson & Magnusson (2001) demonstrated elderly subjects with impaired vibration sensation had increased high frequency sway
compared to adults and the elderly subjects with intact sensation. This postural instability contributes to increased fall risk. Several research studies have proven the relationship between increased fall risk and poor vibration sense and proprioception (Kenshalo, 1986; Perret & Reglis, 1970; Richardson & Hurvitz, 1995).

Changes in the somatosensory system directly affect not only postural stability but also ability to regain balance following an unexpected disturbance to the system (Rose, 2010; Shumway-Cook et al., 1997). The ability to react to an imbalance in an appropriate manner is crucial to safety and independence as a person ages. When somatosensory loss is permanent, such as peripheral neuropathy, it is necessary to force the use of other sensory inputs to reduce fall risk (Allet et al, 2009; Rose, 2010). However when loss of sensation is temporary, balance training programs that force the use of somatosensory receptors is recommended (Rose, 2010; Woollacott, 2000).

Vestibular

The vestibular system is activated every time a person turns the head and the vestibulo-ocular reflex (VOR) helps stabilize vision during rapid head movements (Rose, 2010). Age-related changes to the vestibular system include a reduced number of hair cells in the inner ear which results in a decreased sensitivity to head movements. If a person does not experience classic vertigo dizziness symptoms, impairment in the vestibular system may go undetected until there is a loss of balance while other sensory systems are engaged and/or impaired (Kaye, 2006). Research indicates that impairments in the vestibular system can affect balance and mobility while walking across uneven surfaces at night or in crowded spaces (Berg, Alessio, Mills, & Tong, 1997; Woollacott,
Thus, early detection of impairment of the vestibular system can reduce dizziness and the risk of an accidental fall.

Fall Prevention Exercise Components

Aging is a unique experience that is different for everyone and there is not a one-size-fits-all approach to the reduction of fall risk among a diverse group of aging individuals who represent three different generations (Hobbs, n.d; Rose, 2005). Research studies have clearly demonstrated the effectiveness of exercise, either as a single intervention or part of multi-factorial strategy, in the reduction of fall risk factors (DeVito et al., 2003; Gillespie et al., 2001; Haines et al., 2009; Jette et al., 1999; Tinetti, 2003). Despite the overwhelming evidence that supports the benefits associated with exercise, 33% of males and 50% of females over the age of 75 engage in no physical activity (Federal Interagency Forum on Aging-Related Statistics, 2010). Researchers agree that exercise programs that incorporate strength, balance, flexibility, and endurance components can reduce the risk of falls among community dwelling older adults (Freiberger, Menz, Abu-Omar, & Rutten, 2007; Nelson et al., 2007; Rose, 2010; Rubenstein, 2006; Tinetti, 2003; Wescott, 1999).

Strength

Adults need lean muscle mass to perform activities of daily living and remain independent. Muscle fibers begin to atrophy at a rate of five percent per decade after the age of 30 and by the seventh decade of life, muscle fiber loss accelerates to 20% per decade (Skelton, 2006). Muscle weakness has been identified as the number one risk factor contributing to falls (Rubenstein & Josephson, 2002). However, the good news is
that it is never too late to benefit from consistent movement; older adults can increase strength by following a consistent exercise program (de Bruin & Murer, 2007; Fahlman, Morgran, McNevin, Topp, & Boardley, 2007; Jette et al., 1999; Wescott, 1999).

Exercise scientists who study the aging process and the physical decline associated with advanced age have identified sarcopenia as the natural loss of muscle mass and strength (Rosenberg, 1989). Lower body weakness has been identified as the leading factor contributing to limited mobility and increased risk of falls among older adults (Rubenstein, 2006; Tinetti, 1994). Fall prevention exercise research studies have demonstrated the effectiveness of strength training on all muscle groups, particularly lower extremities, and fall risk reduction for people of all ages and functional abilities (AGS, 2001; Liu-Ambrose et al., 2008; Rubenstein, 2006; Yeom, Keller, & Fleury, 2009).

A 25-year longitudinal study of 20 men who exercised 5 times per week demonstrated that most of the decline in older adults is due to disuse rather than aging (Skelton, 2006). A sedentary lifestyle exasperates the physical decline associated with aging so in order to remain independent, older adults must maintain strength.

In two studies, Jette et al. (1999) and Wescott (1999) demonstrated that it is never too late to benefit from a strengthening program. In both studies, frail participants over the age 75 showed the greatest improvement as a result of resistance training intervention. Regardless of age and physical condition, older adults demonstrate improvement when participating in strengthening interventions. Thus, the American
Geriatrics Society (2001) strongly recommends a strengthening component as part of older adult programs designed to reduce fall risk.

**Flexibility**

The ability to move a joint through the full range of motion enables a person to perform daily activities of life with a reduced risk of losing balance. Similar to strength, flexibility decreases with age. However, loss of flexibility is joint specific. Age-related declines in lower-extremity joint range of motion are more evident due to gait and mobility limitations (Rose, 2010). A review of fall prevention research studies indicates that the best way to prevent falls is to minimize loss of muscle strength and flexibility of older people (Binder et al., 2002; DeVito et al., 2003). A study by Kannus, Sievanen, Palvanen, Jarvinen, and Parkkan (2005) demonstrated that strength and flexibility not only promote balance but also determine reaction time and gait.

The sciences of anatomy and physiology prove that flexibility decreases as we age due to physiological changes that cause tendons and muscles to lose their elasticity; the older a person gets, the more she/he needs to stretch (Neuman, 2002; Phipps, Marek, Monahan, Neighbors, & Sands, 2003). Thus, the inclusion of flexibility training in a fall prevention exercise program is undisputed among fall prevention researchers and experts.

**Endurance**

The American College of Sports Medicine (ACSM), American Heart Association (AHA) and the US Department of Health & Human Services (DHHS) concur that in addition to strength and flexibility exercises and balance and mobility training, cardiorespiratory endurance is a necessary component of a successful fall prevention
exercise program (Nelson et al., 2007). Endurance is defined as the ability to engage in activities of daily living or sustained total body movement without fatigue (Nelson et al., 2007).

Age-appropriate activities are recommended strategies to improve one’s endurance while reaping cardiovascular benefits. Research studies indicate that older adults can experience as much as 10% increase in walking endurance when following a regular exercise training program (Rubenstein et al., 2000). Research indicates that exercise does not have to be strenuous but consistent in order to be beneficial (Weerdesteyn et al., 2006). The ACSM (2008) recommends that adults over the age of 65 do moderately intense aerobic exercise 30 minutes a day, five days a week or do vigorously intense aerobic exercise 20 minutes a day, 3 days a week and do eight to 10 strength-training exercises, 10-15 repetitions of each exercise twice to three times per week. If a person has been identified at risk of falling, it is recommended that she/he perform balance exercises and have a physical activity plan.

**Balance**

Balance is an obvious skill that needs to be maintained in order to reduce the risk of a fall. Fall prevention research has identified two kinds of balance; static and dynamic (Rogers, Rogers, Takeshima, & Islam, 2003). Static balance is the ability to maintain postural control in a quiet stance (Neumann, 2002). Falls have been associated with a decrease in static balance, as determined by the ability to maintain a stance and postural sway. Dynamic balance is the ability to anticipate changes and coordinate muscle activity in response to perturbations of stability (Lord, 2003; Rogers et al., 2003; Rose,
Dynamic balance is also used during forward, sideways, and backward leaning. Static balance is maintained in the elderly until significant functional declines occur, while losses in dynamic balance occur much earlier. A fall prevention program that focuses on both static and dynamic balance is more effective than a single intervention.

Regardless of the individual, environment or task, balance is an intricate messenger system between the sensory and motor systems and requires quick perception and reaction times (Horak, 2006; Lord, 2003; Rose, 2005; Woollacott, 2000). In order to reduce the risk of falls, it becomes increasingly necessary to train both the motor and sensory systems to counteract the effects of aging. Scientific study of the human body proves that the components of balance are affected by the aging process and fall prevention research studies demonstrate that balance can be improved with specific exercise training (Freiberger, Menz, Abu-Omar & Rutten, 2007; Gardner, Robertson, & Campbell, 2000).

As previously mentioned, the three sensory systems (the visual, vestibular and somatosensory) that contribute to balance and mobility experience significant changes as a result of the natural aging process. However, balance disorders can be improved with training. Programs at the USC Balance Center, Mayo Clinic, University of South Florida and Oregon State University that diagnose and treat balance disorders show 30% to 40% decrease in falls among independent living senior patients (Kaye, 2006). This success is the result of focused assessments, individualized programming, consistent
implementation and ongoing evaluation to determine the effectiveness of fall prevention programs (Pynoos et al., 2006; Rose, 2010; Rubenstein, 2006).

Evidence-based Fall Prevention Strategies

Balance control is a complex network that involves multiple body systems. As researchers discover the intricacies of this dynamic messenger system referred to as balance or postural control, a greater understanding of the contributing subsystems is necessary. The American Geriatrics Society and British Society of Geriatrics (2001) established fall prevention guidelines in order to identify those older adults at risk of falls. Similarly, the panel of experts at the Fall Prevention Center of Excellence reported the most effective Evidence-Based Interventions in Fall Prevention (2006). Both reports provide recommendations for effective fall prevention interventions. The following fall risk reduction strategies apply a systems-based approach to balance control.

**Multisensory Training**

In a well-lit environment with a firm base of support, healthy persons rely on somatosensory (70%), vision (10%) and vestibular (20%) information to determine body position in relation to the environment (Peret & Reigls, 1970). Because the somatosensory system provides sensory information while standing on a firm surface, a person living with an impaired ability to gather information about the surface beneath the feet is at an increased risk of falling. If vision is impaired, the body has difficulty with postural orientation thereby increasing the risk of a fall. If the vestibular system is deficient, a person does not know if it is her or the world that is moving which results in dizziness that increases the risk of a fall. Thus, if one system becomes compromised, it is
important to improve function of the other sensory systems before balance is permanently affected (Rose, 2005). Exercise programs that implement multisensory training activities that target the body systems involved in balance and mobility are effective in minimizing fall risk (Hu & Woollacott, 1994).

**Postural Strategy Training**

Posture is defined as the biomechanical alignment of the individual body parts as well as the orientation of the body to the environment (Neumann, 2002; Rose, 2010). Unfortunately, the body takes the path of least resistance so muscle weakness coupled with the forces of gravity result in poor posture. As previously mentioned, there is inevitable decline of both the sensory and motor systems associated with aging. Postural control is a complex motor skill that is dependent on the interaction of multiple sensorimotor processes (Horak, 2006). As postural stability is affected by muscle weakness, older adults develop maladaptive perceptions of true vertical and begin to adopt abnormal standing postures (Rose, 2010). The maladaptive posture commonly associated with advanced age is forward head, kyphosis, lordosis, hip flexion, and knee flexion. This poor body alignment contributes to an increased risk of falls due to the disruption in postural equilibrium (Horak, 2006; Neumann, 2002). In other words, the body is unable to coordinate sensorimotor strategies to stabilize the body’s center of mass. Inaccurate perception of the actual center of mass reduces limits of stability and increases fall risk (Shumway-Cook et al., 1997).

A limit of stability is the area in which the body can move it’s center of mass while maintaining postural equilibrium without changing it’s base of support (Horak,
This understated fall prevention measure is used to determine the maximum distance a person can lean in a given direction without stepping, losing balance, or reaching for assistance (Newton, 2001; Wallmann, 2001). Limits of stability are influenced by range of motion, muscle strength, and sensory information. As a person ages, the reduced sensory input combined with muscle weakness and loss of flexibility further restrict the limits of stability. Reduced limits of stability affect ability to move efficiently which further increases the fear of falling. (Reelic et al., 2009; Woollacott & Shumway-Cook, 2002).

Therefore, a reduction in limits of stability increases the risk for an individual to be in a situation in which his or her balance is destabilized outside the individual’s area of control, resulting in a fall. Training that orients older adults to center of gravity and postural awareness can significantly improve limits of stability and reduce fall risk. (de Bruin & Murer, 2007; Lord et al., 2001; Rose, 2010).

**Balance and Gait Training**

The broad category of gait problems and weakness is the precipitating cause for 10-25% falls (Rubenstein, 2006) and an overwhelming 50% of falls in community are due to trips and slips that usually occur while walking (Berg et al., 1997; Schiller, Kramarow, & Dey, 2007; Tang & Woollacott, 1998). Although the previously mentioned exercise components are vital to an effective fall prevention program, research indicates that exercises that focus on improving balance and gait are necessary in the reduction of fall risk (Rose, 2005; Rubenstein, 2006). Walking is a dynamic activity that requires lower body strength and flexibility, postural control, and coordination (Neumann, 2002;
As a person ages, physical deterioration is more apparent in large muscles and lower extremities that affect the activities of daily living which is why older adults need to participate in strengthening exercises in order to remain independent.

Further research demonstrates that strength and flexibility training is one of the most effective exercise interventions when coupled with balance and gait training (Rose, 2005). Exercise as stand alone intervention reduced fall risk by 13% but when programs included balance and gait training, the risk of fall was reduced 24% (Rose, 2005). Research indicates that a person with a mobility enhancement problem should start at a low level of intensity and progress with individual adjustment of frequency and intensity (CDC, 2008; Nelson et al., 2007).

Gait problems can stem from simple age-related changes in gait and balance, specific dysfunctions of the nervous, muscular, skeletal, circulatory and respiratory systems or from simple deconditioning following a period of inactivity (Rubenstein, 2006). Because not all balance impairments are the same, a baseline assessment is necessary to identify underlying causes of dysfunction.

**Individualized Programming**

Aging is a unique process that presents different challenges to everyone which is why tailoring an exercise program to address individual risk factors can dramatically reduce incidence of fall (Gillespie et al., 2001; Rose, 2010; Rubenstein, 2006; Skelton, Dinan, Campbell, & Rutherford, 2005). Chronic illness imposes different limitations throughout the progression of the disease (Brawely, Rejeski, & King, 2003). In order for an intervention to meet individual needs, a professional must gather baseline information
to establish functional ability reference point. This assessment enables the professional to identify personal strengths and weaknesses and design an exercise program that can be tailored for people of all fitness levels (Rose, 2005).

Numerous community-based fall prevention research studies demonstrate that fall risk decreases significantly when exercise intervention is individually tailored based on individual risk assessment results (Campbell et al., 1999; Sjosten et al., 2007). A systematic review of fall prevention studies demonstrates that interventions are most effective when individually tailored and targeted to populations identified at high risk of falling.

**Standardized Screening and Assessment**

An intervention is only as good as the assessment. Therefore, assessment of an individual’s risk and deficits is necessary to determine specific needs and deliver effective interventions (AGS, 2001; Stumbo & Peterson, 2009). Screening for fall risk should be performed across a variety of settings. However, it is imperative that a standardized risk assessment tool be used, preferably one which has the highest sensitivity and specificity for use in specific setting and population (Lamb, 2001; Rose, Lucchese, & Wiersma, 2006). Fall prevention research demonstrates that intervention programs are most effective when targeting older adults who have been identified as moderate to high risk of falls (Rose et al., 2006; Yan, Wilber, Wieckowski, & Simmons, 2009). Thus it is critical that the researcher match the assessment tool to the population in order for the measurements to be valid.
Assessment tools are designed to provide objective measurement for screening, baseline status, changes over time, and the effects of interventions. There are a variety of valid and reliable assessment tools that measure dimensions of balance and fall risk among older adults. However, not all assessment tools are appropriate for all older adults. For instance, the Berg Balance Scale (BBS) is an effective measurement tool when assessing frail, older adults but due to ceiling effects, the BBS is not appropriate for healthy, community dwelling older adults (Hernandez & Rose, 2008; Rose et al., 2006; Schlieter, 2010).

Balance assessment tools should meet scientific rigor (reliability and validity), have discrimination power (minimum floor and ceiling effects), and detect meaningful changes (Stumbo & Peterson, 2009). There are assessment tools that measure multiple dimensions of balance and those that measure single factors. Multidimensional tools typically assess a variety of physical characteristics and provide a summary score across all aspects of function (Rogers et al., 2003). Assessing a combination of static and dynamic balance abilities provides a researcher with a better understanding of an individual’s balance control. However, the researcher must match the assessment tool to the population in order for the measurements to be valid.

Duration and Frequency

There is a lack of consensus among fall prevention research studies about the duration, frequency and/or intensity of exercise necessary to reduce fall risk (Rose, 2005; Shumway-Cook et al., 1997; Tinetti, 2008). In a study by Nitz and Choy (2004), researchers discovered that response to intervention improved the more times a week the
exercises were practiced rather than the length of the program. Hauer et al. (2001) showed 12 weeks of an exercise intervention three times per week to positively improve functional ability and Gillies, Aitchison, MacDonald, & Grant (2003) demonstrated functional improvement with a twice-weekly intervention. A systematic review by Yeom, Keller, & Fleury (2009) suggested that significant mobility benefits are experienced with a minimum 12-week intervention, regardless of the frequency of participation each week.

However, if behavior change is an expected outcome, the longer the duration of the program, the more likely the person is to incorporate consistent exercise into his/her routine (Campbell et al., 1997; Williams et al., 2002). The Otago Home-based Exercise program is a 12-month program that has demonstrated a high adherence rate and significant fall risk reduction among older adults (Lui-Ambrose et al., 2008; Thomas et al., 2010). A study by Lord, Ward and Sturdwick (1995) demonstrated that greater adherence to an exercise intervention resulted in greater protection against falls and fall injury. Conversely, short-term, low-intensity programs demonstrate fall risk reduction benefits but participants are less likely to adhere to these types of programs afterward (DeVito et al., 2003). Unfortunately, compliance and adherence to an exercise program is problematic throughout the lifespan.

Service Delivery

Review of fall prevention exercise studies demonstrates that interventions can be successful when practiced in the community or at home (Haines et al., 2009; Jette et al., 1999; Skelton et al., 2005; Thomas et al., 2010). Some older adults prefer the
socialization of group exercise while there are others who like the convenience of a home program. While research indicates that the social support of a group is conducive to adherence, the benefits of home-based programs cannot be understated. Many of the barriers to compliance (i.e., transportation, finances, fear of falling outside of the home, weather, convenience) are eliminated when following an exercise program at home making it easier to access the program (Williams et al., 2002). Fall prevention interventions that combine a group and home-based exercise component significantly lower fall risk (Skelton et al., 2005).

Research studies indicate that home-based adherence increases with self-regulatory skills such as goal setting, self-monitoring and self-reinforcement (Luukinen et al., 2006). The present study included self-monitoring via bi-monthly compliance charts and motivation for adherence to the FallProof™ at Home study was strictly voluntary. Thus, barriers to compliance and motivating factors to program adherence were not analyzed in this study.

In review of fall prevention research studies, only a few studies have tested a progressively challenging exercise program that includes flexibility, strengthening, and progressively challenging balance and mobility components in the home setting (DeVito et al., 2003; Lui-Ambrose et al., 2008; Yan et al., 2009). Most studies combine home visits by a nurse or trained therapist with an exercise program, home safety modifications plus an exercise program, medication management and an exercise component or a community-based exercise program in addition to exercises done in the home (Haines et
Fall prevention research suggests that a group exercise intervention and a home exercise program are the most effective in fall risk reduction as evidenced by a 6.9% reduction in fall risk over 18-month study period (Rose, 2005). While there is data to support the community-based FallProof™ program, there is currently no data on Dr. Rose’s FallProof™ at Home (FAH) program. This study analyzes the efficacy of the FAH program as a single fall prevention exercise intervention done independently in the home.

FallProof™

FallProof™ is an evidence-based program that addresses the multiple dimensions of balance and mobility. Through a comprehensive screening and assessment process, the program explores the underlying causes for falls. The result is a unique exercise program that challenges individual weakness and impairments in a progressive manner. FallProof™ has shown considerable success in a range of settings, including community-based and residential care environments (Pynoos et al., 2006). Similar to the community-based program, FAH is designed for higher functioning, independent older adults who have been identified as moderate to high risk of falls.

Theory Behind FallProof™

This literature review has identified numerous research studies that provide evidence-based support of the design of FallProof™, Dr. Debra Rose’s community-based balance and mobility program (Pynoos et al., 2006; Rubenstein, 2006). Even though falls
are accidents, there are underlying causes that contribute to unsteadiness and loss of balance. The Nagi Disability Model (1991) describes a four-stage progression to disability and provides a clear distinction between pathology (medical condition), impairments (weakness, sensory loss), functional limitations (bed mobility, stability in standing) and disability (inability to function independently at home, inability to participate in former leisure activities) (Schenkman et al., 1999).

One’s behavior is the focus of intervention in the Nagi model; disability is found in the relationship of an individual’s capacity within his or her environment and the capacity of the person to perform basic tasks or actions (Rose, 2003). A prevention-based approach to falls among older adults emphasizes early detection of impairment and functional limitation in order to reduce subsequent disabilities.

**Systems-based Approach to Fall Risk Reduction**

As previously mentioned, the natural decline of the sensory and motor systems associated with aging negatively impacts balance control. A systems approach to fall prevention enables the professional to identify functional impairment in specific subsystems that contribute to loss of balance control (Shumway-Cook et al., 1997). The systems perspective views balance as a complex interaction between the neural and musculoskeletal systems of the individual and the task and environmental conditions (Rose, 2010; Woollacott, 2000). As intrinsic systems fail to function, the ability to accomplish daily tasks is compromised (Rose, 2003). Knowledge of the body systems that contribute to balance enables a professional to assess the different body systems and identify impairments that contribute to balance dysfunction. An important goal of the
FallProof™ program is to challenge but not exceed the individual’s intrinsic capabilities (Rose, 2010). As falls among the aging population become a public health concern, researchers agree that a systems based approach to fall risk reduction is necessary (AGS, 2001; Rose, 2010; Rubenstein et al., 2003; Woollacott, 2000). These scientifically researched principles are the foundation for the FallProof™ program.

**Standardized Assessment Tools Used in FallProof™**

Fall prevention researchers recommend the use of standardized assessment tools to measure fall risk and link treatment planning to these risk assessments (Lamb, 2001). In order to design a successful intervention program, the assessment tool must match the population (Stumbo & Peterson, 2009). FallProof™ is a balance and mobility program specifically designed for independent community-dwelling older adults identified at moderate to high risk of falls.

Lower extremity weakness, poor endurance, loss of flexibility, slow reaction time to imbalance and slow walking speed have been identified as factors that increase the risk of falls (AGS, 2001; Rose, 2010; Rubenstein, 2006; Tinetti, 2003). Due to these multiple risk factors, a multidimensional approach to screening and assessment is necessary to identify the different impairments, functional limitations, and disabilities that may contribute to falls among older adults. In review of fall prevention literature, it was noted that researchers assessed more than one risk factor pre- and post-study in order to ascertain the impact of intervention on select dimensions of balance (Lui-Ambrose et al., 2008, Pynoos et al., 2006). As recommended by the California Blueprint for Fall
Prevention (2004), FallProof™ begins with a systematic screening process to gather as much information as possible about participants.

The Health History Questionnaire (HHQ) is used to identify medical conditions, medication use, visual and cognitive ability, and physical activity status (Rikli & Jones, 1999). Applied to the Nagi Disability model, the HHQ gains insight to the underlying pathology and lifestyle patterns that contribute to impairment or functional limitations. Numerous fall prevention studies use the Composite Physical Function (CPF) scale to measure functional ability and need for assistance in activities of daily living (Lord, 2006). The HHQ includes a self-report CPF scale to gain a better understanding of functional ability and to identify and predict those at risk of falls.

The Fullerton Advanced Balance (FAB) scale was designed to measure the multiple dimensions of balance and is recommended for functionally independent older adults who live in the community (Rose et al., 2006). When used to assess this population, the FAB has proven to be reliable and valid in identifying functional limitations that contribute to fall risk (Rose et al., 2006). Research studies support the content and convergent validity as well as test-retest and intra- and inter-rater reliability of the FAB (Rose & Hernandez, 2008; Rose et al., 2006; Schlieter, 2010).

The ten-item FAB uses the systems approach to test the motor and sensory body systems in both static and dynamic situations. Dynamic balance tests stress the balance control systems and therefore greater losses in balance are typically seen during these types of tests (Rogers et al., 2003). When working with higher functioning older adults, early detection of impairment is essential to one’s independence. Although fairly new,
the FAB has proven to be a valid balance and mobility assessment tool for the higher functioning older adult population.

The Senior Fitness Test (SFT), formerly known as the Functional Fitness Test (Rickli & Jones, 1999), has proven to be a valid assessment tool to measure physical impairments and functional limitations among older adults. The SFT meets scientific rigor (reliable and valid) and has normative and criterion-referenced performance standards that increase the interpretability of the test items (Jones et al., 1999; Jones et al., 1998). A number of investigators have found that lower body strength and flexibility affect gait and mobility and thus influence the risk of a fall (Lord et al., 1996). In the present study, lower body strength and lower body flexibility were assessed using the SFT Chair Stand and Sit and Reach, respectively.

Numerous fall prevention studies indicate that fear of falling is a predictor of future falls and can severely affect quality of life after a fall (Beattie, 2002; Powell & Meyers, 1995). A commonly used balance confidence assessment tool is the Activities-specific Balance Confidence (ABC) Scale and is a valid and reliable balance confidence assessment tool when used with higher functioning older adults (Powell & Meyers, 1995). In this study, the Balance Efficacy Scale (BES) was used to measure balance confidence. Similar to the ABC scale, the BES measures self-perceived confidence levels on a 0% (no confidence) to 100% (absolutely confident) scale when performing various activities of daily living that require balance and is intended for use among community-dwelling older adults (Rose, 2010). Programs that increase awareness of fall risk while improving self-confidence are needed to address the paralyzing fear of falling.
Individualized Programming in FallProof™

The use of valid assessment tools provides the professional with baseline data that can be used in the development of treatment planning. Individualizing treatment to address the underlying cause of falls is an effective fall prevention strategy. In this study, subjects received the same intervention program and started at level one. However, there were modifications to facilitate participation according to individual ability. Because it is recommended that older adults start exercise programs slowly, the first level of FallProof™ at Home (FAH) program is the easiest and moves at a slower pace than subsequent levels.

Loss of balance is the result of conflict between personal capabilities, task demand and environmental circumstances (Rose, 2010; Woollacott, 2000). The community-based FallProof™ balance and mobility program individualizes balance activities by increasing task demand or changing environmental circumstances when appropriate. FAH participants are able to increase environmental challenges by sitting on a cushion, using adjustable ankle weights and working with a resistance band. To increase task demand, FAH participants have the option of practicing with a narrow or wider base of support, changing placement of arms, or eliminating visual input by closing eyes (Rose, 2010). These modifications were suggested by the FallProof™ instructor on each DVD.

Progressively Challenging Exercises in FallProof™

All participants enrolled in the FallProof™ balance and mobility program undergo extensive screening and assessment in order for the instructor to personalize
activities to individual capabilities according to baseline measurements. Although the class material is presented in a sequential order, individuals will progress at different rates. FallProof™ instructors are professionally trained to increase the difficulty of activities in a manner that is safe for all class participants. Research studies indicate that fall prevention exercises also need to be progressively challenging in order to be effective (Binder et al., 2002; Nitz & Choy, 2004; Tinetti, 2008). The three levels of the FAH provide progressively challenging balance and mobility exercises.

Service Delivery of FallProof™ and Duration, Frequency and Intensity

The community-based FallProof™ program has improve the lives of thousands of older adults living in the communities of Southern California, Fresno, and Florida. The 12-week intensive program meets twice a week to practice progressively challenging balance and mobility techniques led by a highly trained instructor. To the best of this researcher’s knowledge, FallProof™ at Home (FAH) is the first progressively challenging balance and mobility DVD series designed to reduce the risk of falls.

The FAH program was designed to supplement the exercises taught in the community-based class in order to increase the frequency of balance exercise. The more a person practices, the greater the improvement in balance abilities. There is currently no data on the FAH program as a single intervention to be followed at home to reduce the risk of falls.

Summary

Falls among the aging of the population are quickly becoming a public health concern. As the cost of healthcare continues to escalate, the need for fall prevention
programs is undeniable. While falls are accidents, research has demonstrated multiple causes of falls, some modifiable and some not. The more risk factors a person is living with, the greater risk of a fall.

Research indicates interventions that address more than one fall risk factor at a time show significant improvement in risk reduction. However, exercise has been demonstrated to be the single best intervention to reduce loss of balance control. The first step to identifying individual fall risk factors is a thorough screening and assessment process to identify underlying impairments and functional limitations.

Balance is a complex system involving multiple body systems. Unfortunately, the physical decline associated with the natural aging process detrimentally affects the sensory and motor systems involved in balance. Standardized balance and mobility assessment tools that assess functional and physical parameters associated with increased fall risk can help professionals design individually tailored programs to safely challenge system weakness and impairment.

Although strength and flexibility remain central to fall prevention exercise programs, balance training has evolved to include multiple sensory and postural strategies. Muscle weakness, loss of joint flexibility, and sensory decline associated with aging contribute to reduced limits of stability and gait disorders. Whether standing stationary or moving through life, the speed at which sensory information is received, processed and acted upon determines an individual’s ability to adapt to changes in environment or task demand. Research studies demonstrate that older adults can improve
the multiple dimensions of balance through specific training. Successful treatment planning is dependent on valid risk assessment.

FallProof™ is a research-based balance and mobility program designed for higher functioning older adults living in the community who have been identified at moderate to high risk of falls. The FallProof™ multidimensional balance training components can be practiced either in the community or at home. Similar to the community-based program, FallProof™ at Home is progressively challenging. This is a pilot study to determine the effectiveness of the FAH program on select fall risk factors.
Chapter 3

METHODS

The purpose of this study was to investigate the effectiveness of the FallProof™ at Home (FAH) DVD program in improving balance, select functional fitness parameters, and balance-related self-confidence among community dwelling older adults who have been identified as moderate to high risk of falls. Participants were evaluated in terms of fall risk (Fullerton Advanced Balance scale), lower body strength (Senior Fitness Test item, “Chair Stand”), lower body flexibility (Senior Fitness Test item, “Sit and Reach”) and self-perceived balance confidence (Balance Efficacy Scale).

Participants

The participants in this study were 38 older adults, aged 67-89, who live in the communities of Sacramento, California. These volunteer study participants were recruited through the City of Sacramento’s 50+ Wellness program and advertisement flyers that were posted in local community centers, senior centers, farmer’s markets, and coffee shops. Each participant was assessed by a certified FallProof™ instructor and identified “at risk” of falls using the Fullerton Advanced Balance (FAB) scale. Other measures of assessment included lower body strength and lower body flexibility as identified by Senior Fitness Test items, the Chair Stand and Sit and Reach, respectively. Self-perceived balance confidence in different situations was measured using the Balance Efficacy Scale. Participants completed a health history questionnaire to identify current health status and ability to engage in activities of daily living.
Additional inclusion criteria for random assignment into the intervention group (those who participated in the FAH program) or control group included:

- Must live independently in house or apartment
- Do not require an assistive walking device for mobility (FallProof™ criterion is ability to ambulate independently a distance of 200 feet)
- Must have fallen at least once in the prior year or have one or more fall risk factors
- Does not have cognitive impairment
- Does not have heart disease, respiratory, or circulation disease that impairs ability to function independently.
- Does not require assistance with basic daily living tasks
- Does not have a progressive neurological condition (e.g., Parkinson’s Disease)
- Must have a DVD player or access to a player three times a week

Data Collection Materials

Participants completed several measures. The FAB scale is a standardized assessment tool for measuring multiple dimensions of balance and mobility in higher functioning community-dwelling older adults (Hernandez & Rose, 2008; Rose et al., 2006; Schlieter, 2010). The FAB Scale consists of ten items that are scored on a 5-point ordinal scale. The FAB scale includes a combination of static and dynamic balance activities performed in different sensory environments. A total score of 25 or less out of
40 points indicates that the participant is “at risk” of falls. High test-retest reliability (.95) has been demonstrated in the FAB (Rose et al., 2006). The equipment necessary for the FAB is colored masking tape, one 6-inch bench, two foam pads, a 12-inch ruler, a 36-inch ruler, and a metronome (Appendix A).

The Senior Fitness Test (SFT) is a standardized assessment tool that measures fitness parameters in older adults (e.g., lower and upper body strength and flexibility, aerobic endurance, and dynamic balance and agility). Only lower body strength and flexibility were measured using SFT items “Chair Stand” and “Sit and Reach”, respectively. A numeric score is given to the number of times the participant can perform the Chair Stand in 30 seconds, and the participant’s flexibility is measured in the Sit and Reach. The SFT provides norm-referenced standards, and the test–retest reliability values range from .80-.95 for all test items. The equipment needed for these two test items is a chair and a 12-inch ruler.

The Health History Questionnaire (HHQ) is an in-depth assessment tool that is used to gather baseline information about potential FallProof™ participants (Appendix B). This tool is administered before physical assessment and provides information about both past and present medical diagnoses and medications and overall health status. Additionally, the HHQ identifies physical activity and exercise patterns and includes the self-report Composite Physical Function (CPF) scale that assesses function abilities related to basic and instrumental activities of daily living. Individuals who indicate they are able to complete all 12 items are considered high functioning while those who report
being unable to perform six or fewer without difficulty are considered to be low functioning (Rickli & Jones, 2001).

The Balance Efficacy scale (BES) measures self-confidence in performing activities of daily living that require balance and is a good indicator of one’s fear of falling. Research studies indicate that adults who have fallen are afraid of falling again. These individuals restrict their activities, which leads to an increased risk of falling and a compromised quality of life (Tinetti et al., 1994). Participants are asked to rate, on a scale of 0 to 100, how confident they are that they can successfully perform a given task without losing their balance. The BES consists of 18 questions. The total score obtained on the test is divided by 18 to yield a mean BES. Participants who score below 50 on the scale are considered to have low self-confidence (Appendix C). Study participants completed the BES before any of the physical assessments so their self-evaluation of abilities is not influenced by performance on a physical test.

The intervention group received the 3-level, progressive FAH DVD Program. Level 1 consists of exercises using a resistance band and non-weighted ball. Building upon Level 1, Level 2 consists of more challenging exercises using adjustable ankle weights. Level 3 is the most challenging and uses the same equipment used in levels one and two. Compliance charts were used to measure participant’s adherence to the FAH Program and their progress (Appendix D).

Both the control and intervention groups recorded any falls using the Falls Incidence Report (Appendix E), which describes the circumstances surrounding the fall and its consequences (e.g., injury/no injury and any medical treatment).
Procedures

Older adults came to local community and senior centers to be assessed for fall risk using the Fullerton Advanced Balance (FAB) scale. At that time, the research study was briefly explained and all participants were shown a flyer that listed the strict eligibility requirements of the FallProof™ at Home (FAH) DVD exercise study. Participants who met these eligibility requirements and wanted to be a part of the research study were given consent forms to sign (Appendix F).

After reading and signing the consent form, participants completed the HHQ and BES. A research assistant was available for anyone who needed assistance completing these questionnaires. After the paperwork was completed, participants were called into a semi-private room to be assessed by a certified FallProof™ instructor, who was also the researcher in this study. The testing space had to be at least 12’ long and 16’ wide with at least 10’ of wall access.

Participants were assessed for fall risk using the FAB scale. Per protocol instructions, each participant watched the instructor explain and demonstrate each test item. Then the participant performed the test under the instructor’s supervision. The instructor recorded observations after each test item.

Next, the instructor explained and demonstrated the two SFT items, the Chair Stand and Sit and Reach. To measure lower body strength, the participant performed the Chair Stand. With the chair against the wall, the subject sat in the middle of the chair with arms crossed across chest. When the instructor said, “GO”, subject was to stand up and sit down as many times as safely possible in 30 seconds. His/her arms had to remain
against the chest or the stand up didn’t count. The number of times each participant successfully completed this task was recorded.

The Sit and Reach test was used to assess lower body flexibility. The participant sat with one leg extended at the edge of a chair that was placed against the wall. With his/her hands stacked on top of one another, the participant exhaled as he/she leaned as far forward as safely possible. The participant was allowed two practice tests to determine which leg felt more comfortable. The best score was recorded; not able to touch toes was reflected by a negative number, able to touch toes was scored a zero, and the distance past the toes was recorded as a positive number. The greater the positive number, the greater lower body flexibility the participant exhibited.

All assessment tests were scored and ranked within 4 hours of testing. Each participant received an individualized “Report Card”, which stated if she/he was identified at fall risk as indicated by FAB score. Test items that the participant scored 2 or less were listed, but no information was given to indicate how to score better. The Report Card also listed scores and norm-referenced percentile ranks for the two SFT items. For example, if a participant scored 7 on the Chair Stand, the score was listed with the percentile rank comparing her/him to others of similar age and gender. The higher the percentile rank, the better the performance on the test.

After the assessment results were totaled, the researcher identified participants who met both the eligibility criteria and were identified “at risk” of falls. These eligible participants were randomly assigned to one of two groups:

1. The usual activity control group did not receive any intervention but agreed to
retest in 12 weeks. Participants in the control group also agreed to not begin an exercise program during the intervention period. Participants were offered the FAH series at the end of the study period to encourage retest compliance.

2. The *intervention group* participated in the 12-week, 3-level progressive FallProof™ at Home (FAH) Program. Participants were instructed to perform exercises at each level for 4 weeks.

Participants in the intervention group contacted the researcher to schedule an appointment to receive the initial study materials: Level 1 DVD, a resistance band, a non-weighted ball, Compliance Charts, Falls Incidence Reports, and self-addressed, stamped envelopes. Despite different fitness abilities, all participants started at Level 1. On each DVD, the instructor and older adult participants demonstrate how to perform the exercises at all levels, seated, standing using assistance and standing independently. It was recommended that participants use the program at least three times per week and practice the Level 1 exercises for four weeks before progressing to Level 2.

During the third week at level 1, the researcher visited participants at home to deliver the FAH Level 2 DVD, adjustable ankle weights, and more Compliance Charts, Falls Incidence Reports, and self-addressed stamped envelopes. To ensure safety, the researcher observed each participant performing several exercises at current Level 1. Since safety was the primary concern of the study, the participant did not advance to the next level unless the researcher was confident it was within the participant’s physical abilities. Level 2 is progressively more challenging, and the balance challenges build upon the skills learned at Level 1. Participants were instructed to practice these exercises
at least three times per week for four weeks before moving onto Level 3.

Level 3 is the most challenging and again, the researcher visited each participant’s home during the third week of the study at Level 2 to deliver the final DVD with more compliance charts, fall incidence reports, and self-addressed stamped envelopes. Again, the researcher observed the participant performing several Level 2 exercises before recommending progression to Level 3 for safety reasons.

Compliance Charts and Falls Incident Reports were completed by participants every two weeks and returned to the researcher in self-addressed, stamped envelopes. If the chart was not received within five days, the researcher called the participant to check in and remind her/him to send in the completed form.

The researcher arranged post-testing sites for intervention group after 12 weeks of participation in the FAH Program. The control group was notified 9-10 weeks after the pre-test assessments to arrange post-test assessments at same location. They were also offered the FAH Home DVD Program upon completion of post-testing.

Research Design

This pilot study incorporated the true quasi-experimental pretest-posttest research design. After recruitment of a convenience sample, the researcher randomly assigned participants to either the control group or the intervention group, whom performed exercises in the FAH DVD Program. The dependent variables were measured at pre-test and 12 weeks later at post-test:

- Fall risk or balance and mobility (FAB)
- Lower body strength (SFT Chair Stand)
Lower body flexibility (SFT Sit and Reach)

Balance self-confidence (BES)

Data were analyzed using a 2 (Group: Control or Invention) X 2 (Time: Pre-Test and Post-Test) repeated-measures MANOVA to determine differences between groups at each test time and within groups at each test time for all dependent variables. Subsequent univariate analyses and post-hoc comparisons were used to identify specific group differences.

Protocol for Human Subjects Committee

This study was identified “at risk” and was reviewed by the Human Subjects Research Committee at California State University, Sacramento. The FallProof™ program was identified as a best practice health promotion program by the National Council on the Aging in 2006. The developer of the program, Dr. Debra Rose, is the Director of the Center for Successful Aging at California State University, Fullerton and Co-Director of the Fall Prevention Center of Excellence housed at the University of Southern California. Dr. Rose designed the FallProof™ at Home program with the viewer’s safety in mind and it is recommended that the viewer watch the entire DVD before following along. Each DVD thoroughly explains each movement as two older adults demonstrate each exercise at different levels of difficulty. This allows the viewer to see age appropriate models engaging in the movements at different ability levels. Thus, the viewer understands that there is no “one” way to do the exercise and that working within one’s personal limits is the best, and safest, way to improve one’s balance abilities.
All results obtained in this study were kept confidential. Individual performance was not reported but only the results of participants as a group. Information provided on the consent form and the health history questionnaire was stored separately from data from the exercise tests and the participant name was marked out with a permanent black magic marker for privacy; the exercise test data contained no personal information. Each participant had a file containing all completed paperwork. These files were kept in a file cabinet in the researcher’s apartment, under lock and key. Personalized results and possible interpretations from the pre-and post-test FAB scale assessment were offered to all subjects after the study.
Chapter 4

RESULTS

The purpose of this study was to examine the efficacy of the FallProof™ at Home (FAH) program on fall risk using standardized testing protocols in higher functioning, community-dwelling older adults. The study was performed over a 12-week period that involved participating in the FAH progressively challenging balance and mobility DVD series at home. The participants were pre–tested at eight different testing sites for fall risk, lower body strength, lower body flexibility, and balance confidence. At the end of the 12-week study period, the study participants were tested again on the same variables.

Hypotheses

11. Participation in the FallProof™ at Home (FAH) program and fall risk:

a) There would be no significant difference between the control group and intervention group on the pre-test measure of fall risk after completing the Fullerton Advanced Balance (FAB) Scale.

b) The intervention group would have a lower fall risk on the post-test FAB measure.

11. Participation in the FallProof™ at Home (FAH) program and lower body strength:

a) There would be no significant difference between the control group and the intervention group on pre-test measure of lower body strength by performing the “Chair Stand” from the Senior Fitness Test (SFT).
b) The intervention group would demonstrate greater lower body strength on the post-test Chair Stand measure.

11. Participation in the FallProof™ at Home (FAH) program and lower body flexibility:

a) There would be no significant difference between the control group and the intervention group on the pre-test measure of lower body flexibility by performing the “Sit and Reach” from the SFT.

b) The intervention group would have greater lower body flexibility on the post-test Sit and Reach measure.

11. Participation in the FallProof™ at Home (FAH) program and balance confidence:

a) There would be no significant difference between the control group and the intervention group on the pre-test measure of self-perceived balance confidence from completing the Balance Efficacy Scale (BES) score.

b) The intervention group would have higher self-perceived balance confidence on the post-test BES measure.

Data were analyzed using PASW Statistics 18 (formerly SPSS Statistics 18) computer package. Demographic characteristics between the control and intervention groups were compared with independent t-tests for continuous variables (age and education) and chi-square tests for categorical variables (gender and race). The effects of the FAH program on the fall risk variables were assessed with a 2 (Group) X 2 (Time) repeated-measures ANOVA with time as the repeated measure. When the interaction was significant on a measure, post-hoc comparisons were performed. Independent t-tests
were used to compare between-group differences (control vs. intervention), and paired $t$-tests were used to compare within-group differences (pre-test vs. post-test). The results were considered significant if $p<.05$.

Participants

There were eight research study clinics throughout the city of Sacramento. A total of 81 older adults were tested for fall risk using the Fullerton Advanced Balance (FAB) Scale. Forty adults were not eligible according to FAB results (scored 26 or greater), two adults were identified at risk of falls but were not interested in participating in the study, and one adult was identified at risk of falls but did not have access to a DVD player. The remaining 38 eligible adults were randomly assigned to either the control group (n=15) or the intervention group (n=23), which received the FAH program. Eight subjects withdrew due to extraneous circumstances (1 fell at church, 1 got sick, 1 had arthritis flare-up, 1 found full-time employment, 1 had prior knee pain flare-up, 1 was in a car accident, and 2 could not be contacted.). Figure 2 below shows the participant flow chart throughout the study period.
8 Research study FAB clinics: 81 subjects; 43 NE, 38 study subjects
- Hart Senior Center: 6 subjects; 5 NE, 1 study
- Oak Park: 8 subjects; 1 NE, 2 NI, 5 study
- Hart Senior Center #2: 14 subjects; 8 NE, 6 study
- Parkside Community Church: 14 subjects; 8 NE, 6 study
- Oak Park #2: 11 subjects; 5 NE, 6 study
- Cordova Senior Center: 12 subjects; 4 NE, 8 study
- Natomas Community Center: 4 subjects; 4 NE
- Eskaton Jefferson Village: 12 subjects; 7 NE, 5 study

4 baseline measurements
- FAB (≤25)
- BES
- Chair Stand
- Sit and Reach

Inclusion criteria
- Community dwelling
- No cognitive impairment
- Able to ambulate w/o assistance
- Unsupervised medical care

38 eligible
43 Not eligible

FAH intervention
N=23
12-week intervention
18 completed FAH
4 withdrew
1 fell

No activity control Group
N=15
2 refused post-test
12 retested

Figure 2. Study Participant Flow Chart
Demographics

Table 1 shows the demographic statistics for the study participants. The control and intervention groups were similar on age, gender, race, and education variables.

Table 1
Descriptive Statistics for Participants’ Demographics (N=30)

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Control Group</th>
<th>Intervention Group</th>
<th>t or □ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n= 12)</td>
<td>(n = 18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years), mean ± SD</td>
<td>77.0 ± 6.9</td>
<td>79.2 ± 6.7</td>
<td>-0.86</td>
</tr>
<tr>
<td>Gender: F / M</td>
<td>12 / 0</td>
<td>15 / 3</td>
<td>2.22</td>
</tr>
<tr>
<td>Race: White / Asian</td>
<td>11 / 1</td>
<td>15 / 3</td>
<td>0.43</td>
</tr>
<tr>
<td>Education (years), mean ± SD</td>
<td>14.0 ± 2.2</td>
<td>14.5 ± 2.5</td>
<td>-0.51</td>
</tr>
</tbody>
</table>

11. p<.05; and ** p<.001.

FAB

In support of hypothesis 1(a), post-hoc comparisons found no difference on the FAB Scale between the control group (21.9 ± 3.9) and intervention group (21.8 ± 3.8) during the pre-test, $t(28) = 0.1$, $p = .954$. Hypothesis 1(b) is accepted. The intervention group (26.3 ± 3.8) scored significantly higher than the control group (23.0 ± 5.1) on the FAB Scale during the post-test, $t(28) = 2.02$, $p = .053$. In addition, there was no difference on the FAB Scale between the pre-test and post-test for the control group, $t(11) = -1.3$, $p = .237$. In support of the hypothesis, the intervention group scored higher on the FAB Scale during the post-test than pre-test, $t(17) = 6.5$, $p = .000$. Figure 3
shows the significant Group X Time interaction on the FAB Scale, $F(1,28) = 9.4$, $p = .005$.

![Figure 3. Group by Time Interaction on FAB Scale](image_url)

### SFT: Chair Stand and Sit & Reach

In support of hypothesis 2(a), the control group ($10.3 \pm 5.4$) demonstrated equal lower body strength to the intervention group ($11.1 \pm 4.7$) on the pre-test Chair Stand measure. Even though the means on the Chair Stand were in the hypothesized pattern, hypothesis 2(b) is rejected due to non-significant findings. The intervention group ($13.2 \pm 4.9$) showed more lower body strength than the control group ($9.9 \pm 4.9$) on the post-test but the differences were not significant.
In support of hypothesis 3(a), no significant difference in means was seen at the pre-test for the control (1.1 ± 5.0) and intervention groups (0.5 ± 3.8) on the Sit & Reach test. Hypothesis 3(b) is rejected. The difference in means at the post-test did not show the hypothesized pattern (i.e. an increase for the intervention group and no change for the control group). Surprisingly, the intervention group mean was lower from pre- to post-test (0.2 ± 1.0) and the control mean was higher from pre- to post-test (2.2 ± 4.5). However, the difference in the post-test means for the control and intervention group was not significant.

The small sample size may have influenced the results for the Chair Stand and Sit & Reach. That is, there was not enough statistical power to detect differences and small numbers allow for skewed results due to outlier effects.

Table 2 shows the means and standard deviations for the participants’ scores on the Senior Fitness Test. One participant declined to perform the post-test Chair Stand. Both Group X Time interactions were not significant on the Chair Stand, \( F(1,27) = 2.1, \ p = .157 \), and Sit & Reach, \( F(1,28) = 1.3, \ p = .272 \).
Table 2
Means and Standard Deviations for Participants’ Scores on Senior Fitness Test (N=30)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre–Test</th>
<th>Post–Test</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chair Stand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>10.3 ± 5.4</td>
<td>9.9 ± 4.9</td>
<td>2.12</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>11.1 ± 4.7</td>
<td>13.2 ± 4.9</td>
<td></td>
</tr>
<tr>
<td>Sit &amp; Reach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Group</td>
<td>1.1 ± 5.0</td>
<td>2.2 ± 4.5</td>
<td>1.26</td>
</tr>
<tr>
<td>Intervention Group</td>
<td>0.5 ± 3.8</td>
<td>0.2 ± 1.0</td>
<td></td>
</tr>
</tbody>
</table>

11. p<.05; and ** p<.001.

BES

In support of hypothesis 4(a), post-hoc comparisons revealed no difference in pre-test balance confidence between the control (70.4 ± 17.9) and intervention group (65.1 ± 24.1), t(28) = 0.7, p = .518. Hypothesis 4(b) is accepted. The intervention group (84.4 ± 9.7) exhibited significantly more balance confidence than the control group (71.3 ± 19.1) on the post-test, t(28) = 2.5, p = .019. Also, there was no difference on balance confidence between the pre-test and post-test for the control group, t(11) = −0.3, p = .769. Demonstrating the effects of the FallProof™ at Home (FAH) program, the intervention
group exhibited significantly more balance confidence on the post-test than pre-test, \( t(17) = 3.8, p = .002 \). Figure 4 shows the significant Group X Time interaction found on the BES, \( F(1,28) = 7.6, p = .010 \).

![Figure 4. Group by Time Interaction on BES](image-url)
Chapter 5

DISCUSSION

The purpose of this study was to examine the influence of participation in the FallProof™ at Home (FAH) program on fall risk, lower body strength and flexibility, and self-perceived balance confidence among higher functioning community residing older adults who were identified as high to moderate risk of falls. All subjects in this 12-week study met the eligibility requirements for the community-based FallProof™ balance and mobility program and had access to a DVD player at least three times per week. All subjects were assessed for fall risk using the Fullerton Advanced Balance (FAB) scale, lower body strength was measured with the 30-second Chair Stand, lower body flexibility was recorded using the Sit and Reach and self-perceived balance confidence was measured by the Balance Efficacy Scale (BES).

Hypotheses

11. Participation in the FallProof™ at Home (FAH) program and fall risk:

   a) There would be no significant difference between the control group and intervention group on the pre-test measure of fall risk after completing the Fullerton Advanced Balance (FAB) Scale.

   b) The intervention group would have a lower fall risk on the post-test FAB measure.

11. Participation in the FallProof™ at Home (FAH) program and lower body strength:
a) There would be no significant difference between the control group and the intervention group on pre-test measure of lower body strength by performing the “Chair Stand” from the Senior Fitness Test (SFT).

b) The intervention group would demonstrate greater lower body strength on the post-test Chair Stand measure.

11. Participation in the FallProof™ at Home (FAH) program and lower body flexibility:

a) There would be no significant difference between the control group and the intervention group on the pre-test measure of lower body flexibility by performing the “Sit and Reach” from the SFT.

b) The intervention group would have greater lower body flexibility on the post-test Sit and Reach measure.

11. Participation in the FallProof™ at Home (FAH) program and balance confidence:

a) There would be no significant difference between the control group and the intervention group on the pre-test measure of self-perceived balance confidence from completing the Balance Efficacy Scale (BES) score.

b) The intervention group would have higher self-perceived balance confidence on the post-test BES measure.

In support of hypotheses 1(a), 2(a), 3(a), and 4(a), the only difference between the control group and the intervention group was participation in the FAH DVD series. The results of this study demonstrated that the group who participated in the 12-week progressively challenging 3-level home-based DVD program had a significant decrease
in fall risk based on pre- and post-study FAB scores. More importantly, as a result of participating in the FAH program the intervention group is no longer classified “at-risk” of falls as evidenced by post-study testing FAB scores equal to or greater than 26. These findings accept hypothesis 1(b). The intervention group also demonstrated a significant increase in balance confidence based on their post-study BES scores whereas the control group did not. Thus, hypothesis 4(b) is also accepted.

Hypothesis 2(b) is rejected because neither the intervention nor the control group demonstrated a significant difference in lower body strength based on pre- and post-study Chair Stand scores. Similarly, hypothesis 3(b) is rejected since the intervention and the control group did not demonstrate a significant difference in lower body flexibility based on pre- and post-study Sit and Reach scores after the 12-week study period.

Two similar groups of older adults were evaluated in this study. The group who participated in the 12-week FAH program showed greater statistically significant gains than their counterparts who did not participate in the home-based balance and mobility intervention. Thus, all but two hypotheses were accepted in this study that examined the effect of participating in the FallProof™ at Home (FAH) DVD series upon fall risk factors that increase the likelihood of falls among older adults who are at high to moderate risk of falls and live in the community.

There are an increasing number of fall prevention research studies being conducted to identify a cost-effective approach to the public health epidemic of falls among the aging population. This pilot study of the FAH balance and mobility program has added to the wealth of knowledge on exercise as a single intervention in fall risk
reduction (Day et al., 2002; Lin et al., 2007; Rose, 2005; Tinetti et al., 1996). More specifically, this study supports individualized balance training programs that include postural strategy training (Hue et al., 2003; Horak, 2006; Shumway-Cook et al., 1997), multisensory training (Allet et al., 2009; Hu & Woollacoot, 1994), gait training (Berg et al., 1997; Lord et al., 1996; Lui-Ambrose et al., 2008; Rubenstein et al., 2001), strengthening activities (Haines et al., 2009; Jette et al., 1999), and range of motion exercises (DeVito et al., 2003; Robitaille et al., 2005) that can be done at home (Campbell et al., 1999; Day et al., 2002; Hektoen et al., 2009) in a progressively challenging manner (Haines et al., 2009) to improve balance confidence (Delbaere et al., 2006; Williams et al., 2002) and reduce fall risk. These authors hypothesized that the use of specific fall risk reduction interventions would help older adults reduce the incidence of falls.

Similar to most fall prevention studies, this study measured multiple dimensions of balance associated with increased fall risk. Most studies have chosen to focus on the influence of community and/or home-based activity interventions of differing durations and intensities on various combinations of fall risk variables whereas this study’s primary objective was to discover the effect of participating in the home-based FallProof™ program for 12 weeks. More specifically, this study aimed to discover if the four dependent variables of fall risk, balance confidence and lower body strength and flexibility would be affected by participation in the progressively challenging DVD program done at home.
The testing area that demonstrated the biggest significant difference between the control group and the experimental group was the area of fall risk. Although the Berg Balance Scale (BBS) is commonly used to assess for fall risk, the FAB is an appropriate balance and mobility functional assessment tool for higher functioning, community-dwelling older adults (Hernandez & Rose, 2008; Schleiter, 2010; Rose et al., 2006). The FAB measures multiple dimensions of balance, including motor and sensory components. The theoretical foundation of the FallProof™ design addresses the underlying impairments of the motor and sensory systems involved in balance and mobility in order to reduce the risk of falls among higher functioning older adults who live independently within the community. In essence, if a person wants to reduce the risk of a fall, she/he must train the motor and sensory systems involved in balance. The repeated practice of motor skills and training of sensory systems will facilitate the muscle strength and sensory awareness necessary to improve balance and mobility skills and thereby reduce fall risk (Nitz & Choy, 2004; Pavlov et al., 2001; Rose, 2002; Woollacott, 2000).

The second most affected area of study that appeared to be influenced by participation in the FAH program was self-perceived balance confidence. The intervention group had far more significant balance confidence gains than the control group. These significant gains might be attributed to increased self-efficacy due to successful completion at each level and positive feedback from researcher upon observation before progressing (Diattlo, Kleiber & William, 1998; Bandura, 1982;). Gains in balance confidence might also be attributed to an increased awareness of physical strengths and weaknesses (Brouwer et al., 2003). Previous studies done on
balance confidence have also concluded that lack of balance confidence or the fear of falling is a significant risk factor for falls (Yan et al., 2009). Restricting activities and avoiding events that present the risk of falling may seem logical in the short-term but prolonged inactivity and social isolation actually increase the risk of falling in the long run (Rose, 2010). On the other hand, overconfidence in one’s balance has also been identified as a fall risk (Cyrato et al., 2008). Most studies combine a cognitive and/or behavioral intervention and exercise to address fear of falling whereas this study demonstrated the effectiveness of multidimensional exercise training as a successful intervention for the fear of falling.

Not surprisingly, the aspect of lower body strength was one of the least influenced factors of the FAH intervention. The strength gains were not significant in either the control or intervention group after the 12-week period, thereby rejecting hypothesis 2(b). One major reason for this outcome could be attributed to the fact that older adults may not push themselves to the point where strength gains will be realized (Orsega-Smith et al., 2007). It is also difficult to exercise with sufficient amounts of resistance in order to gain strength with access to minimal equipment common in the home setting. The low intensity nature of the FAH could have contributed to non-significant strength gains. According to the SAID principle, the body will adapt to imposed demands. However, an older body requires more time to recover (Sale & MacDougall, 1981). On the other hand, studies indicate that the more de-conditioned a person, the greater the strength gains (Wescott, 1999). The amount of time required to gain strength is still questionable.
A more surprising finding of this study was that the aspect of lower body flexibility was not significantly influenced by participation in the FAH program. The control group improved as much as the intervention group, thereby rejecting hypothesis 3(b). A possible explanation for this finding could be attributed to the fact that older adults did not hold the stretches long enough to experience gains in stretch reflex. The flexibility training segment was at the end of the DVD program and subjects could have been tired or felt rushed to finish the forty-minute routine for the day. Improper form while performing the hamstring stretch could have negatively impacted flexibility gains. Also, it could take the older body longer than 12 weeks to adapt to demands of flexibility training.

In summary the results of this study suggest that participation in the FallProof™ at Home balance and mobility program will yield improvement in self-perceived balance confidence scores, and more importantly in motor and sensory skills related to fall risk. Older adults who have been identified at risk of falls improved scores on the FAB and are no longer considered ‘high risk’ of falling after participating in the home-based balance training program. Although non-significant increases in lower body strength and flexibility were amongst the control and intervention groups, it may be necessary to practice chair stands and sit and reach stretches for periods longer than twelve weeks to recognize significant strength and flexibility gains, respectively, in older adults living in the community. In addition to progressively challenging strengthening and flexibility exercises, the combination of multisensory training, postural strategy training, and gait and mobility training strategies that are individually tailored to subject ability could
provide the greatest results for older adults who are identified at risk of falls. This study assessed fall risk using standardized assessment tools; the FAB scale, the BES, and the two SFT items; the chair stand and sit and reach. The FAB measures functional limitations and is appropriate for higher functioning older adults. For future studies, additional standardized tests that measure functional limitation are the 8-foot Up & Go (Rikli & Jones, 2001), the 50-foot walk test, or the Walkie Talkie Test (Rose, 2010). Any combination of service delivery options, modified training interventions or assessment of fall risk factors could be avenues to explore for future researchers who may decide to replicate this study.

Limitations

Although this study uncovered several significant findings and provided an assessment of the FallProof™ at Home program, there are inherent study limitations for the reader to consider when interpreting results. One of the first concerns of this quasi-experimental research design was the small sample size. The study group was not a random sample of older adults living in the communities of Sacramento due to eligibility requirements of the FallProof™ balance and mobility program. Designed for higher functioning community dwelling older adults, FallProof™ participants undergo a thorough screening process to identify possible balance and mobility impairments and personal limitations that increase the risk of a fall. The participants in this study wanted to participate and were therefore, a self-selected group. The intent to treat purpose of the study further limited the number of potential study participants.
The chance of developing a chronic disease increases with advanced age; over 80% of adults over the age of 65 are living with one chronic disease and 50% have at least two (CDC, 2007). The physical activity level, history of falls, diseases or impairments known to affect balance or any other diseases or conditions affecting the health of older adult participants were not controlled for. Also, the race, gender and education level of the older adults were not controlled. Similar to most fall prevention studies, this study group was predominantly Caucasian, higher-educated women.

There is a plethora of research that supports exercise as the best way to reduce the risk of accidental falls (Rubenstein et al., 2003; Tinetti et al., 1996). Even though it was predictable that a non-exercise control group would score less on post-study testing, the purpose of a non-exercise control group was to demonstrate the natural decline of physical function associated with aging.

Another limitation of the study could have been honesty of study subjects in reporting participation rates. Compliance and adherence to an exercise program is difficult throughout the lifespan (Brawley et al., 2003). Subjects who participated in the 12-week FAH intervention may have reported greater compliance than actual participation. Study subjects may also not have reported accidental falls accurately. Lastly, subjects in the control group may have started an exercise program during the study period, which would skew their post-test results and interfere with true statistical analysis.

Finally, both pre- and post-testing for each subject was carried out by the person responsible for designing this study, introducing the possibility of evaluator bias.
However, the researcher did not access pre-test scores within 30 days of post-test evaluation, reducing the probability of evaluator bias. It must also be stated that the outcome assessor was not blinded to group allocation, and therefore possible observer biases regarding the assessments must be acknowledged.

Suggestions for Future Studies

This study could be further elaborated on by several major suggestions. One such suggestion that could yield different results would be to perform the pre- and post-study evaluations with two or more certified FallProof™ instructors. The researcher in this study was also the pre-and post-test assessor; this could have made an impact on the accuracy of FAB test item observations. This study could be more powerful with a larger sample size. A longer and more thorough marketing effort to advertise the study could have resulted in a more representative sample population in the diverse community of Sacramento. Another factor that could be adjusted would be the types of fall risk factors that the subjects are tested in pre- and post-study intervention. The subjects in this study were assessed for fall risk, lower body strength and flexibility and self-perceived balance confidence. Since half of slips, trips and falls occur due to gait disorders, the inclusion of a pre- and post-assessment of dynamic gait and mobility could also be used to measure the impact of participating in the FAH program on fall risk reduction.

Implications for Practice

The results of this study indicate that FallProof™ at Home is an effective intervention to reduce fall risk and improve self-perceived balance confidence among higher functioning older adults living the community who have been identified at
moderate to high risk of falls. Home-based fall prevention interventions are a cost-effective way to improve the quality of life of older adults who are faced with financial, transportation, physical and emotional barriers to programs in the community. As the older adult population expands, the need for cost-effective programs that reduce the risk of falls grows proportionately. This study demonstrated that older adults who have been identified at high risk of falling are no longer considered at risk of falls after participating in the FallProof™ at Home program for 12-weeks. The three-level progressively challenging multidimensional approach to balance training also significantly improved balance confidence among high fall risk adults. The improvement of these two risk factors not only reduces the risk of falls but also improves the quality of life for older adults living in the community. Replication and expansion for this study is therefore strongly recommended.
APPENDIX A

Fullerton Advanced Balance (FAB) Scale
Test Administration Instruction

11. Stand with feet together and eyes closed

**Purpose:** Assess participant’s ability to use somatosensory input (i.e., ground and body position cues) to maintain upright balance while standing in a reduced base of support with vision removed.

**Equipment:** Stopwatch (with lanyard for placing around neck).

**Safety procedures:** Position person being tested in a corner (if available) or close to a wall. Stand close to participant in case of loss of balance. Hold stopwatch (lanyard around neck) at eye level so participant’s eyes and time can be monitored simultaneously.

**Testing procedures:** Demonstrate the correct test position and then instruct the participant to move the feet independently until they are together. If some participants are unable to achieve the correct position due to lower extremity joint problems, encourage them to bring their heels together even though the fronts of the feet are not touching. Have participant adopt a position that will ensure their safety as the arms are folded across the chest and they prepare to close the eyes. Begin timing as soon as the participant closes the eyes. Instruct participants to open the eyes if they feel so unsteady that a loss of balance is imminent.

**Verbal instructions:** “Bring your feet together, fold your arms across your chest, close your eyes when you are ready, and remain as steady as possible until I instruct you to open your eyes.”

11. Reach forward with outstretched arm to retrieve an object (pencil)

**Purpose:** Assess participant’s ability to lean forward to retrieve an object without altering the base of support and measure the participant’s stability limits in a forward direction.

**Equipment:** Pencil and 12-inch ruler

**Safety procedures:** Position person facing out from corner (if available) or close to wall. Position self to side of participant’s outstretched hand. Use arm holding pencil in horizontal position to manually assist client if a loss of balance occurs.

**Testing procedures:** Provide participant with sagittal view of correct action. Instruct the participant to raise the preferred arm to 90 degrees and extend it with fingers outstretched. Use the ruler to measure a distance of 10 inches from the end of the fingers of the outstretched arm. Hold the object (pencil) horizontally and level with the height of the participant’s shoulder. Be sure not to move the pencil once the instructions are provided. Instruct the participant to reach forward, grasp the pencil,
and return to the initial starting position without moving the feet, if possible. (It is acceptable to raise the heels as long as the feet do not move.) If the participant is unable to reach the pencil within 2-3 seconds of initiating the forward lean, tell the participant that it is OK to move the feet in order to reach the pencil. Record the number of steps the participant takes in order to retrieve the pencil.

**Verbal instructions:** “Try to lean forward to take the pencil from my hand and return to your starting position without moving your feet.” (Allow 2-3 seconds of lean time.) “You can move your feet in order to reach the pencil.”

11. **Turn in a full circle in right and left directions**

**Purpose:** Assess the participant’s ability to turn in a full circle in both directions without losing balance and using a minimum number of steps.

**Equipment:** None

**Safety procedures:** Position person being tested about one foot in front of a wall and facing you. Stand close enough during test to provide manual assistance if a loss of balance occurs.

**Testing procedures:** Verbally explain and then demonstrate the task to be performed, making sure to complete each circle in four steps or less and pause briefly between turns. Instruct the participant (who is facing you) to turn in a complete circle in one direction, pause, and then turn in a complete circle in the opposite direction. Count the number of steps taken to complete each circle. Stop counting steps as soon as the participant is facing you after completing each turn. Allow for a small correction in foot position before a turn in the opposite direction is initiated.

**Verbal instructions:** “Turn around in a full circle, pause, and then turn in a full circle in the opposite direction.”

11. **Step up onto and over a 6-inch bench**

**Purpose:** Assess participant’s ability to control COG in dynamic task situations and measure lower body strength and bilateral motor coordination.

**Equipment:** 6-inch-high bench (14- by 18-inch stepping surface)

**Safety procedures:** Position bench close to a wall and self on opposite side of bench. Adopt close supervisory position and move with participant as she/he steps up and over the bench in each direction.

**Testing procedures:** Verbally explain and then demonstrate (at normal speed) the step up onto and over the bench in both directions. Instruct the participant to step onto the bench with the right foot, swing the left leg directly up and over the bench, step off the other side, and then repeat the movement in the opposite direction with the left leg leading the action. Encourage the participant not to touch the wall or you to maintain balance during the test. While the participant performs the test, watch to
see that the trailing leg does not make contact with the bench or swing around, as opposed to going directly up and over, the bench. Verbally cue which leg should be leading the action just prior to the start of the movement in each direction.

**Verbal instructions:** “Step up onto the bench with your right leg, swing your left leg directly up and over the bench, and step off the other side. Repeat the movement in the opposite direction with your left leg as the leading leg.”

5. **Walk with feet in a tandem position**

**Purpose:** Assess participant’s ability to dynamically control center of mass with an altered base of support.

**Equipment:** Masking tape.

**Safety procedures:** Set the tandem walk line approximately 12 inches away from a wall. Monitor the participant closely during performance of the test and walk forward with the client as he/she performs the test. Be ready to provide manual assist if a loss of balance occurs.

**Testing procedures:** Verbally explain and demonstrate how to perform the test correctly before allowing the participant to perform the test. Instruct the participant to tandem walk (heel-to-toe) on the line until you say to stop. Allow participants who are unable to achieve a tandem stance position within the first two steps to repeat the test one time. The participant may elect to step forward with the opposite foot on the second attempt. Score as interruptions any instances where the participant takes one or more steps away from the line when performing the tandem walk or is unable to achieve the correct heel-to-toe position during any step taken along the course. Do not ask the participant to stop until 10 steps have been completed.

**Verbal instructions:** “Walk forward along the line, placing one foot directly in front of the other such that the heel and toe are in contact on each step forward. I will tell you when to stop.”

6. **Stand on one leg**

**Purpose:** Assess participant’s ability to maintain upright balance with a reduced base of support.

**Equipment:** Stopwatch

**Safety procedures:** Position the person being tested in a corner (if one is available) or close to a wall. Stand In a close supervisory position and on the side of the raised leg.

**Testing procedures:** Instruct the participant to fold the arms across the chest, lift one leg off the floor, and maintain balance until instructed to return the foot to the floor. Begin timing as soon as the participant lifts the foot from the floor and allow 20 seconds to elapse. Stop timing if the legs touch, the raised leg contacts the floor,
or the participant removes the arms from the chest before the 20 seconds are up. Allow participants who are unsure which leg to raise to perform the test once on each leg.

**Verbal instructions:** “Fold your arms across your chest, lift one leg off the floor (without touching your other leg), and stand with your eyes open as long as you can.”

11. **Stand on foam with eyes closed**

**Purpose:** Assess participant’s ability to maintain upright balance while standing on a compliant surface with the eyes closed.

**Equipment:** Stopwatch and two Airex® Balance Pads, with a length of nonslip material placed between the two pads and an additional length of nonslip material placed between the floor and the bottom pad if the test is being performed on an uncarpeted surface.

**Safety procedures:** Position the participant in a corner (if one is available) or close to a wall. After demonstrating the test, place the Airex® pads in front of the person if standing in a corner. Adopt a close supervisory position and hold the stopwatch at a height that allows for simultaneous monitoring of the participant’s arm position and eyes, as well as the time. Instruct the participant to open the eyes if she/he feels so unsteady that a loss of balance is imminent. Manually assist the client to step forward off the foam pads.

**Testing procedures:** Following a demonstration of the task, instruct the participant to step onto the foam pads without assistance, position the feet shoulder width apart, fold the arms across the chest, and close the eyes when ready. (Be sure to demonstrate the correct standing position on the pads with the feet shoulder width apart.) Begin timing as soon as the eyes close. Stop the trial if the participant (a) opens the eyes before 20 seconds have elapsed, (b) lifts the arms off the chest, or (c) loses balance and requires manual assistance to prevent falling. Be sure to instruct participants to open their eyes if they feel so unsteady that a loss of balance is imminent. Have the participant step forward off the foam at the completion of the test item. Provide manual assistance if needed.

**Verbal instructions:** “Step up onto the foam and stand with your feet shoulder width apart. Fold your arms over your chest, and close your eyes when you are ready. I will tell you when to open your eyes.”

8. **Jump with both feet for distance**

*Do not introduce this test item if participant cannot perform test item 4 safely, has a diagnosis of osteoporosis, or complains of lower body joint pain. Score a zero on the test form and move immediately to test item #9.*

**Purpose:** Assess the participant’s upper and lower-body coordination and lower-body power.
**Equipment:** 36-inch ruler; masking tape.

**Safety procedures:** Position the participant close to a wall and adopt a close supervisory position during the jump. Stand to the side of the participant and move forward as he or she jumps. Place your hand on the participant’s back to steady him/her as soon as the feet contact the ground following the jump.

**Testing procedures:** Demonstrate the correct movement prior to the participant performing the jump, but do not jump more than twice the length of your own feet. Instruct the participant to perform a jump with both feet jump (jump with two feet and land on two feet). Use the ruler to measure the length of the participant’s foot and then multiply by two to determine the ideal distance to be jumped. Position the ruler on the floor and on the opposite side of the participant and close to the wall so that you can glance down and see how far the participant jumped. Observe whether the participant leaves the floor with both feet and lands with both feet. Be sure to move with the participant during the performance and place your hand on the participant’s back to provide stability as soon as the feet contact the ground following the jump.

**Verbal instructions:** “Jump as far but (emphasize) as safely as you can. Try and make sure that both feet leave the floor and land at the same time.”

9. **Walk while turning head**

**Purpose:** Assess participant’s ability to maintain dynamic balance while walking and turning the head.

**Equipment:** Metronome set at 100 beats per minute

**Safety procedures:** Position yourself behind and slightly to the side of the participant during the standing portion of the test so you can clearly see how far the head turns in either direction. Stand close enough that you can provide manual assistance if the participant becomes unstable while walking. Ensure that the participant is stable upon completing the test and before you move away from the participant.

**Testing procedures:** After demonstrating the test item, allow the participant to practice turning the head in time with the metronome while standing in place. Encourage participants to turn the head at least 30 degrees in each direction by instructing them to turn the head to look into each corner of the room. When the participant is finished practicing, instruct the person to walk forward while turning the head from side to side in time with the metronome. Observe whether the participant deviates from a straight path while walking or is unable to turn the head the required distance (30 degrees) to the timing of the metronome. Ask the person to stop after 10 steps. In most cases, the steps will be synchronized with the head turns, making the counting of 10 steps easier.
Verbal instructions: “Walk forward while turning your head from side-to-side with each beat of the metronome. I will tell you when to stop.”

10. Restore balance after backward disturbance

Purpose: Assess participant’s ability to restore balance following an unexpected perturbation.

Equipment: None

Safety procedures: Position the client approximately 3-4 feet in front of a wall. Stand immediately behind the participant and adopt a wide base of support. Be ready to move your feet quickly once you release your hand and the participant begins to lose balance. Flex the elbow and release your hand as soon as you determine that the participant is exerting sufficient pressure against your hand to require that he/she must step backwards one or more times to restore balance. This release should be unexpected, so do not prepare the participant for the moment of release or allow the participant to lean too far back onto your hand before releasing it.

Testing procedures: Instruct the participant to stand with the back turned toward you. Extend your arm, lock your elbow, and place the palm of your hand in the middle of the participant’s back. Instruct the participant to lean back slowly against your hand until you say to stop. Quickly flex your elbow to remove your hand from the participant’s back as soon as the participant applies a sufficient amount of force against your hand to require a movement of the feet to restore balance once the hand is removed. This release should be unexpected, so do not prepare the participant for the moment of release or allow the participant to lean too far back onto your hand before releasing it.

Verbal instructions: “Slowly lean back into my hand until I ask you to stop.”
# Health History Questionnaire (HHQ)

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>State:</th>
<th>Zip:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Home</th>
<th>Gender:</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone #:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date of Birth</th>
<th>Height:</th>
<th>Weight:</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ /</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender: Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

---

**Center for Successful Aging**

**Fall Risk Screening and Assessment**

*California State University, Fullerton*
<table>
<thead>
<tr>
<th>Ethnicity:</th>
<th>Highest level of education completed:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>____________________________</td>
</tr>
<tr>
<td></td>
<td>____________________________</td>
</tr>
</tbody>
</table>

1. **Have you ever been diagnosed as having any of the following conditions?**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>Year of Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart attack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transient ischemic attack</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angina (chest pain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuropathies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(problems with sensations)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Multiple sclerosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polio/Post polio syndrome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epilepsy/seizures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other neurological conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other arthritic conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual/depth perception problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner ear problems / Recurrent ear infections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebellar problems (ataxia)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other movement disorders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical dependency (alcohol and/or drugs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint replacement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If YES, how many times?

_________

☐ Right Hip

☐ Left Hip

☐ Right Knee

☐ Left Knee
2. Please indicate your ability to do each of the following. (Place an “x” in the most appropriate box).

<table>
<thead>
<tr>
<th></th>
<th>Can do</th>
<th>Can do</th>
<th>Can do</th>
<th>Can not</th>
<th>Can not do</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with some difficulty</td>
<td>with a lot difficulty</td>
<td>do without difficulty</td>
<td>at all difficulty</td>
<td>help</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11. Take care of own personal needs (e.g., dressing yourself)</th>
<th>☐</th>
<th>☐</th>
<th>☐</th>
<th>☐</th>
<th>☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Bathe yourself, using tub or shower</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. Climb up and down a flight of stairs (e.g., second story)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. Do light household activities (e.g., cooking, dusting, washing dishes, sweeping a walkway)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. Do heavy household activities (e.g., scrubbing floors, vacuuming, raking leaves)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>f. Do own shopping for groceries or clothes.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
g. Walk outside one or two blocks)  

h. Walk ½ mile (6-7 blocks)  

i. Walk 1 mile (12-14 blocks)  

k. Lift and carry 25 pounds  
   (e.g., medium-to-large suitcase)  

l. Do strenuous activities  
   (e.g., hiking, calisthenics, moving heavy objects, bicycling, aerobic dance activities, strenuous digging in garden)  

11. In general, how would you rate the quality of your life? (Circle the appropriate number)

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

very low low moderate high very high

4. Choose the answer that best expresses how you felt over the course of the past week:

   a. Are you basically satisfied with your life?  
      □ Yes □ No

   b. Do you often get bored?  
      □ Yes □ No
c. Do you often feel helpless? □ Yes □ No

d. Do you prefer to stay at home rather than going out and doing new things? □ Yes □ No

e. Do you feel pretty worthless the way you are now? □ Yes □ No

5. How much “bodily pain” have you generally had during the past 4 weeks? (While doing normal activities of daily living):

□ None □ Very little □ Moderate □ Quite a bit □ Severe

6. In a typical week, how often do you leave your house? (to run errands, go to work, go to meetings, classes, church, social functions, etc.)

□ less than once/week □ 3-4 times/week
□ 1-2 times/week □ most every day

7. Do you currently participate in regular physical exercise (such as walking, sports, exercise classes, house work or yard work) that is strenuous enough to cause a noticeable increase in breathing, heart rate, or perspiration?

□ Yes □ No

If yes, how many days per week?

□ One □ Two □ Three □ Four □ Five □ Six □ Seven

11. When you go for walks (if you do), which of the following best describes your walking pace:

□ Strolling (easy pace, takes 30 min. or more to walk a mile)
☐ Average or normal (can walk a mile in 20-30 minutes)

☐ Fairly brisk (fast pace, can walk a mile in 15-20 minutes)

☐ Do not go for walks on a regular basis

11. Did you require assistance in completing this form?

☐ None (or very little)   ☐ Needed quite a bit of help

Reason: ___________________________

10. How concerned are you about falling?

☐ 1 - - - - - - 2 - - - - - - 3 - - - - - - 4 - - - - - - 5 - - - - - - 6 - - - - - - 7

Not at all a little moderately very extremely

11. Have there been any changes in your medication since the start of the program (dosage/type)?

<table>
<thead>
<tr>
<th>Type of medication</th>
<th>For what condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>-999</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C

Balance Efficacy Scale

FALL PROOF PROGRAM: CENTER FOR SUCCESSFUL AGING, CAL STATE FULLERTON BALANCE SELF-EFFICACY SCALE (BES)

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?

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. How confident are you that you can get out of bed without losing your balance?

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>somewhat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. How confident are you that you can remove an object from a cupboard located above your head without losing your balance?

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>confident</td>
<td>absolutely</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>absolutely</td>
<td>confident</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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? 

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>confident</td>
<td>absolutely</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18. How confident are you that you could complete a daily task quickly (e.g., answer a ringing phone, remove a pot of water that is boiling over on stove, etc.) without losing your balance? 

<table>
<thead>
<tr>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all</td>
<td>somewhat</td>
<td>confident</td>
<td>absolutely</td>
<td>confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lastly, we are interested in understanding what factors affect your confidence levels. Please provide reasons for why you answered the way you did for questions 1 through 18 on the lines below. For example, if you answered that you were not very confident, why do you feel that way? If you were not very confident about an activity because you no longer do it very often e.g., climb stairs, walk on uneven ground, etc. we would like to know that also.
APPENDIX D

FAH Compliance Chart

FallProof™ at Home DVD

COMPLIANCE CHART

<table>
<thead>
<tr>
<th>Dates:</th>
<th>SUN</th>
<th>MON</th>
<th>TUES</th>
<th>WED</th>
<th>THURS</th>
<th>FRI</th>
<th>SAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of DVD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you participate in exercise program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you fall?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If so, complete falls incident form</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please complete this form each week and return in self-addressed stamped envelope. If you fall, please complete the Falls Incident form and return with completed compliance chart.

If you have any questions, please contact Kelly Ward at (916) 821-5715 or send an email to wardkelly@mac.com.

Best of luck.
APPENDIX E

Falls Incident Report
FALL PROOF PROGRAM:
CENTER FOR SUCCESSFUL AGING, CAL STATE FULLERTON
FALLS INCIDENCE REPORT FORM

Name: ________________  Date: __________________

Q1. Have you had any falls since your last assessment?  YES  NO

Q2. If you answered yes to Question 1 please indicate the number of falls you experienced.  _______ Times.

Q3. If you answered yes to Question 1 please provide the following information about each fall:

(a) Location of fall (e.g. in home; outside in garden, etc.)
____________________________________________________

(b) Reason for the fall (e.g. tripped over obstacle, etc.)
____________________________________________________

(c) Nature of injury (e.g. bruises, fracture, etc.)
____________________________________________________

(d) Did you require medical attention for your injury?  YES  NO

Please provide the same information for each subsequent fall:

(a) Location of fall: ______________________________________

(b) Reason for the fall: _____________________________________

(c) Nature of injury: _________________________________________

(d) Did you require medical attention for your injury?  YES  NO
APPENDIX F

Human Subjects Consent Form
Consent to Participate in Research

(PURPOSE of the research) You are being asked to participate in a research study that will be conducted by Kelly Ward; a graduate student of the Recreation, Parks, and Tourism Administration department at California State University, Sacramento. The purpose of this study is to investigate the benefits of participating in the FallProof™ at Home balance and mobility program for older adults who have been identified at moderate to high risk of falls and live in the communities of Sacramento, California.

(Research procedures) After completing a health history questionnaire to assess personal risk factors for falls, you will be asked to perform balance and mobility tests using the Fullerton Advanced Balance (FAB) scale and the Senior Fitness Test. A professionally trained instructor will explain and demonstrate each of the 10 fitness-item tests then observe you performing the task. The FAB scale and two test items from the Senior Fitness test will be held today and will take between 10-15 minutes.

You will be randomly assigned to one of two study groups; a control group that receives no further exercise program and a treatment group that will take part in a 12-week home-based exercise program using DVD instructions and follow up assistance from the researcher. If assigned to the regular activity control group, you agree not to begin an exercise program during the study period. If assigned to the treatment group, you agree to participate in the 12-week at home program and complete a short weekly report. Both groups will return to original testing site to be retested at the end of the 12-week period.
(Risks) The FAB scale assesses your balance and mobility skills and is not designed to increase heart rate continuously. However, you should be warned that any type of exercise testing involves a risk of possible injury or even heart attack; these risks are considered very small. The risk for heart attack is estimated to be less than 0.04% for people who are suspected to have cardiovascular disease, and substantially less than that for people who are in good health, have few or no risk factors for cardiovascular disease, and have no symptoms of cardiovascular disease.

It is essential that you provide accurate information on the health history questionnaire to be sure that you fall in this low risk category. Muscular strength testing involves a risk of muscle strain. It is possible that you may experience a slight increase in blood pressure, sweating, muscular discomfort, fatigue and the risk of falling during the testing procedures for this study. If you experience any chest pain, tightness, or other abnormal discomfort during the testing procedures, you should notify the researcher immediately and she will call 911.

You should call 911 immediately and notify your personal physician if you experience any chest pain, tightness, or other abnormal discomfort while participating in the FallProof™ at Home DVD program in your home.

There is no risk associated with the testing supplies; equipment is tested regularly for safety.

(Benefits) The results of the FAB scale will provide you with information about your current fall risk and increase awareness of the integrity of the body systems involved in your balance. The information may also be helpful in developing or altering a fall risk
reduction program to enhance your balance and mobility skills. Participating in the FallProof™ at Home program may enhance your balance and mobility skills.

(Confidentiality) All results obtained in this study will be confidential. Your individual performance will not be reported but only the results of all participants as a group. Information you provide on the consent form and the health history questionnaire will be stored separately from data for the exercise tests and your name will be marked out with a permanent black magic marker for privacy; the exercise test data will contain no personal information about you.

(Compensation) You will not receive any compensation for participating in this research. However, if you are part of the study group, the FallProof™ at Home DVD series is yours to keep. People who do not receive the intervention will be offered the FallProof™ at Home DVD set upon completion of the study; using the program regularly may reduce the risk of a fall.

In the event of an emergency, initial medical treatment would be available at the site of assessment. However, if you were to require any other medical care as a result of participating in this research, you would need to contact your personal physician at your own expense.

(Contact information) If you have any questions about this research, you may contact Kelly Ward at (916) 821-5715 or send e-mail to sac73673@csus.edu or her graduate advisor, Kath Pinch at (916) 278-6880 or send e-mail to pinch@csus.edu.

Your participation in this research is entirely voluntary. You are free to decide not to
participate, or to decide at a later time to stop participating. The researcher may also end your participation at any time. By signing below, you are saying that you understand the risks involved in this research and agree to participate in it.

__________________________________________________  _________________________
Signature of Participant                          Date

__________________________________________________  _________________________
Signature of Witness                                Date
REFERENCES


Weerdesteyn, V., Rijken, H., Geurts, A.C., Smits-Engelsman, B.C., Mulder, T., & Duysens, J. (2006). A five-week exercise program can reduce falls and improve
obstacle avoidance in the elderly. Gerontology, 52(1), 131-141. doi:
10.1159/000091822


doi:10.1016/S0966-6362(01)00156-4

Yan, T., Wilber, K.H., Wieckowski, J., & Simmons, W.J. (2009). Results from the Healthy Moves for aging well program: Changes of the health outcomes. Home Health Care Services Quarterly, 28, 100-111. doi: 10.1080/01621420903176136