



2017

## Effectiveness of the Stepping on Program in Fall Prevention Measured by the Four Stage Balance Test (FSBT)

Jenna Goecke  
*University of North Dakota*

[How does access to this work benefit you? Let us know!](#)

Follow this and additional works at: <https://commons.und.edu/pt-grad>



Part of the [Physical Therapy Commons](#)

---

### Recommended Citation

Goecke, Jenna, "Effectiveness of the Stepping on Program in Fall Prevention Measured by the Four Stage Balance Test (FSBT)" (2017). *Physical Therapy Scholarly Projects*. 543.  
<https://commons.und.edu/pt-grad/543>

This Scholarly Project is brought to you for free and open access by the Department of Physical Therapy at UND Scholarly Commons. It has been accepted for inclusion in Physical Therapy Scholarly Projects by an authorized administrator of UND Scholarly Commons. For more information, please contact [und.common@library.und.edu](mailto:und.common@library.und.edu).

EFFECTIVENESS OF THE STEPPING ON PROGRAM IN FALL PREVENTION  
MEASURED BY THE FOUR STAGE BALANCE TEST (FSBT)

by

Jenna Goecke

University of North Dakota

A Scholarly Project

Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

University of North Dakota

In partial of the requirements

For the degree of

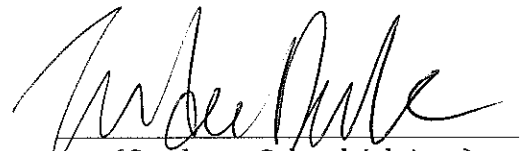
Doctor of Physical Therapy

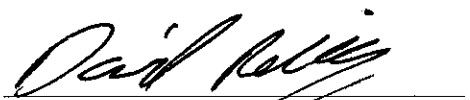
Grand Forks, North Dakota

May

2017

This Scholarly Project, submitted by Jenna Goecke in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Faculty Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

  
(Graduate School Advisor)

  
(Chairperson, Physical Therapy)

PERMISSION

Title                    Effectiveness of the Stepping On Program in Fall Prevention  
                                 Measured by the Four Stage Balance Test (FSBT)

Department            Physical Therapy

Degree                    Doctor of Physical Therapy

In presenting this Scholarly Project in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the department of Physical Therapy shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my work or, in her absence, by the chairperson of the department. It is understood that any copying or publication or other use of this scholarly project or part thereof, for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my scholarly project.

Signature 

Date 10/5/16

## TABLE OF CONTENTS

SCHOLARLY PROJECT SUBMISSION.....	ii
PERMISSION FORM.....	iii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
ACKNOWLEDGEMENTS.....	vii
ABSTRACT.....	viii
CHAPTER	
I. INTRODUCTION.....	1
II. METHODOLOGY.....	6
III. RESULTS.....	15
IV. DISCUSSION.....	20
V. CONCLUSION.....	25
APPENDIX A: Stepping On Exercises.....	27
APPENDIX B: Approved IRB Protocol.....	30
Participant Consent Form.....	31
APPENDIX C: Four Stage Balance Test.....	36
CDC Fall Risk Checklist.....	38
Week 1 Stepping On Baseline Questionnaire.....	39
Week 7 Stepping On Survey.....	40
3 Months After Stepping On Survey.....	42
REFERENCES.....	43

## LIST OF TABLES

### Table

1. Participant Demographics and Characteristics.....	7
2. Mean Single Leg Stance Times Based on Age and Gender.....	9
3. Four Stage Balance Test Results.....	16
4. Fall Risk Checklist Results.....	18

## LIST OF FIGURES

### Figure

1. Four Stage Balance Test foot positions.....8

## ACKNOWLEDGEMENTS

I would like to thank Meridee Danks, PT, DPT, for her support, hard work, and guidance throughout the completion of this project. Her knowledge and passion in fall prevention and the Stepping On program made this project possible. I would also like to thank Bill Vasicek for organizing the Stepping On program and allowing us to be part of the program sessions. Lastly, I would like to thank the participants of Stepping On and the study for allowing us to work with them.



## ABSTRACT

**Introduction:** Falls are a leading cause of injury for older adults. Stepping On is one of many fall prevention programs in which individuals who have a fear of falling can participate. Stepping On is a 7 week multifactorial fall prevention program for community-dwelling adults age 65 and older. The program implements an exercise program and addresses education on mobility safety in the community and home. The program addresses how different fall risk factors impact function including diet, medication, vision, balance, and strength.

**Purpose:** The purpose of this study is to measure pre- and post-program fall risk with the Four Stage Balance Test (FSBT) and examine whether static balance improves Week 1 to Week 7. The study will assess whether identified fall risk by the CDC Fall Risk Checklist and past medical history correlates with fall risk identified by the FSBT. The study will also assess whether self-perceived balance, confidence, and physical activity level improve after the completion of Stepping On.

**Methods:** There were 3 participants in this study (2 female and 1 male) with a mean age of 87 years that were enrolled in the Stepping On program. Two participants completed the program. The FSBT was used to assess fall risk based on standing balance performance Week 1 and Week 7. The CDC Fall Risk Checklist and Week 1 Stepping On Baseline Questionnaire were used to identify fall risk based on past medical history and to identify self-perceived balance, confidence, and physical

activity level. Other surveys and assessments used in conjunction to this study were the 30-second Sit to Stand (30secSTS), Timed Up and Go (TUG), Activities-specific Balance Confidence (ABC), and the Stepping On Exit Survey.

**Results:** From Week 1 to Week 7, Subject 1 increased tandem stance time by 22% and single leg stance time by 40%. Subject 2 had a 45% decrease in tandem stance time and 100% decrease in single leg stance time. Fall risk was identified for Subject 1 with single leg stance Week 1 and Week 7 and for Subject 2 with Week 1 and Week 7 single leg stance and Week 7 tandem stance. Fall risk identified by the CDC Fall Risk Checklist and past medical history inconsistently correlated with fall risk identified by tandem stance but consistently correlated with single leg stance when using age and gender normative data. Self-perceived balance improved in Subject 1, confidence remained the same in both Subjects, and physical activity level improved in both Subjects.

**Conclusion:** After the first 7 weeks, an increase in static balance measured by the FSBT occurred in 1 of the 2 participants. A longer duration between pre- and post-assessments may show greater improvement in balance. The FSBT as a whole does not consistently identify fall risk based on the CDC Fall Risk Checklist and past medical history. The clinical significance of this study suggests that the FSBT may not be the best to use in identifying fall risk with the current test procedure and normative data. The small sample size ( $n=2$ ), older participant age (mean age = 87 years), and participant past medical history may have influenced the results of this study. A 3 month follow up is planned to check in on the Subjects' reported progress.

## CHAPTER I

### INTRODUCTION

Falls among adults, 65 and older, are the greatest source of injury and are the main reason elderly individuals lose their independence.<sup>1,2</sup> Falls account for many social and economic problems within this population.<sup>3</sup> One-third of community-dwelling adults over the age of 65 will experience a fall, and 10% of them will cause major injury.<sup>4</sup> Major injuries cause 2.5 million individuals of this population to seek a hospital emergency department and 700,000 individuals to be hospitalized every year.<sup>1,2</sup> Injuries accumulated from falls include, but are not limited to, bruises, soft tissue injuries, fractures, and head trauma.<sup>1,2,4</sup> Falls cause 95% of all hip fractures.<sup>2</sup> Other consequences of falls include the fear of falling, decreased individual confidence, feelings of helplessness, decreased mobility and activity, increased risk for subsequent falls, depression, and institutionalization.<sup>2,3</sup> Falls are also very costly with a direct medical cost adjusted for inflation of 34 billion dollars a year, in which, two thirds of this value is in hospital costs.<sup>2</sup>

It is a popular belief that falls are just a result of aging because there are reports that the elderly fall more often than young individuals.<sup>5</sup> This belief is false, as aging does not directly cause falls. Research shows that there are many risk factors that can predispose an individual to falling; many of which are modifiable through intervention. These risk factors include lower body muscle weakness, gait

and balance difficulties, certain medications, polypharmacy, vitamin D deficiency, postural hypotension, vision problems, foot pain or poor footwear, and home and community hazards.<sup>2,4</sup> Falls more often result from an accumulation of multiple risk factors.<sup>4</sup> A combination of the above risk factors increases an individual's risk of falling with a greater risk as the amount of risk factors increase.<sup>2</sup>

Due to the many consequences of falls, reducing the risk and rate of falls in the elderly population is extremely important for the individual, community, and economy. Intervention and prevention of falls can be tackled through single or multifactorial intervention strategies.<sup>4</sup> The Center for Disease Control (CDC) recommends individuals to minimize their risk of falling by talking to their doctor about their potential risk and risk factors for falling, doing strength and balance activities, having their eyes checked, and making their home safer.<sup>2</sup> Physical therapy plays an important role in the above recommendations. Physical therapists can reduce fall risk in individuals by implementing interventions such as gait training, progressive strength and balance exercises, and home evaluation for environmental hazards.<sup>4,5</sup> Physical therapy intervention combined with care from other health disciplines with skills in geriatric medicine including physicians, optometrists, and pharmacists can synergistically reduce the risk of falls in the elderly.<sup>3</sup> Multifactorial fall prevention programs aim to do just that and have been proven to be effective.<sup>3,4,5</sup>

There are many fall prevention programs implemented into the community such as Stepping On, Otago Exercise Program, and STEADI (Stopping Elderly Accidents, Deaths, & Injuries). Specifically, Stepping On is a multifactorial small

group-oriented program that aims to reduce falls and improve confidence in ambulatory community-dwelling older adults.<sup>5</sup> Inclusion criteria for an individual to participate in Stepping On includes a fall in the past year or fear of falling, walks independently (may use a cane indoors or out, or a walker for outdoor use only), cognitively intact, and lives independently.<sup>6</sup> Stepping On was adapted for use in the United States by the Wisconsin Institute for Healthy Aging (WIHA) from its original development in Australia.<sup>5</sup> Training for Stepping On leaders, the implementation manual, and the evaluation plan are all provided by the WIHA.

Fall prevention will only be achieved when participants change their behaviors.<sup>7</sup> The stages of change model validates through a variety of behaviors that the stages are precontemplation, contemplation, preparation, action, and maintenance. Stepping On addressed change in participants' behavior with recognition of the stages in order to prevent falls with the idea of cognitive-behavioral learning through adult education and social learning principles.<sup>3,5</sup> The program is designated to be once a week for 7 weeks consecutively; each session is the length of 2 hours with a class size of about 10 to 14 participants.<sup>5</sup> Each session is conducted by a program leader with different "guest specialists" invited throughout the course such as physical therapists, pharmacists, nutritionists, and optometrists. The leader and "guest specialists" address different fall risk factors each week including education and instruction for environmental and behavioral home and community safety, diet and medication, the importance of vision and medication reviews, and strength and balance exercises.<sup>3,5</sup> The physical therapists teach the participants fall prevention exercises and provides education for safe

mobility within the home and community. The exercises implemented by the physical therapist are based off the Otago Exercise Program and include sit-to-stand, sideways walking, tandem standing, and tandem walking for balance and standing hip abduction, seated long arc quads, standing heel raises, and standing toe raises for strength.<sup>6,8</sup> See Appendix A for exercise descriptions.

Reduced fall risk can be assessed through pre- and post-program participant surveys and questionnaires and by tests and measures conducted by physical therapists. The CDC created a tool kit called STEADI for fall prevention and education.<sup>9</sup> The tool kit is based on a simple algorithm and provides health care professionals who treat older adults at risk for falling with basic information about falls, case studies, conversational starters, educational handouts designated for patients and their friends and family, and standardized balance and gait assessments. Through the STEADI tool kit, the CDC recommends the use of the Four Stage Balance Test (FSBT), 30-second Sit to Stand (30secSTS), the Timed Up and Go (TUG), and the Fall Risk Checklist for a comprehensive fall risk assessment.

Research has shown that Stepping On in the past has decreased fall risk in participants. Clemson et al<sup>3</sup> conducted a randomized trial to test whether Stepping On is effective in reducing falls in at-risk people living at home. The study recruited 310 participants that were community-dwelling men and women over the age of 70. The control group had a mean age of 78.47 (SD  $\pm$  5.66) and the intervention group had a mean age of 78.31 (SD  $\pm$  5.26). The study resulted in a significant reduction rate of 31% (P=.025) in fall risk of individuals who were in the intervention group whom participated in Stepping On.

Ory et al<sup>5</sup> measured the changes in participants' functional and self-reported health status after completing Stepping On with their study in 2015. The study finished with 266 participants that completed pre- and post-program self reported health and functional survey data and 254 participants that completed pre- and post-program functional assessment using the TUG. The participants were from 3 different states with a mean age of 78.7 (SD  $\pm$  8.0), a gender majority of female (83.4%), and most were in at least good health (85.6%). After the completion of Stepping On participants' self report of being mostly or very satisfied with their physical activity level and confidence that a fall could be avoided increased significantly, along with a 56% increase in self-report of excellent or very good. Participants' TUG scores also significantly decreased by an average of 2.1 seconds (SD  $\pm$  3.1) with the greatest change in score among the participants with the highest risk of falling. Based on the results of this study, Stepping On continues to reduce fall risk and provides positive benefits in community-dwelling participants.

The purpose of this study is to measure pre- and post-program fall risk, and whether there was an improvement in fall risk after completion of Stepping On. Research questions to consider are 1) Does static balance measured by the FSBT improve with the Stepping On program Week 1 to Week 7? 2) Does fall risk measured by the FSBT correlate with fall risk identified by the CDC Fall Risk Checklist? 3) Does static balance measured by the FSBT correlate with past medical history? 4) Does self-perceived balance, confidence, and physical activity level improve with the Stepping On program Week 1 to Week 7?

## CHAPTER II

### METHODOLOGY

Participants of this study were individuals enrolled in the Stepping On program that voluntarily chose to be in this study. The Institutional Review Board (IRB) of University of North Dakota gave approval of the Physical Therapy Department to distribute surveys and perform balance assessments on participants who volunteered from the local Stepping On Program. Each participant completed a consent form prior to participating in the study. See Appendix B for approved IRB protocol (#201209-047) and copy of consent forms.

#### Subjects

The study had 3 participants (2 female, 1 male) ages 81, 89, and 92 (mean age = 87.3 years). Each participant met the inclusion criteria: had a fall in the past year or has a fear of falling, walks independently (may use a cane indoors or out, or a walker for outdoor use only), is cognitively intact, lives in their own home or other independent living facility, and is able to speak conversational English.<sup>6</sup> See Table 1 for participant demographics and characteristics.

#### Instrumentation

##### Four Stage Balance Test

The FSBT was used to assess participant standing balance. The FSBT consists of a progression of 4 balance positions that include narrow base (feet side by side),



Table 1. Participant Demographics and Characteristics

	Subject #1	Subject #2	Subject #3
Age	89	93	81
Gender	Female	Male	Female
Fall History	Yes, x 2	Yes, x 1	Yes, x 5-6
Past Medical History	None	Mild stroke w/ L sided weakness 20 years prior	Knee pain from past car accident, balance/walking difficulties
Vision Impairments	Yes	Yes – glasses	Yes – glasses, L macular degeneration
Self Rated Activity Level (Inactive/Min/Mod/Highly active)	Minimally Active	Minimally Active	Minimally Active

semi-tandem stance (instep of one foot next to big toe of other foot), tandem stance (heel to toe), and single leg stance.<sup>10</sup> The foot positions can be viewed in Figure 1. The assessor may provide hand support initially so that an individual is able to achieve each position if needed. Hand support is to be reduced by the assessor once the individual is comfortable in each position. Timing of each position begins once the individual has achieved the position and hand support is reduced if it was needed. Once one position is achieved for 10 seconds, the individual progresses to the next position, and continues in the same manner to progress through each position as able. Timing is stopped if an individual steps out of the position or touches the wall or other objects with their hands to catch themselves. If the individual does not reach 10 seconds they do not progress to the next position. If they are unable to hold tandem stance for 10 seconds they are at an increased risk for falling. See Appendix C for the FSBT directions and guidelines.

Although there is limited research and normative data for the FSBT as a whole, there is normative data for its individual stages of tandem stance and single



Figure 1. Four Stage Balance Test foot positions.

leg stance. Based on the CDC, an older adult who cannot hold tandem stance with or without initial support for at least 10 seconds is at increased risk for falling.<sup>10</sup>

Tandem stance for 10 seconds is also used as a subtest on an assessment similar to the FSBT called Frailty and Injuries: Cooperative Studies of Intervention (FICSIT-4).<sup>11</sup> The FICSIT-4 differs from the FSBT as when assessing tandem stance using the FICSIT-4 the individual must step into the position without initial support in order to achieve the highest subtest score of 4. Tandem stance is also included as a subtest in the Berg Balance Scale, in which the individual must achieve the stance without initial support and hold the position for 30 seconds to get the highest

subtest score of a 4.<sup>12</sup> A time of 10 seconds without initial support is used for the highest subtest score of a 4 in single leg stance on the FICSIT-4 and Berg Balance Scale. The FICSIT-4 and Berg Balance Scale are both reliable and valid assessments. Springer et al<sup>13</sup> studied age normative data for single leg stance by assessing single leg stance in healthy adults ages 18 to 80+ years old. The study concluded that single leg stance times decrease as age increases in healthy adults. A study by Bobannon et al<sup>14</sup> also found that in healthy adults, single leg stance times decrease as age increases. For the purpose of this study age normative data based on Springer et al<sup>13</sup> was used for single leg stance. The age normative data for single leg stance for healthy adults is as follows: mean of 32.1 seconds for 60-69 year olds, mean of 21.5 seconds for 70-79 year olds, and mean of 8.4 seconds for 80-99 year olds. See Table 2 for gender specific age normative data.

Table 2. Mean Single Leg Stance Times Based on Age and Gender.<sup>13</sup>

Age (years)	Female (time in seconds)	Male (time in seconds)
60-69	30.4	33.8
70-79	16.7	25.9
80-89	10.6	8.7

A study completed by Franchignoni et al<sup>15</sup> analyzed the interrater and intrarater (test-retest) reliability of tandem stance, single leg stance, functional reach, and sit-to-stand test and their inter-correlations. Forty-five women ages 55-75 (mean age 63+/-3) participated in this study. Tandem stance and single leg stance were tested with participant arms across their chest, barefoot, and without initial support. The interrater and intrarater reliability of all four tests were found to be good. The interrater value for tandem stance and single leg stance was 0.99, functional reach was 0.96-0.97, and sit-to-stand test was 0.98. The intrarater value

for tandem stance was 0.90-0.91, single leg stance was 0.76-0.77, functional reach was 0.86-0.88, and sit-to-stand test was 0.92-0.93. The results of each of these tests were compared to the participants' results on the Tinetti Balance Subscale. The Tinetti Balance Subscale is highly valid and widespread tool used to assess fall risk.<sup>16</sup> The scores of each of the tests correlated with the Tinetti Balance Subscale, providing evidence that all four tests are valid in assessing fall risk.<sup>15</sup> This study suggests that tandem stance and single leg stance are both reliable and valid in assessing fall risk.

A study 117 participants (71% female) completed by Hile et al<sup>17</sup> suggests that there is clinical significance in the need for support versus no support when stepping into and stabilizing tandem stance. The study identified participants' performance on tandem stance as unable even with support, able only with support, and able without support. The participants' identified performance on tandem stance was then compared to individual primary outcomes of gait speed, TUG, and balance confidence. The study found that participants who needed initial support to achieve stability in tandem stance had slower gait speeds, slower TUG times, and lower balance confidence than participants who did not need initial support to step into tandem stance. Based on these results, the need for initial support to attain tandem stance may demonstrate meaningful deficits in balance-related mobility.

Research completed by Goldberg et al<sup>18</sup> analyzed the reliability and minimum detectable change (MDC) of the single leg stance in a geriatric population. Twenty-five adults ages 60-89 (mean age  $72 \pm 9.1$ ) participated in this study. The study found that single leg stance has poor absolute reliability and that the MDC is

24.1 seconds. This suggests that single leg stance has poor sensitivity to detecting significant change in a clinical setting. This study, in regards to Franchignoni et al,<sup>15</sup> may suggest that the single leg stance is less reliable and useful in a clinical setting as the participants' age increases. According to age normative data by Springer et al<sup>13</sup>, the MDC will not be applicable to participant population ages 70 years and older as the MDC value is greater than the age normative data for 70-79 year olds (mean of 21.5 seconds) and 80-99 year olds (mean of 8.4 seconds). Due to the MDC value, a greater hold time of 30 seconds would be more useful in identifying clinical change rather than using the time of 10 seconds suggested by the CDC in the FSBT when assessing individuals 69 years old and younger. This is indicated as the age normative data identified by Springer et al<sup>13</sup> for 69 year olds and below is greater than 30 seconds.

#### Fall Risk Checklist

During Week 1, each participant completed the CDC Fall Risk Checklist. The checklist includes 12 behavior questions regarding fall risk in which individuals answer yes or no. The first 2 questions are worth 2 points while the remaining 10 questions are worth 1 point. A score of 4 points or higher (maximum score of 14) indicates that an individual may be at risk for falling.<sup>19</sup> See Appendix C for the Fall Risk Checklist.

#### Week 1 Stepping On Baseline Questionnaire

Self-reported past medical history, history of falls, demographics, and characteristics were recorded Week 1 for all participants. Other past medical

history reported throughout the 7 Weeks of the program was noted by the Stepping On staff. See Appendix C for the Week 1 Stepping On Baseline Questionnaire.

#### Week 7 Stepping On Survey

During Week 7, all participants completed the survey based on self-report. The survey included questions about perceived improvement in balance and confidence, falls since the start of the Stepping On program, daily physical activity level, faithfulness of exercise completion, frequency and intensity of exercises performed, difficulties while performing the exercises, activity level prior to the Stepping On program, and community exercise groups other than the Stepping On program. See Appendix C for the Week 7 Stepping On Survey.

#### Three Months After Stepping On Survey

The participants will complete a survey during the planned 3 month follow up. The survey includes questions regarding self-reported improvement in balance and confidence, whether the Stepping On program has helped, falls since Stepping On Program completion, continued performance of the Stepping On Program exercises, and community exercise involvement since the Program. See Appendix C for the 3 Months After Stepping On Survey.

#### Procedure

Each participant signed the consent form prior to partaking in assessments. In addition to the assessment of the FSBT, other pre-program assessments and surveys were used for a comprehensive balance assessment and included the 30secSTS, TUG, Activities-specific Balance Confidence (ABC), Week 1 Stepping On Baseline Questionnaire, and the CDC Fall Risk Checklist. During the last session the

post-program assessments and surveys included a Stepping On Exit Survey, Week 7 Stepping On Survey, ABC, 30secSTS, TUG, and the FSBT. Each assessment was completed in a random order during Week 1 and Week 7. FSBT procedures were practiced during instrumentation class prior to completing study assessments. A follow up was planned for 3 months following the completion of the Stepping On program in which the 3 Months After Stepping On Survey would be administered.

For the purpose of this study, the FSBT was modified based on the above research. To decrease the ceiling effect, each position was to be held 30 seconds maximum rather than 10 seconds maximum. For time efficiency, tandem stance was tested first. If tandem stance was held greater than 10 seconds successfully then the individual progressed to single leg stance. If tandem stance was not achieved successfully for 10 seconds then the individual was regressed to semi-tandem stance. Further regression to narrow base occurred if semi tandem stance was not successfully achieved for 10 seconds. Whether the participant needed initial support or no support was recorded due to the significance of support in relation to fall risk. Beside the above modifications, all directions and guidelines are from the CDC.<sup>10</sup>

Each position was described and demonstrated for the participants. The participants wore gait belts with a chair in front of them for safety and were tested in a corner with their back facing the wall but not touching. The participants wore their comfortable "everyday" shoes. The instructions to each participant was as follows: "I'm going to show you one position. Try to stand in the position for 30 seconds. You can hold your arms out or move your body to help keep your balance

but don't move your feet. Hold this position until I tell you to stop. For each stage I will say 'Ready, begin' and begin timing. After 30 seconds I will say 'Stop'." For tandem stance and semi-tandem stance the participants were given the opportunity to trial which foot forward they would like to be tested on and for single leg stance which foot they would like to be tested on. The foot of choice was recorded to ensure the same foot would be used for assessment pre- and post-program completion. Participants were encouraged to step into each position without support but were provided support by the hand of the assessor if needed. Timing began immediately when the participant was standing independent in position. Time was stopped if the participant needed to step out of the position, touched the wall or other objects with their hands to catch themselves, or achieved 30 seconds in the position.

#### Data Analysis

Percent change in tandem stance and single leg stance times from Week 1 to Week 7 will be reported. Whether or not falls risk was identified or if initial support was used for each stance Week 1 and Week 7 will also be reported. The score on the CDC Fall Risk Checklist will be compared to the score on the FSBT identifying whether a fall risk was present. Past medical history will be compared to the score on the FSBT and whether significant history of falls or comorbidities indicates identified fall risk. Change in self-perceived balance, confidence, and activity level based on the Week 1 Stepping On Baseline Questionnaire and Week 7 Stepping On Survey will be reported. The results of the other tests including the ABC, 30secSTS, and TUG will be reported in other research papers.



## CHAPTER III

### RESULTS

All 3 participants completed pre-program assessments and surveys including the Week 1 Stepping On Baseline Questionnaire, CDC Fall Risk Checklist, ABC, 30secSTS, TUG, and FSBT during Week 1. After the first week, one participant dropped out of Stepping On program due to concerns with completing the exercises due to knee pain from a past car accident. The remaining two participants (1 female and 1 male, mean age = 91 years) attended all 7 weeks and reported exceptional adherence to their home exercise program. During Week 7, the remaining two participants completed post-program assessments and surveys including the Stepping On Exit Survey, Week 7 Stepping On Survey, ABC, 30secSTS, TUG, and FSBT. The pre- and post-program results of the FSBT for the participants can be viewed in Table 3.

#### Four Stage Balance Test

Subject 1 completed the FSBT individual stage of tandem stance Week 1 for 24.54 seconds and Week 7 for 30 seconds indicating an improvement of 5.46 seconds and 22% increase in time. These times indicate no increased fall risk in reference to normative data. Subject 1 completed the FSBT individual stage of single leg stance Week 1 for 4.41 seconds and Week 7 for 6.16 seconds indicating an improvement of 1.75 seconds and 40% increase in time. These times indicate

Table 3. Four Stage Balance Test Results. \***Bolded** scores indicate fall risk based on normative data for tandem stance and age related norms for single leg stance.

FSBT	Single Leg Stance		Tandem Stance		Semi-Tandem Stance	
	Week 1	Week 7	Week 1	Week 7	Week 1	Week 7
Subject 1	<b>(R) 4.41 sec w/out support</b>	<b>(R) 6.16 sec w/out support</b>	(R) 24.54 sec w/out support	(R) 30 sec w/out support	N/A	N/A
Subject 2	<b>(L) 3.90 sec w/ initial support</b>	<b>Unable</b>	(L) 12.66 sec w/initial support	<b>(L) 6.91 sec w/ initial support</b>	(L) 30 sec w/out support	(L) 30 sec w/out support
Subject 3	<b>(R) 3.75 sec w/support</b>	N/A	(R) 13.40 sec w/ initial support <b>(R) 3.10 sec w/out support</b>	N/A	N/A	N/A

increased fall risk in reference to age and gender related norms. Subject 1 completed both Week 1 and Week 7 assessments without support for all positions.

Subject 2 completed the FSBT individual stage of tandem stance Week 1 for 12.66 seconds and Week 7 for 6.91 seconds indicating a decrease in performance of 5.75 seconds and 45% decrease in time. FSBT tandem stance results from Week 1 indicate no fall risk, while results from Week 7 indicate an increased fall risk in reference to normative data. Subject 2 completed single leg stance Week 1 for 3.90 seconds and was unable to complete the stance (0 seconds) Week 7 indicating a decrease in performance of 3.90 seconds and 100% decrease in time. FSBT single leg stance results from Week 1 and Week 7 indicate an increased fall risk in reference to age and gender normative data. Subject 2 had difficulty completing tandem stance during the home exercise program in which a modified tandem

stance was practiced instead (heel of front foot lined up with toe of back foot with increased distance between feet to increase base of support). Modified tandem was tested during Week 7 only and was completed for 11.09 seconds. Semi-tandem stance was performed Week 1 and Week 7 and was completed for 30 seconds both weeks. Subject 2 completed both Week 1 and Week 7 assessments with initial support for all positions except semi-tandem stance.

Subject 3 completed the tandem stance Week 1 with initial support for 13.40 seconds indicating no increased fall risk as shown in reference to normative data. Subject 3 completed single leg stance with support for 3.10 seconds indicating fall risk in reference to the age and gender related norms. Subject 3 did not complete the Stepping On program due to previous knee pain.

#### Fall Risk Checklist

All three participants scored 4 points or higher indicating a risk of falling. See Table 4 for each Subject's score and detailed responses. When comparing the fall risk results on the CDC Fall Risk Checklist to the results found with the FSBT Week 1 they are dissimilar as all participants resulted in no fall risk in reference to the normative data provided for the FSBT for the tandem stance stage. Week 7 FSBT results of Subject 2 reflect results found with the Fall Risk Checklist, as fall risk was identified with tandem stance. Week 7 FSBT results of Subject 1 did not reflect results found with the Fall Risk Checklist, as fall risk was not identified with tandem stance. When comparing the fall risk results from the Fall Risk Checklist to the results found Week 1 and Week 7 with the FSBT individual stage of single leg stance

Table 4. Fall Risk Checklist Results.

	Subject #1	Subject #2	Subject #3
I have fallen in the past year. (2 points)	Yes, x 2	Yes, x 1	Yes, x 5-6
I use or have been advised to use a cane or walker to get around safely. (2 points)	No	No	Yes, not at home
Sometimes I feel unsteady when I am walking. (1 point)	No	No	Yes
I steady myself by holding onto furniture when walking at home. (1 point)	No	No	No
I am worried about falling. (1 point)	No	No	Yes
I need to push with my hands to stand up from a chair. (1 point)	No	No	Yes
I have some troubles stepping up onto a curb. (1 point)	Yes	No	Yes
I often have to rush to the toilet. (1 point)	Yes	Yes	Yes
I have lost some feeling in my feet. (1 point)	No	Yes	No
I take medicine that sometimes makes me feel light-headed or more tired than usual. (1 point)	No	Yes, 6 types of meds	When on antibiotic, 3 meds taken
I take medicine to help me sleep or improve my mood. (1 point)	Yes	Yes	No
I often feel sad or depressed. (1 point)	No	No	Yes
<b>Total</b>	<b>5</b>	<b>6</b>	<b>11</b>

the results are similar, as each participant demonstrated increased fall risk in reference to age and gender related normative data.

#### Week 1 Stepping On Baseline Questionnaire

Subject 1 had a history of 1 fall and a non-specified vision impairment. Subject 1 had increased fall risk identified with Week 1 and Week 7 single leg stance, but no increased fall risk was identified with Week 1 and Week 7 tandem stance. Subject 2 had a history of 1 fall, a mild stroke 20 years prior with left sided weakness, present loss of sensation in both feet due to trench foot, and glasses for vision impairment. Subject 2 had increased fall risk identified with Week 1 and

Week 7 single leg stance and Week 7 tandem stance, but no increased fall risk was identified with week 1 tandem stance. Subject 3 had history of 5-6 falls, knee pain from a past car accident, macular degeneration of left eye, glasses for vision impairment, and balance and walking difficulties. Subject 3 had increased fall risk identified with Week 1 tandem stance without initial support and single leg stance, and no increased fall risk identified with Week 1 tandem stance with initial support. When comparing significant past medical history to the results found Week 1 and Week 7 with the FSBT individual stage of single leg stance the results reflect similarities, as each participant demonstrated increased fall risk in reference to age and gender related normative data. Fall risk identified by significant past medical history inconsistently correlated with fall risk identified with tandem stance results.

#### Week 7 Stepping On Survey

Subject 1 reported that self-perceived balance improved and confidence stayed the same after completion of Stepping On. Subject 2 reported that self-perceived balance and confidence stayed the same after completion of Stepping On. Subject 1 and Subject 2 reported an improvement in physical activity level from minimally active using the Week 1 Stepping On Baseline Questionnaire to moderately active using the Week 7 Stepping On Survey. Subject 1 and Subject 2 also reported that no falls occurred since the start of Stepping On and that the exercises were performed faithfully.

## CHAPTER IV

### DISCUSSION

The purpose of this study is to find whether participant static balance measured by the FSBT improved with the Stepping On program Week 1 to Week 7. Subject 1 had improved times between Week 1 to Week 7 for both tandem stance and single leg stance demonstrating a 22% increase in tandem stance time and a 40% increase in single leg stance time. Subject 2 had decreased times Week 1 to Week 7 demonstrating a 45% decrease in tandem stance time and a 100% decrease in single leg stance time. These results indicate that FSBT scores improve in 1 of 2 individuals with the Stepping On program Week 1 to Week 7.

One probable reason that Subject 2 did not show improvements in FSBT times may be attributed to older age. Past research that demonstrated the effectiveness of Stepping On in fall prevention through functional testing had a much younger participant mean age (78 years old) than the mean age in this study (87 years old).<sup>3,5</sup> Research that found the reliability and validity of tandem stance and single leg stance to be good also had a much younger participant mean age (63 years old) than in this study.<sup>15</sup> Research that found that the single leg stance has poor absolute reliability and poor sensitivity in a clinical setting had a participant mean age (72 years old) older and closer in age to this study.<sup>18</sup> This indicates that

as participant age increases the reliability and sensitivity to functional change using single leg stance may decrease in a clinical setting.

Another probable reason that subject 2 did not show improvements in FSBT times might be attributed to the short duration between Week 1 and Week 7 assessments. A fall prevention program called the Otago Exercise Program uses solely exercise for fall prevention.<sup>8</sup> The exercises implemented in this program are similar to the Stepping On exercises. Research provided by the Otago Exercise Program indicates that the program is effective in individuals with fall risk through assessments one year after starting the program. The program was especially effective in reducing fall risk in participants 80 years and older. A study by Sherrington et al<sup>20</sup> found that 50 hours of exercise and balance training must be completed in order for improved balance. The minimum effective dose of exercise was found to be 2 times a week for 25 weeks or 4 to 5 times a week for 12 weeks. This indicates that a duration of 7 weeks is not adequate time for the participants of Stepping On to demonstrate improved balance even with faithfulness in completing the exercises.

Subject 2 also had a significant past medical history including a stroke and decreased sensation in both feet. This may have also contributed to why Subject 2 did not show improvements in FSBT times. Subject 1 did not have a past medical history as extensive as Subject 2, and may contribute to why Subject 2 did show improvements in FSBT times.

Other purposes of this study are to identify whether fall risk measured by the FSBT correlates with fall risk identified by the CDC Fall Risk Checklist and

participant past medical history. Fall risk identified with the individual stage of tandem stance was inconsistent in identifying fall risk found with the Fall Risk Checklist and participant past medical history. Based on research by Hile et al,<sup>17</sup> the inconsistency may be due to the allowance of initial hand support during the FSBT when stepping into the positions, as initial hand support has been positively correlated to decreased performance on the TUG, decreased gait speeds, and decreased balance confidence. The FICSIT-4 and Berg Balance Scale are also valid and reliable measures of balance and both do not allow initial hand support when stepping into tandem stance in order to receive the highest subtest score of 4.<sup>11,12</sup> The allowance of initial hand support when using the FSBT may permit fall risk to not be accurately accounted for or recognized. Another reason there was an inconsistency may be due to the normative data set by the CDC for the FSBT. According to the CDC, an older adult who cannot hold tandem stance for 10 seconds is at an increased for falls.<sup>10</sup> This time may be inaccurate as it may be dependent on an individual's actual age and gender rather than the broad category of "older adult". Fall risk identified with the individual stage of single leg stance was consistent in identifying fall risk found with the Fall Risk Checklist and participant past medical history. This may be due to utilizing age and gender normative data by Springer et al<sup>13</sup> to identify fall risk rather than the FSBT set time of 10 seconds. Within the FSBT, single leg stance may be more valid in identifying falls risk using age and gender normative data than tandem stance in this study when comparing identified falls risk to falls risk identified with the Fall Risk Checklist and participant past medical history.



The last purpose of this study was to assess whether participants' self-perceived balance, confidence, and physical activity level improved following the completion of Stepping On. Subject 1 reported an improvement in self-perceived balance while Subject 2 reported that it stayed the same. Subject 2 had difficulty with some of the balance exercises and had a more significant past medical history including a stroke and decreased sensation in both feet, which may attribute to the report of balance remaining the same. Subject 1 and Subject 2 reported that their confidence remained the same from Week 1 to Week 7. Subject 1 and Subject 2 both reported an increase in self-perceived physical activity level from minimally active to moderately active. This improvement may be attributed to both Subjects' faithfulness in completing their exercises.

Limitations to this study include the small sample size ( $n=2$ ), the average age of the participants (87 years old), and the short duration between pre- and post-program assessments (7 weeks). Typical Stepping On classes include larger class sizes of about 12 to 14 participants, in which more data would be available to be collected. Since the mean age of the participants was older, improvements in balance may be harder to achieve and take longer than in a younger population. The short duration of 7 weeks between Week 1 and Week 7 FSBT assessments may not give the participants adequate time to show improvements in balance even when the participants are faithful in completing their exercises.

Recommendation for future research is to conduct functional assessments including the FSBT at the 3 month follow up in order to give participants time to show improvement in balance. Suggested research for future studies on fall

prevention includes additional research on falls risk associated with tandem stance. Age normative data for tandem stance in healthy adults should be identified and the fall risk associated with initial support needed for stabilization in tandem stance should also be tested. In addition, research on the reliability, validity, and age normative data should be conducted on the FSBT as a whole.

## CHAPTER V

### CONCLUSION

Static balance measured by the FSBT improved in 1 of 2 individuals with the Stepping On program Week 1 to Week 7. In order to conclude that static balance measured by the FSBT improves with the Stepping On program, a longer duration of study may need to be conducted, greater than one balance assessment may need to be used, or a different balance assessment may need to be used. Fall risk identified by the FSBT individual stage of tandem stance did not consistently correlate with fall risk identified with the Fall Risk Checklist and past medical history. Fall risk identified by the FSBT individual stage of single leg stance did consistently correlate with fall risk identified with the Fall Risk Checklist and past medical history when age and gender normative data was used. This indicates that single leg stance was more valid in identifying fall risk than tandem stance. Self-perceived balance improved in 1 of 2 participants, confidence remained the same for both participants, and activity level improved in both participants. Both participants reported no incidents of falls from Week 1 to Week 7. Overall, the clinical significance of this study suggests that the FSBT as a whole may not be the best to use in identifying fall risk with the current test procedure and normative data. It is important to keep in mind that factors such as the small sample size, participant age, and participant past medical history may have influenced the results of this study.

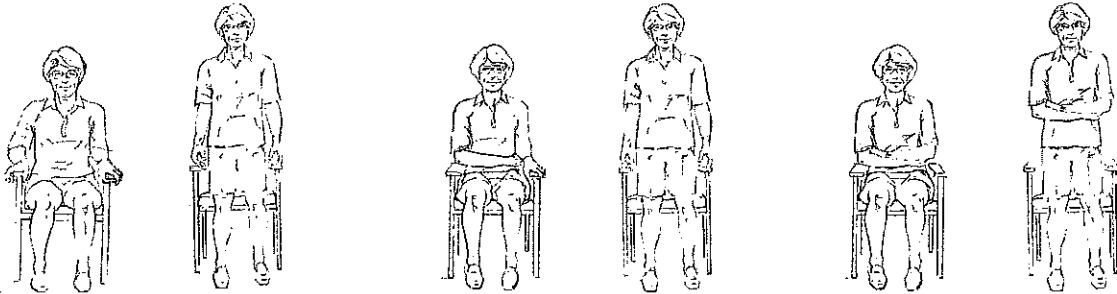
APPENDIX A  
Stepping On Exercises

# Exercises at a glance

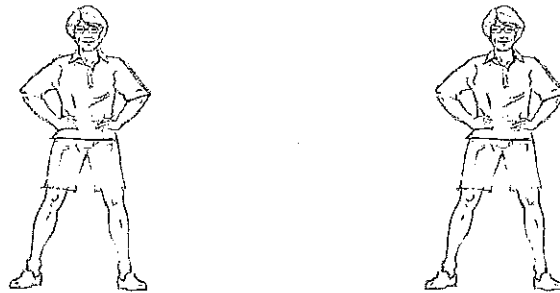
## BALANCE EXERCISES

For more specific instructions on advancing each exercise, refer back to the manual.

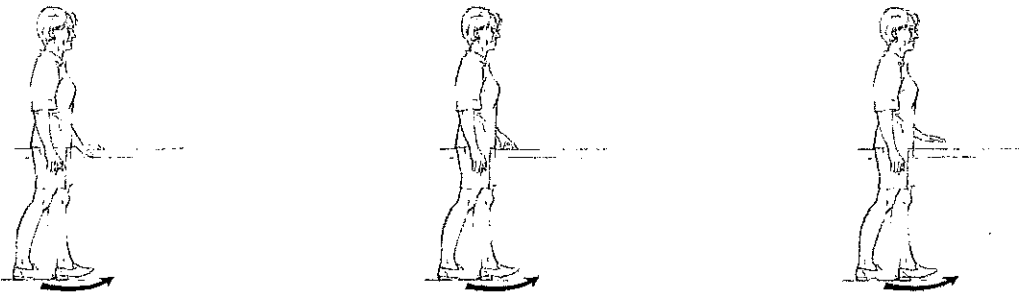
### Sit-to-stand



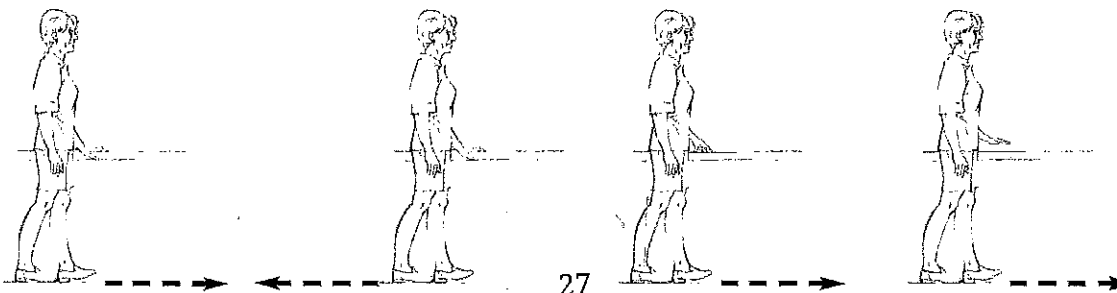
### Sideways walking



### Heel-toe (tandem) standing



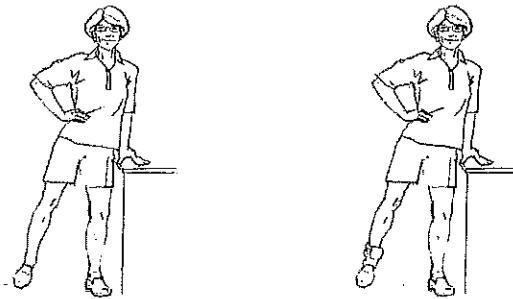
### Heel-toe (tandem) walking



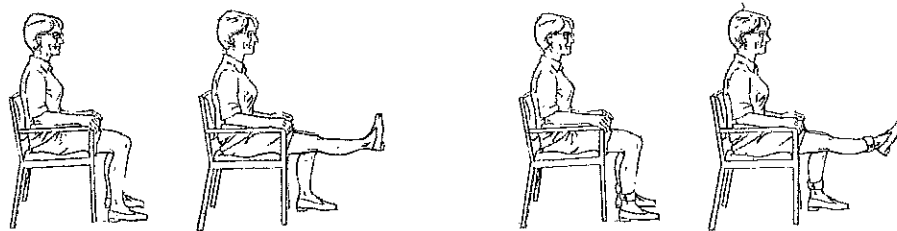
## Strength Exercises

For more specific instructions on advancing each exercise, refer back to the manual.

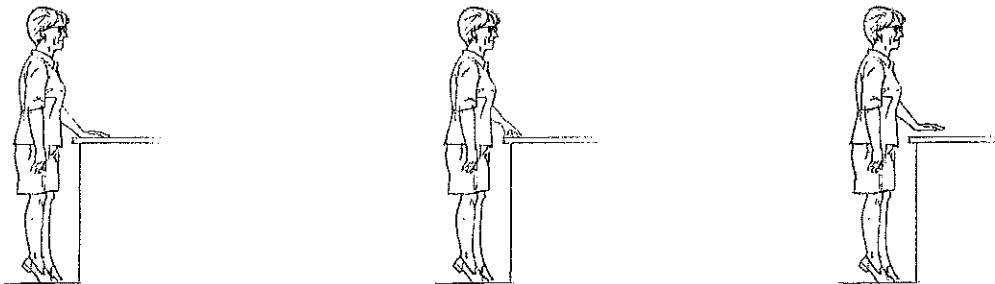
### Side-hip-strengthening



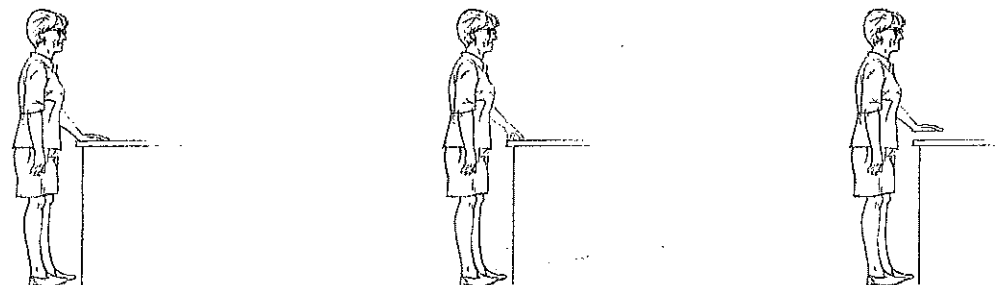
### Front-knee-strengthening



### Heel raises

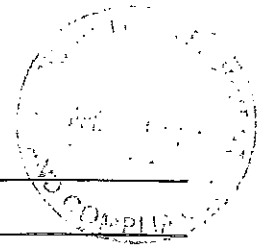


### Toe raises



APPENDIX B  
Approved IRB Protocol  
Participant Consent Form

**Research Project Review and Progress Report**  
 University of North Dakota Institutional Review Board



DATE: 2/26/2016 DEPARTMENT: Physical Therapy

PRINCIPAL INVESTIGATOR: Danks, Meridee; Johnson, Beverly

PROJECT TITLE: The Effectiveness of the "Stepping On" Program for Reducing the Incidence of Falls in the Elderly

PROPOSAL NUMBER: IRB-201209-047

IF MEDICAL COMPONENT, PLEASE GIVE PHYSICIAN'S NAME: \_\_\_\_\_

<b>IRB USE ONLY</b>	
<input type="checkbox"/>	FULL BOARD REVIEW REQUIRED, EVEN THOUGH ORIGINAL APPROVAL WAS EXPEDITED
<input checked="" type="checkbox"/>	CONTINUED APPROVAL, "EXPEDITED" CATEGORY <u>4,7</u>
<input checked="" type="checkbox"/>	NEXT REVIEW REQUIRED BEFORE: <u>APR 3 2017</u>
<input type="checkbox"/>	CONTINUED APPROVAL, BASED ON FULL BOARD REVIEW
<input type="checkbox"/>	NEXT REVIEW REQUIRED BEFORE: _____
<input type="checkbox"/>	SUSPEND APPROVAL, PENDING INVESTIGATION
<input type="checkbox"/>	APPROVAL TERMINATED
COMMENTS OF REVIEWER: _____	
Signature of Chair/Vice Chair or Designee: <u>[Signature]</u>	
cc: Chair, Physical Therapy	Approval Date: <u>4.5.16</u>

1. Is project complete? Yes  No

2. Is project ongoing? Yes  No

If No, explain below and indicate if continued approval and continuing review is desired.

3. How many subjects have been enrolled in the research project?

14 since the date of last approval, and  
34 since the initial approval

4. Is the research permanently closed to the enrollment of new subjects? Yes  No

Have all subjects completed all research-related interventions? Yes  No

Does the research remain active only for long-term follow-up of subjects? Yes  No

5. Is data analysis complete? Yes  No

\*\*\* If the research is permanently closed to the enrollment of new subjects, all subjects have completed all research-related interventions, the research does not need to remain active for long-term follow-up of subjects, and all data analysis is complete, please sign here that you would like the IRB to terminate approval for this project, and finish filling out the rest of this form.

Please terminate IRB approval for this research project \_\_\_\_\_  
 Signature of Principal Investigator Date



## INFORMED CONSENT

**TITLE:** The Effectiveness of the "Stepping On" Program for Reducing the Incidence of Falls in the Elderly

**PROJECT DIRECTOR:** Meridee Danks and Beverly Johnson

**PHONE #** 701-777-2831

**DEPARTMENT:** Physical Therapy

### STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on an understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

### WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study that will look at the effectiveness of education and exercise in reducing falls. You have been identified as a possible subject as you are presently participating in the "Stepping On" program. The purpose of this research study is to test whether the Stepping On program is effective in reducing falls in older people living at home. Participants need to be 65 or older, live in on their own, and be able to walk independently in the community.

### HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 10-12 people at each site will take part in this study being performed by University of North Dakota Department of Physical Therapy.

### HOW LONG WILL I BE IN THIS STUDY?

Your participation in the study will last the same length of time you will be in the Stepping On program (7 weeks with a 3 & 6-month follow-up). The assessment times will be at the same days as when you will be attending your Stepping On program. Each visit will take about 20 minutes during the Day 1, Day 7, 3-month & 6-month recheck of the Stepping On program.

Approval Date:     MAY 11 2015    

Expiration Date:     MAY 10 2016    

University of North Dakota IRB

## WHAT WILL HAPPEN DURING THIS STUDY?

Assessments will occur at Week 1 and 7 sessions and then at 3 month booster session and at 6 month recheck at the same site. Assessment will include the following:

1. Baseline Questionnaire and Fall Risk Survey - are filled out as part of the Stepping On program. Questionnaire is to gather demographic, mobility and fall information. You are free to skip any questions that you prefer not to answer. Time to complete is ~10 minutes.

Additional test performed (beyond Stepping On gathered information), include:

2. Activities-specific Balance Confidence (ABC) Scale - subject rates level of confidence in doing everyday activities with out falling using a 0 – 100% scale (0 = no confidence to 100 = completely confident). Total score is sum of 16 individual activity scores, which is than averaged, the higher the score the less concerns the subject has about falling. Time to complete is less than 5 minutes.

3. Sit to Stand Test (STS) - the subject will be asked to go from a sit to stand for 30 seconds. The number of repetitions will be completed in 30 sec and the length of time to complete the first 5 sit to stands will be recorded. This is an objective measurement of strength and balance. Time to complete ~ 3 minutes.

4. Timed Up and Go Test (TUG) - the test requires that subjects stand up from a chair, walk 10 ft, turn around, and return. The time to complete the activity is recorded. A second trial will be performed with the subject perfroming a cognitive task (i.e. subtracting by 3s or spelling words) while walking. A safety belt will be used when performing the assessment. Time to complete is 1 minute. This is an objective measure of balance in an activity of daily function. If available, the GAITRite electronic walkway may be used to allow the researchers to gather greater data on subjects walking parameters during the 10 meter walk.

5. Four-Test Balance Scale -- This is a four part balance test, each part progressively challenges a person balance. The subject first will try to balance for 10 seconds with feet together, then with feet together but one slightly ahead of the other, progressing to one foot in front of the other (heel-toe) and lastly, the subject stands on one leg for up to 30 seconds with eyes open. If subject is unable to stand for the allotted time for any part the test will be stopped. A safety belt will be used during this assessment. Time to complete is 3-5 minutes. This is an objective measure of balance and strength.

6. Fall and Activity Survey and Stepping On Participation Evaluation - each subject will be given the 2 survey's following the completion of Stepping On session at Week 7, at 3-month Booster session and at the 6 months recheck to record any falls that have occurred and to monitor follow through of assigned strength and balance exercises. Fall is defined as an event that results in a person unintentionally coming to rest on the ground, floor, or

Approval Date:     MAY 11 2015    

Expiration Date:     MAY 10 2016    

University of North Dakota IRB

other lower level. (Buchner) If a subject is unable to attend the Booster session and/or at the 6-month recheck they will be contacted by phone or mail in regards to the survey.

### **WHAT ARE THE RISKS OF THE STUDY?**

There may be some risk from being in this study, mainly with the potential to lose your balance. This risk will be minimized by use of safety precautions. For each physical balance assessment a safety belt and spotter will be used to prevent any falls. You can decide not to perform any assessment that you do not feel comfortable/safe performing.

### **WHAT ARE THE BENEFITS OF THIS STUDY?**

You benefit personally from being in this study. However, we hope that, in the future, other people might benefit from this study because it may help identify benefits of prevention education and exercise on falls in the elderly population. You may benefit by knowing your balance strengths and weakness that will be identified by the assessment scores.

### **ALTERNATIVES TO PARTICIPATING IN THIS STUDY**

You can decide to participant only in the Stepping On program and not in the research study.

### **WILL IT COST ME ANYTHING TO BE IN THIS STUDY?**

You will not have any costs for being in this research study. Nor will you be paid for being in this research study.

### **WHO IS FUNDING THE STUDY?**

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research study.

### **CONFIDENTIALITY**

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of assigning you an identification number that will be used instead of your name on any data that is kept. Your signed consent form and your data will be stored separately in a locked room. Only the researchers will have access to any identifiable information. If we write a report or article about

Approval Date:     MAY 11 2015    

Expiration Date:     MAY 10 2016    

University of North Dakota IRB

this study, we will describe the study results in a summarized manner so that you cannot be identified.

**IS THIS STUDY VOLUNTARY?**

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota or the Stepping On program

**CONTACTS AND QUESTIONS?**

The researchers conducting this study are Meridee Danks and Beverly Johnson. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact **Meridee Danks or Beverly Johnson at 701-777-2831** during the day.

If you have questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the **University of North Dakota Institutional Review Board at (701) 777-4279**. Please call this number if you cannot reach research staff, or you wish to talk with someone else.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subjects Name: (Print) \_\_\_\_\_

Signature of Subject \_\_\_\_\_ Date \_\_\_\_\_

I have discussed the above points with the subject or, where appropriate, with the subject's legally authorized representative.

Signature of Person Who Obtained Consent \_\_\_\_\_ Date \_\_\_\_\_

Approval Date: <u>    MAY 11 2015    </u>
Expiration Date: <u>    MAY 10 2016    </u>
University of North Dakota IRB

APPENDIX C

Four Stage Balance Test

CDC Fall Risk Checklist

Week 1 Stepping On Baseline Questionnaire

Week 7 Stepping On Survey

3 Months After Stepping On Survey

Patient: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ AM/PM

## The 4-Stage Balance Test

**Purpose:** To assess static balance

**Equipment:** A stopwatch

**Directions:** There are four progressively more challenging positions. Patients should not use an assistive device (cane or walker) and keep their eyes open.

Describe and demonstrate each position. Stand next to the patient, hold his/her arm and help them assume the correct foot position.

When the patient is steady, let go, but remain ready to catch the patient if he/she should lose their balance.

If the patient can hold a position for 10 seconds without moving his/her feet or needing support, go on to the next position. If not, stop the test.

**Instructions to the patient:** I'm going to show you four positions.

Try to stand in each position for 10 seconds. You can hold your arms out or move your body to help keep your balance but don't move your feet. Hold this position until I tell you to stop.

For each stage, say "**Ready, begin**" and begin timing.

After 10 seconds, say "**Stop.**"

*See next page for detailed patient instructions and illustrations of the four positions.*

For relevant articles, go to: [www.cdc.gov/injury/STEADI](http://www.cdc.gov/injury/STEADI)



Centers for Disease  
Control and Prevention  
National Center for Injury  
Prevention and Control

**STEADI** Stopping Elderly  
Accidents, Deaths & Injuries

**Instructions to the patient:**



1. Stand with your feet side by side.

**Time:** \_\_\_\_\_ **seconds**



2. Place the instep of one foot so it is touching the big toe of the other foot.

**Time:** \_\_\_\_\_ **seconds**



3. Place one foot in front of the other, heel touching toe.

**Time:** \_\_\_\_\_ **seconds**



4. Stand on one foot.

**Time:** \_\_\_\_\_ **seconds**

***An older adult who cannot hold the tandem stance for at least 10 seconds is at increased risk of falling.***

Notes:

## Stepping On – Week 1 Fall Risk Checklist (CDC)

Name \_\_\_\_\_ Age \_\_\_\_\_ Date \_\_\_\_\_

Please Circle “Yes” or “No” for each statement below. ( ) indicates # of points .

Yes (2) or No (0) I have fallen in the past year. If yes, how many times? \_\_\_\_\_

Yes (2) or No (0) I use or have been advised to use a cane or walker to get around safely.

\*If yes, what assistive device do you use most often?

Yes (1) or No (0) Sometimes I feel unsteady when I am walking.

Yes (1) or No (0) I steady myself by holding onto furniture when walking at home.

Yes (1) or No (0) I am worried about falling.

Yes (1) or No (0) I need to push with my hands to stand up from a chair.

Yes (1) or No (0) I have some trouble stepping up onto a curb.

Yes (1) or No (0) I often have to rush to the toilet.

Yes (1) or No (0) I have lost some feeling in my feet.

Yes (1) or No (0) I take medicine that sometimes makes me feel light-headed or more tired than usual.

\*How many prescription medicines do you take per day? \_\_\_\_\_

Yes (1) or No (0) I take medicine to help me sleep or improve my mood.

Yes (1) or No (0) I often feel sad or depressed.

**TOTAL** \_\_\_\_\_ Add up the number of points for each “yes” answer. *If you scored 4 points or more, you may be at risk for falling.*



## Stepping On Baseline Questionnaire – Week 1

Yes or No Do you have any vision impairments? (glasses, macular degeneration, glaucoma, etc.)

\*If yes, what kind?

Yes or No Have you had any surgeries in the last year? (hip, knee, etc.)

\*If yes, what kind?

Yes or No Have you had any major health issues in the past year?

\*If yes, briefly describe.

Yes or No Do you have difficulty with walking or balance?

Yes or No Do you exercise regularly (3x/week or more)?

\*If yes, what type of exercise & how often do you perform it?

\*How would you rate your level of physical activity on a typical day? (circle one)

Inactive

Minimally Active

Moderately Active

Highly Active

Date \_\_\_\_\_

Name \_\_\_\_\_

### Stepping On Survey – Week 7

1. Do you feel your balance and confidence have improved while performing daily activities as a result of participating in the Stepping On Program?

Balance      Yes \_\_\_\_\_      No \_\_\_\_\_

Confidence      Yes \_\_\_\_\_      No \_\_\_\_\_

If yes, what information helped you the most?

2. A fall is any event that led to an unplanned, unexpected contact with a supporting surface such as the floor. Have you fallen since starting the Stepping On Program?

Yes \_\_\_\_\_      No \_\_\_\_\_      If yes, how many falls since the program began: \_\_\_\_\_

Describe the cause of fall(s) and any injuries that occurred:

3. How would you rate your present level of daily physical activity? (circle one)

**Inactive/Low**

**Moderate**

**High**

If your physical activity is limited, what do you think is the major reason?

4. Have you performed the Stepping On exercises faithfully?

Yes \_\_\_ No \_\_\_

If no, what has kept you from performing the exercises as per the recommended amount of times?

If yes, record on the chart below how often each week you perform the Stepping On exercises, the number of repetitions you do of each exercise, and the amount of weight you use with the strength exercises?

**Balance Exercises:**

	# times/week	# of repetitions
Sit-to-Stand		
Sideways Walking		
Heel-toe standing		
Heel-toe walking		

**Strength Exercises:**

	# times/week	# of reps & weight
Side-hip-strengthening		
Knee-strengthening		
Heel raises		
Toe raises		

5. Do you have any difficulties performing the above exercises?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, describe what difficulties you are having?

6. Had you been actively exercising at home prior to the Stepping On program?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, what type of exercise did this include?

How frequently do you perform these? \_\_\_\_\_

7. Do you participate in community exercise groups (other than Stepping On program)?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, what group and/or type of exercise?

How often do you attend? \_\_\_\_\_

Date \_\_\_\_\_

ID # \_\_\_\_\_

### Stepping On Survey – 3 months after

1. Do you feel your balance and confidence have improved while performing daily activities as a result of participating in the Stepping On Program?

Balance Yes\_\_\_ No\_\_\_

Confidence Yes\_\_\_ No\_\_\_ If yes, what strategies have helped you?

2. Do you feel that the Stepping On Program has helped you?

Yes\_\_\_ No\_\_\_ If yes, how has it helped you?

3. Have you had any falls since completing the Stepping On Program?

Yes\_\_\_ No\_\_\_ If yes, how many falls: \_\_\_\_\_  
What was the cause(s) of the fall(s)?

4. How often do you perform the Stepping On exercises usually? (Circle below)

**Strength:**  $\geq 3x/\text{week}$  2x/week 1x/week < than 1x/week Not at all

**Balance:**  $\geq 3x/\text{week}$  2x/week 1x/week < than 1x/week Not at all

If you have not been doing the exercises regularly, what has kept you from doing so?

5. Have you joined or continued any community exercise groups since the Program?

Yes\_\_\_ No\_\_\_ If yes, what group?

## REFERENCES

1. Jaffe S. Fear of falling: One trip can cause serious damage. Here's how to avoid it. Washington Post 2016. Available at: [https://www.washingtonpost.com/national/health-science/fear-of-falling-one-trip-can-cause-serious-damage-heres-how-to-avoid-it/2016/01/11/fbe94564-a2a5-11e5-b53d-972e2751f433\\_story.html](https://www.washingtonpost.com/national/health-science/fear-of-falling-one-trip-can-cause-serious-damage-heres-how-to-avoid-it/2016/01/11/fbe94564-a2a5-11e5-b53d-972e2751f433_story.html). Accessed May 2016.
2. Important Facts About Falls. Centers for Disease Control and Prevention 2016. Available at: <http://www.cdc.gov/homeandrecreationalafety/falls/adultfalls.html>. Accessed May 2016.
3. Clemson L, Cumming RG, Kendig H, Swann M, Heard R, Taylor K. The effectiveness of a community-based program for reducing the incidence of falls in the elderly: A Randomized Trial. *Journal of the American Geriatrics Society*. 2004;52(9):1487-1494.
4. Brown C, Gottschalk M, Van Ness P, Fortinsky R, Tinetti M. Changes in physical therapy providers' use of fall prevention strategies following a multicomponent behavioral change intervention. *Phys Ther*. 2005;85:394-403.
5. Ory MG, Smith ML, Jiang L, et al. Fall prevention in community settings: Results from implementing stepping on in three states. *Frontiers in Public Health*. 2015;2.
6. Clemson L, Swann M, Mahoney. Stepping On Program Manual. 3<sup>rd</sup> ed. Cedar Falls, IA: *Feiberg Press Inc*. 2001
7. Talking about Fall Prevention with Your Patients. Center for Disease Control and Prevention 2016. Available at: [https://www.cdc.gov/steady/pdf/talking\\_about\\_fall\\_prevention\\_with\\_your\\_patients-a.pdf](https://www.cdc.gov/steady/pdf/talking_about_fall_prevention_with_your_patients-a.pdf). Accessed February 2016
8. OTAGO Exercise Programme. Available at: [http://www.hfwcnny.org/Tools/BroadCaster/Upload/Project13/Docs/Otago\\_Exercise\\_Programme.pdf](http://www.hfwcnny.org/Tools/BroadCaster/Upload/Project13/Docs/Otago_Exercise_Programme.pdf). Accessed July 1, 2016.

9. About CDC's STEADI (Stopping Elderly Accidents, Deaths, & Injuries) Tool Kit. Centers for Disease Control and Prevention 2015. Available at: <http://www.cdc.gov/steady/about.html>. Accessed May 2016.
10. The 4-Stage Balance Test. Centers for Disease Control and Prevention 2014. Available at: [https://www.cdc.gov/steady/pdf/4-stage\\_balance\\_test-a.pdf](https://www.cdc.gov/steady/pdf/4-stage_balance_test-a.pdf). Accessed February 2016.
11. Rossiter-fornoff JE, Wolf SL, Wolfson LI, Buchner DM. A cross-sectional validation study of the FICSIT common database static balance measures. Frailty and Injuries: Cooperative Studies of Intervention Techniques. *J Gerontol A Biol Sci Med Sci*. 1995;50(6):M291-7.
12. Rehab measures: Berg balance scale. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=888>. Accessed July 1, 2016.
13. Springer BA, Marin R, Cyhan T, Roberts H, Gill NW. Normative values for the unipedal stance test with eyes open and closed. *J Geriatr Phys Ther*. 2007;30(1):8-15.
14. Bobannon RW. Single limb stance times: A descriptive meta-analysis of data from individuals at least 60 years of Age. *Topics in Geriatric Rehabilitation*. 2006;22(1): 70-77.
15. Franchignoni F, Tesio L, Martino MT, Ricupero C. Reliability of four simple, quantitative tests of balance and mobility in healthy elderly females. *Aging Clinical and Experimental Research*. 1998;10(1):26-31.
16. Faber MJ, Bosscher RJ, Van wieringen PC. Clinimetric properties of the performance-oriented mobility assessment. *Phys Ther*. 2006;86(7):944-54.
17. Hile ES, Brach JS, Perera S, Wert DM, Vanswearingen JM, Studenski SA. Interpreting the need for initial support to perform tandem stance tests of balance. *Physical Therapy*. 2012;92(10):1316-1328.
18. Goldberg A, Casby A, Wasielewski M. Minimum detectable change for single-leg-stance-time in older adults. *Gait & Posture*. 2011;33(4):737-739.
19. STEADI Materials for Health Care Providers. Centers for Disease Control and Prevention 2015. Available at: <http://www.cdc.gov/steady/materials.html>. Accessed June 19, 2016
20. Sherrington C, Whitney JC, Lord SR, Herbert RD, Cumming RG, Close JCT. Effective exercise for the prevention of falls: A systematic review and meta-analysis. *Journal of the American Geriatrics Society*. 2008;56(12):2234-2243.