

Short Paper

Improving Balance of Older Adults by Walking, Education, and Wii™ Bowling

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Abstract

The purpose of this study was to determine if balance education, walking, and Wii™ bowling can reduce the risk of falls in older adults. Seventeen older adults (84.59±4.65 years old), 65 years and older, who were at a risk for falls were recruited for the balance intervention program held twice a week for 8 weeks. Each session consisted 20 minutes of balance education in topics such as medication side-effects, vision and lighting, environmental hazards, footwear, sleep, hydration, and nutrition; 20 minutes of walking at the subject's own pace; and 20 minutes of Wii™ bowling which included standing up from a chair, walking 3 meters, bowling, walking back 3 meters, and sitting down; twice a week for 8 weeks. Participants were compared to 10 participants in a control group (83.40±6.75 years old). Participants in the intervention group had significant improvement on the Berg Balance Scale (BBS) and the Timed "Up and Go" Test (TUG) compared to the participants in the control group (BBS $p=.001$; TUG $p=.003$). The Activities-specific Balance Confidence (ABC) Scale scores were not significant between groups ($p=.725$). At follow-up testing the BBS scores were maintained ($p=.401$). The program improved balance and reduced fall risk for older adults in this study.

Keywords: Wii™; Falls; Older adult

Introduction

Each year, 30-40% of adults over 65 years old fall [1-3]. Falls are the leading cause of non-fatal injury among all ages [4]. Injuries from falls in older adults most often result in hip fractures [2]. Impaired mobility, especially impaired balance, is linked to increase falls [5,6]. When older adults are more active, their fall risk declines [3]. Fall intervention programs have been developed to address fall risk.

In 2010, the American Geriatrics Society/British Geriatrics Society Clinical Practice Guideline for Prevention of Falls in Older Persons recommended that exercise along with balance, strength, coordination, and gait combined with a multi-factorial program is ideal to reduce falls [7]. Studies

containing multi-factorial components have been shown to decrease fall risk [8-13]. A meta-analysis of 10 studies examining older adults at risk for falls showed that exercise was successful in decreasing falls with it being 5 times more effective if the program had smaller groups and were of shorter duration [10]. One particular program that emphasized education had a 31% fall reduction rate [13]. Although just having an education program without intervention is not found to be effective [12].

Walking is a simple activity to add to a multi-factorial fall prevention program since it is chosen as the primary physical activity by 81% of older adults [14]. The programs that included a walking component have shown a decrease in fall risk [15,16]. Although brisk walking is not recommend-

ed due to increased fall risk [17]. Adding the Wii™ to balance programs is also found to improve balance [18] but it is not as effective when done as the only intervention [19].

The purpose of this study was to determine if balance education, walking, and Wii™ bowling will improve balance and reduce the risk of falls in older adults.

Materials and Methods

This was a quasi-experimental design study that compared an intervention group to a control group that was not randomized since the control group was added after the intervention group data was collected. The Institutional Review Board at The Sage Colleges in Troy, NY, approved this study.

Participants:

Recruitment occurred at a senior center and 2 retirement communities via verbal communication and postings. Recruitment continued biweekly for a 1-month period and then the intervention commenced which was based on the researchers' schedules. The procedures were explained to each subject and informed consent was obtained prior to the start of the study. Participants were 65 years and older and determined to be at risk for falls. Individuals were considered at risk for falls if they had a score of 45/56 or less on the Berg Balance Scale (BBS) according to research done by Berg, Maki, Williams, Holliday, and Wood-Dauphinee [20]. This criterion was expanded to a score of 50/56 or less and a fall in the past 6 months to include more participants. The BBS has excellent reliability (ICC=.97) [20] with a sensitivity of 91% and a specificity of 82% for older adults [21]. Minimal detectable change (MDC) scores for older adults ranges from 3.3-4.9 for the criteria that we chose [22].

Additional inclusion criteria were that the participants had to be able to walk at least 20 feet without an assisted device and to be able to see an image on a TV screen. Individuals were excluded from the study if they had a resting blood pressure over 160/100 mmHg or if they required physical assistance in order to stand or walk. Other criteria that caused participants to be excluded were if they had unstable health or were unable to attend the intervention sessions on a consistent basis.

Procedure:

After the participants met the inclusion criteria, they were given the Timed "Up & Go" Test (TUG) and the Activity-specific Balance Confidence (ABC) scale. In the TUG, the participants were timed when they stood up from a chair, walked 3 meters, turned around, walked back to the chair and sat down [23]. The TUG was done twice and the times were averaged. The TUG has excellent reliability (ICC=.90) [24] and concurrent validity with the BBS ($r=-.76$) [20]. The MDC for older adults is 2.77 seconds [25]. On the ABC scale the participants rated

their balance confidence on a scale from 0-100 on 16 items [26]. The ABC scale has 84.4% sensitivity and 87.5% specificity with a score of less than 67% predicting falls [27]. The MDC score for older adults is not established but it is 11.2 for people with Parkinson's disease [28].

The intervention program was conducted at the senior center and retirement communities. The intervention for participants in the experimental group included a 1 hour balance program consisting of 20 minutes each of balance education, walking, and Wii™ bowling, twice a week for 8 weeks. During the balance education part of the program, a topic was introduced on the first visit in the week and follow up discussions on the same topic were addressed on the second visit to see if there were any changes made. General topics discussed were medication side-effects which may affect their balance; vision and lighting, environmental hazards, and footwear which may lead to falls; sleep, hydration, and nutrition. Samples of food and beverages for proper nutrition were provided at these events, and each participant in the intervention group was given a reacher, night light, and gift cards to a local grocery store.

Walking took place in the hallway of the retirement communities or around the ballroom of the senior center. Researchers walked with participants in order to provide safety and motivation. The participants were told to walk at their normal pace and to take breaks when needed. They were allowed to use an assistive device.

Wii™ bowling simulated the TUG test as described by Clark [29]. The participants stood up from a chair, walked 3 meters, bowled, turned around and walked back to the chair to sit down each time that they bowled. Unlike the TUG test, participants were not encouraged to walk as fast as they could. Participants did not use assistive devices for the bowling intervention and were guarded for safety.

Participants in the intervention group were re-examined on the BBS, TUG, and ABC scale at the end of the 8 week program. A follow-up of the same measures were done between 12-18 weeks following the intervention depending on participant and researchers' availability. Participants in the control group who met the inclusion criteria were tested using the BBS, TUG and ABC scale and then re-tested 8 weeks later without any intervention. A follow-up was not done with participants in the control group due to scheduling difficulties.

Data Analysis:

Nonparametric statistics were used due to the small samples sizes. A Mann-Whitney *U* Test was done to compare the data at pre-test between groups and then the compared the results of the participants in the intervention group to the participants in the control group. The Wilcoxon signed-rank test was performed from post-test to follow-up scores on the BBS, TUG,

and ABC for participants in the intervention group since there wasn't a follow-up with the control group due to time constraints. SPSS 21.0 was used to analyze the results.

Results

After the 1-month recruitment period at the 3 different sites, 17 participants (84.59±4.65 years old; 5 males, 12 females) were recruited for the intervention group, 3 from a senior center, 7 from 1 retirement community and 7 from another. Four of the participants had a fall in the past 6 months. The intervention was done separately at each setting for the 3 groups. Twelve participants were involved in the follow-up at 12-18 weeks after the intervention due to the researchers and participants' availability. Ten participants recruited from 2 senior centers were in the control group (83.40±6.75 years old; 2 males, 8 females). One subject in the intervention group reported a fall at follow-up. Refer to the Table for the results.

ance confidence scores of 72% at pre-test were above the 67% cut-off for falls [27] which may have affected the amount of improvement at post-test and follow-up. Our findings corroborate with Huang and Wang who found that ABC scores of older adults who live in the community, who were weren't frail, were less likely to improve their scores after intervention [31].

The results of our study are consistent with previous studies that show that a fall prevention program with multi-factorial components is effective in reducing the risk of falls [8-13]. Exploring topics related to falls assisted the participants in determining modifiable factors that they could change to reduce their risk, and they reported that changes were made. The walking program provided aerobic activity that is shown to also reduce falls, and Wii™ bowling incorporated the TUG which has a variety of transitions for the participant to practice and improve their balance. The combination of these interventions made a difference in the participants' balance thereby reducing their fall risk.

Table. Pre-test, Post-Test, and Follow-Up Scores on the Balance Measures.

Participants	Berg Balance Scale Pre-test	Berg Balance Scale Post-test	Berg Balance Scale Follow-up (n=12)	Timed "Up & Go" Test (s) pre-test	Timed "Up & Go" Test (s) post-test	Timed "Up & Go" Test Follow-up (n=12)	Activities-specific Balance Confidence Scale (%) Pre-test	Activities-specific Balance Confidence Scale (%) post-test	Activities-specific Balance Confidence Scale (%) Follow-up (n=12)
Intervention Group	41.6±4.8	48.1±3.1	48.1±3.1	14.1±4.3	11.6±3.3	12.0±3.4	72.0±13.5	74.9±15.2	77.0±16.9
Control Group	40.4±5.9	40.1±6.0	NA	17.2±8.1	17.9±7.5	NA	68.5±24.3	77.5±13.1	NA
Significance	p=.86	p=.001	p=.40	p=.28	p=.003	p=.05	p=.74	p=.73	p=.79

Discussion

In this multi-factorial fall intervention program consisting of balance education, walking, and Wii™ bowling, participants in the intervention group improved their balance scores on the BBS and TUG whereas the participants in the control group did not. At pre-test, 4 out of the 17 participants in the intervention group had fallen in the past 6 weeks whereas at follow-up, 5-6 months later, only 1 person had fallen. The participants made statistical improvements on the BBS which is the gold standard used to measure balance and predict fall risk. The mean score of 48/56 at post-test, was maintained at follow-up, and is above the 45/56 cut-off score that predicts falls [20]. Significant improvement was made on the TUG for participants in the intervention group from pre-test to post-test and they walked faster than the cut-off time for fall risk of 13.5 seconds at post-test and follow-up [30].

The ABC scale was the only measure that the participants in the intervention group did not improve on. Their mean bal-

Strengths of this study are that the intervention was done in small groups of 3-7 people and improvements in the reduction of fall risk were seen in just 8 weeks. A follow-up was done with the participants in the intervention group to determine if their improvements were maintained. A control group of participants not involved in the balance program were used for comparison. The participants in the intervention group enjoyed the program as seen by lively discussions during the balance education, rooting for each other during Wii™ bowling, and consistent attendance. Participants talked about continuing the program on their own after its conclusion. The results from this study can be generalized to older adults who live in the community who are at risk for falls. Limitations include not having a randomized or blinded group assignment and not having the examiners blinded to the balance scores. The sample size was small although significant results were obtained using conservative statistics. The ABC scale was not a good measure to use in this study because the participants were not

frail and had high scores at pre-test.

Suggestions for further studies is to have a larger sample size and to not use the ABC scale for determining balance confidence with participants who have high balance scores at pre-test. A gait measure such as the 6 Minute Walk Test could be used to determine if the participants improved their endurance which has been linked to functional status [32]. Since it was noted that many of the participants could walk farther during the walking portion of the intervention after 8 weeks.

Conclusion

In this study we did a multifactorial fall intervention program consisting of balance education, walking, and Wii™ bowling with older adults living in the community at a risk for falls, twice a week for 8 weeks. The participants improved their balance on the BBS and the TUG and their scores improved above the cut-off for fall risk at post-test and follow-up. This is a fun, motivating program that is simple and cost effective to carry out with older adults living in the community.

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