

Nintendo® Wii™ and a Physical Activity Routine: Effective Therapeutic Interventions in the Older Adult Population?

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Abstract

Occupational therapists work with individuals across the lifespan to promote health and wellness. “Occupational therapy promotes health and wellbeing through active involvement in meaningful occupations. By helping clients eliminate barriers, enhance their self-management skills, improve their performance of daily activities and adopt healthy habits and routines, occupational therapy unlocks the door to participation across the lifespan” (AOTA, 2010). In today’s world, health and wellness-related services are in demand for those aged 65 and older. As life expectancy rates continue to rise, there is an increase in concern for the field of occupational therapy to find a successful and efficient way to meet the needs of the growing number of older adults (National Center for Health Statistics, 2006). The idea that physical activity can be a beneficial occupation in the elderly has been examined and proved effective as a means of enhancing the quality of life in this population. “Although functional impairments due to the aging process seem to be inevitable, functional limitations due to an inactive lifestyle might be reversed. Indeed, it has been suggested that physically active lifestyles may contribute to improving or maintaining health and wellness” (Fletcher, Gulanick, & Braun, 2005). The purpose of this study was to investigate the effects of two different physical activity programs on individuals aged 65 and older. The variables that were examined were functional skills (activities of daily living), balance skills, and overall upper extremity function. This study looked at two forms of physical activity to determine their individual effects on functional skills, balance, and overall upper extremity function in this population. The two physical activity interventions were the Nintendo™ Wii gaming system and a videotaped exercise routine.

Keywords

Nintendo™ Wii, Physical Activity, Functional Skills, Activities of Daily Living

1. Introduction

The oldest members of the “Baby Boomer Generation” are now senior citizens and beginning to face the physical and cognitive challenges associated with aging [1]. Since this group makes up nearly one-third of the US population, healthcare professionals are faced with the challenge of finding strategies and interventions to improve health and wellness, while appealing to the culture of this unique generation. The needs of those aged 65 and older include mental, social, and physical promotion to maintain and/or improve levels of functioning, which are compromised naturally by the aging process.

Decreased functioning can be a direct result of the body’s declining physiological changes that are typically seen in older adults. Changes in the nervous system and the musculoskeletal system can lead to impairments in gait, balance, body structures, and other client factors such as strength, endurance, and coordination. Impairments, even in the absence of disease, leave the older adult population at high risk for falls, functional impairment and decreased independence. Falls are among the leading causes of disability, injury, and death among the elderly [2]. Even without falling, natural impairments lead to undesirable consequences such as fear of falling, loss of confidence, loss of independence, and lowered quality of life [3].

Although functional decline is a part of the natural aging process, evidence shows that participating in physical activity promotes healthy aging and delays functional loss [4]. However, Heath & Stuart [5] found that “only 30% of those aged 65 and older report any regular exercise”. Increasing activity levels in this population is important to slow age-related health decline, increase wellness, reduce safety risks, and maintain the ability to participate in everyday activities. Physical activity is defined as any musculoskeletal body movement that results in energy expenditure and includes categories such as leisure, recreation, work, caregiver duties, household chores, yard work, sports, and planned exercise [6]. Given the wide range of physical activity possibilities, it is important to understand what physical activity routines address the needs of the older adult population.

In the past ten years a new form of physical activity has been increasing in popularity. Virtual reality gaming systems are bringing physical activity right into our living rooms. One of the advantages to using these gaming systems is that the players use the same cognitive and physical skills that are used in everyday activities [7]. The Nintendo® Wii™, which is one example of a virtual reality gaming system, is an ideal therapeutic intervention tool for occupational therapists because of its “ability to facilitate client participation in activities that they want or need to do, while controlling the physical environment in which this takes place” [7]. Although there has been a significant increase in the use of the Nintendo® Wii™ for rehabilitation purposes in the older adult population, there is limited research and evidence on the efficacy as a therapeutic intervention.

The purpose of this study was to investigate the effectiveness of two different physical activity programs for adults aged 65 and older. The two types of physical activity programs were the Nintendo® Wii™ and a video exercise routine, representing a “new era” type of physical activity and a more traditional approach respectively. The two forms of physical activity were studied to address the following questions: 1) Are the Nintendo® Wii™ gaming system and a video exercise routine effective therapeutic interventions for the older adult population to improve functional skills (activities of daily living), balance skills, and overall extremity function? 2) Is the Nintendo® Wii™ gaming system a more effective therapeutic intervention than a traditional physical activity routine?

2. Full Description of Study Design

This study used a pretest-posttest design with a control group and two intervention groups. The two independent variables were the Nintendo® Wii™ gaming system and a video exercise routine. Functional skills, balance, and upper extremity function were the dependent variables. The two assessments used were the Functional Reach Test (FRT) and the Physical Performance Test (PPT). One group participated in the Nintendo® Wii™ intervention, one group participated in the video exercise routine intervention, and the third group served as a control and did not receive any type of intervention. Both interventions were performed eight times over the duration of the study. The video exercise routine was performed for 20 minutes and the Nintendo® Wii™ intervention lasted approximately 20 minutes. At the end of the intervention time period, all groups completed the posttest using the same protocol for the PPT and FRT that was used in the pretest.

3. Sample

The study took place at four assisted living communities in a southern state. The pretest, posttest, and interven-

tions were administered in a designated activity room at each facility. The sample size consisted of 30 participants ($N = 30$). The Wii intervention group consisted of 8 participants, the video exercise routine group consisted of 12 participants and the control group consisted of 10 participants who received no intervention.

4. Methods and Procedures

All members of the research team were trained in the implementation of the pretest and posttest assessment tools and interventions prior to the start date. Each member of the research team had a record of completion for the Collaborative Institutional Training Initiative (CITI), a human subjects' research ethics program, training on file. The faculty advisors initiated the study by contacting assisted living communities that were willing to participate in the study. Prior to beginning the pretest assessments and interventions, an informed consent and participation waiver was presented to each of the participants. The researchers read the form aloud and met one-on-one with participants if further explanation was needed. Once the participants signed the waivers, the assessments were implemented.

The researchers chose the Functional Reach Test (FRT) to evaluate the outcomes of the video exercise routine and the Nintendo® Wii™ interventions. The FRT measures the distance an individual can reach while standing with elbows extended, shoulders flexed at 90°, and feet in a fixed position. The participant's score was the average distance of 3 reach attempts. A score of less than or equal to 5.9 inches on the FRT indicates a balance deficit and is predictive of falls. The FRT requires approximately 5 - 7 minutes per participant for completion. The FRT has a test-retest reliability of 0.89 and an inter-rater reliability of 0.98 [8].

The Physical Performance Test (PPT) was chosen to evaluate the time necessary to complete functional activities. The 7-item PPT measures the time needed to complete 7 different functional activities: writing a sentence, simulated eating, lifting a book and placing it on a shelf, putting on and removing a jacket, picking up a penny from the floor, turning 360°, and walking 50 feet. The time measurements collected for each test item are then correlated to scores ranging from 0 (unable to do) to 4 (the fastest). The maximum score for the 7-item test is 28. Participants were allowed to use a walker for the 50-foot walk. It requires approximately 10 - 12 minutes per participant to complete the assessment. The PPT is a reliable and valid tool to measure physical function capabilities, risk of falls, and dynamic balance in older adults [9].

The Nintendo® Wii™ bowling game was selected out of the different available Nintendo® Wii™ games because the researchers believed it most closely resembled the movements needed for functional activities, balance, and function of the upper extremities. After reviewing the recommendations from the American College of Sports and the National Institute on Aging, a home exercise routine was designed and videotaped. Important components such as flexibility, strength, balance, and endurance, were incorporated into the routine design.

After completing the pretest assessments, the participants began the interventions with, the Nintendo® Wii™ or the physical activity program. They attended the program for 8 sessions. The participants were allowed to sit or stand during the 20-minute physical activity video or the Nintendo® Wii™ activity. Rest and water breaks were taken as needed. The Sports was utilized as the intervention throughout the sessions. Participants engaged in the Nintendo® Wii™ activity for an average of 15 - 20 minutes. During the physical activity program participants followed along with exercises led by the researchers and also viewed on a 20 minute video. The physical activity program included functional exercises and movements that the participants utilize in everyday activities. After completing all intervention sessions, the posttest was administered utilizing the same methods and instruments as stated previously.

The Functional Reach Test and the Physical Performance Test collected quantitative data, which was analyzed using parametric statistics. All of the participants' assessment results were documented and kept confidential. The researchers examined the information gathered from the assessments at the end of the study to compare the results. The researchers adhered to all policies and procedures regarding the participants' privacy and avoided any disclosure of confidential information.

5. Data Analysis

Statistical analyses were performed using paired t-tests and ANOVA with repeated measures. All data was analyzed on a personal computer using Microsoft® Excel™. Descriptive statistics were first generated for the pretest and posttest scores for each intervention group (Table 1). Paired t-tests allowed for comparison of pretest and posttest scores for the FRT and PPT. Calculations for the mean and standard deviations were included for

Table 1. Raw data collected from pretest and posttest.

Intervention	Pre PPT	Post PPT	Pre FRT	Post FRT
Wii™	14	18	2	3
Wii™	2	18	6	5
Wii™	3	15	6	7
Wii™	8	8	2	3
Wii™	15	7	4	4
Wii™	21	25	9	6
Wii™	14	10	4	4
Wii™	2	8	8	10
Video	17	19	4	2
Video	5	7	7	6
Video	13	8	15	6
Video	3	8	1	2
Video	15	12	9	5
Video	17	15	11	5
Video	21	20	10	9
Video	21	20	7	7
Video	11	13	2	3
Video	12	19	4	8
Video	16	17	9	10
Video	20	18	9	5
Control	11	4	2	3
Control	13	9	2	6
Control	16	19	2	5
Control	13	11	1	5
Control	13	10	2	3
Control	18	16	6	7
Control	10	9	4	6
Control	9	8	5	8
Control	21	14	5	9
Control	17	18	7	6

each group (Nintendo Wii intervention group, video exercise routine intervention group, and control group). ANOVA with repeated measures determined the effectiveness of each intervention, in addition to the variance among groups.

6. Results

Thirty-four participants met the inclusion criteria. Four participants withdrew from the study and were excluded

from the data analysis. The final sample size consisted of 30 participants ($N = 30$). 8 participants received the Wii intervention, 12 participants received the video exercise routine, and the control group consisted of 10 participants who received no intervention.

No significant differences were distinguished between the intervention groups and control group in regards to age and living situation. However, there were significant differences in the participants' baseline functional status and paired t-tests were used to compare individual results (Table 2). The alpha value of $p = 0.05$ was chosen to determine statistical significance. The confidence interval was 95%. The results of the Nintendo® Wii™ were not found to be statistically significant, (PPT = -1.34 [$p = 0.11$] and FRT = -0.23 [$p = 0.41$]). There was also no statistical significance in the results for the video exercise routine, (PPT = -0.42 [$p = 0.34$] and FRT = 1.61 [$p = 0.67$]). There was a statistically significant decrease in the control group regarding the FRT (-4.125) [$p = 0.001$]. The results for the control group did not show statistical significance in regards to the PPT (2.3) [$p = 0.024$].

ANOVA with repeated measures was chosen as a secondary analysis to determine the variance among the groups. The variance rates for the PPT were: Wii = 62.21, video exercise routine = 11.72, and control = 10.01. The variance rates for the FRT were: Wii = 2.41, video exercise routine = 12.79, and control = 2.844.

7. Discussion

Our findings suggest that the small sample size ($N = 30$) and high variance rates contributed to the absence of statistical significance among the groups. However, results did indicate that failure to participate in a physical activity routine may lead to a decrease in overall function (Figure 1). Figure 1 shows the average percent change of the Nintendo® Wii™ intervention group, the exercise routine intervention, and the control group's scores from their pretest to posttest of the PPT and FRT. By looking at the participant's raw scores from the PPT and FRT, it indicates that the Nintendo® Wii™ intervention group had the greatest percent change from pretest to posttest and the control group, on average, performed worse from pretest to posttest of the PPT.

As with any study using human participants, there are variables that researchers are unable to control. For example, posttest results may have been negatively impacted due to some participants feeling ill during the designated data collection period. There were also individuals who were demonstrating gains in function, but due to extenuating circumstances, had to withdraw from the study. Researchers acknowledge that further investigation

Table 2. Changes in outcome measures from pretest to posttest.

	N	t (PPT)	t (FRT)	p (PPT)	p (FRT)	ANOVA Variance (PPT)	ANOVA Variance (FRT)
Nintendo® Wii™	8	-1.34	-0.23	0.11	0.41	62.21	2.41
Exercise Program	12	-0.42	1.61	0.34	0.067	11.72	12.79
Control	10	2.3	-4.125	0.024	0.001	10.01	2.844

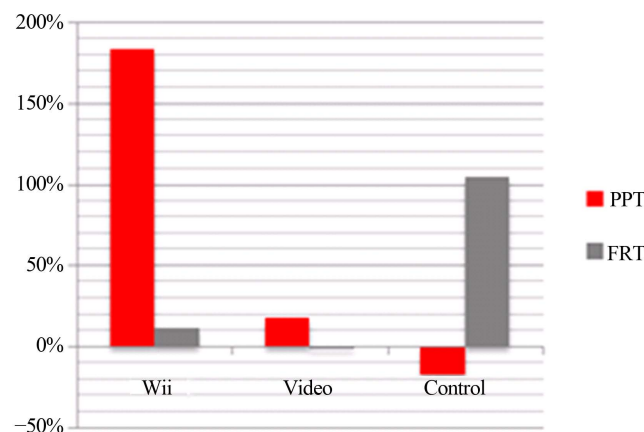


Figure 1. Average percent change from pretest to posttest of the PPT and FRT.

with longer duration time frame and frequency of the study would yield more meaningful data. While the duration for this study was restricted to an eight week period in which all data collection and interventions were completed the data yielded trends that correlate with previous studies. It is believed that by increasing the frequency and duration of the study, a greater positive increase in posttest results may have been seen.

Some of the major disadvantages of using the Nintendo® Wii™ include the lack of control over the gaming system, difficulty operating the hand-held remote, technical problems with the game and remote, and the participants' lack of familiarity with virtual reality. Several of the participants in the Nintendo® Wii™ intervention group had conditions that involved tremors, upper extremity weakness, and impaired coordination, thus making it difficult for them to manipulate the hand-held remote of the gaming system. This difficulty impacted their ability to participate and increased their frustration and motivation.

Further research is needed in order to understand the effectiveness of the Nintendo® Wii™ compared to a more traditional exercise routine, as a therapeutic intervention and the impact it has on functional skills, balance, and upper extremity function. Based on data analysis and observations, recommendations for future research studies are to: 1) include a larger sample size; 2) increase the frequency and duration of the interventions; and 3) document and consider any changes in the participants' medical status during the research study.

8. Conclusions

Results indicate that participating in either a Nintendo® Wii™ activity or a video exercise routine contribute to gains regarding functional status. However, results did not determine which type of intervention was more advantageous to positively impact functional skills, balance, and upper extremity function. Researchers conclude that engaging in physical activity does improve functional status when compared to a more sedentary lifestyle.

The Nintendo® Wii™ continues to be used as a therapeutic intervention tool with the older adult population despite the lack of evidence to support its utility and effectiveness. Therefore, when considering the continued and increasing utilization of the Nintendo® Wii™ and the significant results obtained from this study, further research is imperative to support this technology in the therapeutic setting.

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