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INTERACTIVE VIDEO DANCE GAMES FOR HEALTHY OLDER ADULTS

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Abstract: *Background:* Physical activity promotes health in older adults but participation rates are low. Interactive video dance games can increase activity in young persons but have not been designed for use with older adults. The purpose of this research was to evaluate healthy older adults' interest and participation in a dance game adapted for an older user. *Methods:* Healthy older adults were recruited from 3 senior living settings and offered three months of training and supervision using a video dance game designed for older people. Before and after the program, data was collected on vital signs, physical function and self reported quality of life. Feedback was obtained during and after training. *Results:* Of 36 persons who entered (mean age 80.1+ 5.4 years, 83 % female), 25 completed the study. Completers were healthier than noncompleters. Completers showed gains in narrow walk time, self-reported balance confidence and mental health. While there were no serious adverse events, 4 of 11 noncompleters withdrew due to musculoskeletal complaints. *Conclusions:* Adapted Interactive video dance is feasible for some healthy older adults and may help achieve physical activity goals.

Key words: Aging, exercise, dance, video game.

Introduction

Physical activity promotes health but participation rates in general are low, worsen with increasing age and have not improved in decades despite multiple public health efforts (1). One potential contributing factor to poor participation may be the repetitive nature of some forms of exercise, which may be perceived as boring. Recently, interactive electronic exercise games have been promoted as a way to increase the recreational aspects of physical activity, thus making exercise more "fun" and potentially increasing adherence (2). One popular form of interactive game involves dancing to music on a surface that interacts through a monitor with the game. Beneficial effects have been found in young people (3, 4). Early evidence in older persons suggests that postmenopausal women express interest in such games, (5) and older adults are able to respond to the game cues, although more slowly than young adults (6). Since the game requires careful attention to objects that are moving across a monitor and demands complex weight shifting in time to a musical beat, this form of exercise might benefit important factors beyond fitness, including balance, coordination, attention and visual-spatial ability. Most currently available forms of dance games are not designed for the older user; they incorporate modern music and visually complex graphics, and progress in difficulty at a rate that may be too rapid for older adults (6). Dance games have recently been adapted for the older user, but as yet there is almost no evidence base regarding their use or health benefits. The purpose of this study was to evaluate interest, feasibility and safety of an interactive video dance game adapted for use in healthy older adults.

Methods

This single group, pre-post design three month study was performed at 3 senior living centers. Participants were eligible if they were aged 65 or older, reported ability to walk 1/2 mile and did not report medical problems that were considered contra-indications to exercise, such as chest pain at rest or with activity, emergent hospitalization in the past 6 months, history of bone fracture in the absence of major trauma, history of falls in the last 6 months, or limited activity due to weight bearing pain or dyspnea. Permission to participate was obtained from each subject's physician. The research was approved by the Institutional Review Board and all participants signed informed consent.

Each site was led by a trained coordinator. After a group session to describe the activity and recruit to the study, individuals underwent baseline testing and then began supervised dance sessions, with a goal of completing 24 sessions in three months. Sessions lasted 30 minutes. We chose to request twice weekly, rather than more frequent sessions, in order to minimize the burden of participation. Participants danced singly or in pairs using a proprietary game. The game is played on a dance pad with four arrow panels (pointing up, down, left and right). The panels are pressed using the player's feet, in response to arrows that appear on the screen in front of the player. The arrows are synchronized to the general rhythm or beat of a song chosen by the player. The proprietary game for older adults (DancetownTM, Cobalt Flux, Inc., Salt Lake City, Utah, USA) offers a range of music from the big band and 1950s eras as well as traditional dance music from around the world, offers simplified graphics and dance step sequences that progress slowly in difficulty. For safety, the coordinators in this study monitored pulse and blood pressure at each dance session and "spotted" the player while dancing. When needed, coordinators spotted two players simultaneously by standing behind and between the players.

Baseline and follow up data was collected on BMI, pulse and blood pressure, short physical performance battery (7), a timed narrow walk on a 10 cm wide 4 meter path 8, digit symbol substitution test (9), activities-specific balance confidence scale (10), and SF36 physical and mental health scales (11). No

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formal cognitive testing was performed other than the digit symbol substitution test. Over the course of the program, data was also collected on number and duration of dancing sessions. Qualitative feedback was sought on interest and if applicable, on reasons to discontinue dancing.

SAS® version 9 (SAS Institute, Inc., Cary, North Carolina) was used for all statistical analyses. We used Wilcoxon rank sum and Cochran-Armitage trend tests for comparing characteristics and baseline measurements between completers and dropouts. We used Wilcoxon signed rank tests for making paired comparisons between pre- and post-dance measurements to assess the significance of change.

Results

Thirty six older adults enrolled in the study (Table1). These healthy older persons ranged from 68 to 89 years and had a range of Short Physical Performance Battery scores of 5 to 12. (Table 1). Twenty five participants (70%) underwent post testing. The completers danced an average of 9.3 hours (range 8.0-11.3) in 23.1 (range 20-24) sessions. Completers had better self reported health than noncompleters and showed a trend toward better physical performance on the SPPB and cognitive performance on the Digit Symbol Substitution test. (Table 1). Completers showed improvement in narrow walk time, self reported balance confidence and self reported mental health (Table 2). Most other measures did not change, although the total SPPB score declined slightly (Table 2). Eleven participants did not complete the study. Noncompleters danced an average of 2.4 hours (range 0 to 5.8). While there were no serious adverse events or injuries, four participants withdrew with complaints of weight bearing pain during or after dancing. Four others left for unrelated medical reasons and three expressed lack of interest. Feedback from some participants was enthusiastic. Comments included, "I can't wait to get up in the morning and come down. I love the music, it really gets me going". "I haven't sweat this much in a long time". "I want to get them all right every time!" One noncompleter stated, "didn't think it was beneficial at all".

Table 2

Change in health and function before and after participation in an interactive video dance game for three months

variable	Change (mean,sd)	p
Systolic blood pressure (mmHg)	2.1±15.6	0.6711
Diastolic blood pressure (mmHg)	0.6±10.2	0.6568
Pulse (beats per minute)	-0.8±10.2	0.7241
BMI	0.1±0.6	0.1506
SPPB	-0.7±1.1	0.0071
SPPB Balance	-0.3±0.6	0.0352
SPPB Walk	-0.1±0.3	0.5000
SPPB Chair rise	-0.3±0.9	0.1924
Narrow walk time (seconds)	-0.5±1.6	0.0260
DSST	0.7±5.5	0.4596
Balance confidence	4.9±10.1	0.0129
SF 36 physical component	0.9±5.6	0.2176
SF 36 mental component	3.9±8.2	0.0180

Discussion

Interactive video dance games are feasible and attractive to some healthy older adults. In this uncontrolled and unblinded study, completers showed gains in balance (narrow walk time and balance confidence) and in mental health. In a carefully screened and supervised sample, there were no serious adverse medical events. This form of exercise has potential to promote physical activity to older persons. Physical activity through dance and the cognitive demands of video games may have potential to promote not only fitness but also balance,

Table 1

Baseline characteristics of 36 older adults who agree to participate in a study of interactive video dance

Variable	Total sample n= 36	Completers n=25	Noncompleters n=11	p-Value*
Age (mean sd)	80.1+ 5.4	80.2±5.4	80.0±5.7	1.00
Gender (n, % female)	30 (83.3)	20 (80.0)	10 (90.9)	0.64
BMI	26.1±3.8	25.8±3.7	26.7±4.2	0.59
Self reported health (n, %)				0.02
Excellent	6 (16.7)	5 (20.0)	1 (9.1)	
Very Good	17 (47.2)	14 (56.0)	3 (27.3)	
Good	11 (30.6)	6 (24.0)	5 (45.5)	
Fair	2 (5.6)	0 (0.0)	2 (18.2)	
Short Physical Performance Battery (0-12)	9.9±1.9	10.3±1.8	9.1±1.9	0.092
Narrow walk time (seconds, mean of 2 trials)	5.5±2.2	5.2±1.7	6.2±3.0	0.57
Digit symbol substitution test	41.1±11.2	43.0±10.2	36.8±12.6	0.12
SF36 physical component summary	49.2±8.2	51.0±6.2	45.2±10.8	0.20
SF 36 mental component summary	52.0±8.7	52.7±7.9	50.4±10.5	0.73
Activities specific balance confidence	84.6±12.1	84.5±13.0	85.0±10.4	0.93
Exercise Time (hours)	7.2±3.5	9.3±1.0	2.4±2.0	< 0.01
Number of Dances	189.3±92.4	245.6±22.6	61.2±51.4	< 0.01

* comparison between completers and noncompleters

sensorimotor coordination and cognitive skills (4, 12-21). Interactive video dance has been shown to promote physical activity in children and young adults (3, 4). It appears to be a potentially attractive option for healthy postmenopausal women (5). Effects of age on video dance performance have recently been described (6).

This is the first study to report an effort to use interactive dance games to promote physical activity in older adults. The study was set in senior living communities rather than an academic environment. While the older adults were healthy volunteers, they demonstrated a range of physical performance and may represent the sizable healthy older population with mild to moderate performance deficits who could have an interest in this type of activity. The adaptations to the music selection appear to be attractive to some individuals. As expected in most exercise studies, older adults who did not complete the study tended to report worse health and had poorer physical performance at baseline. This type of physical activity program should probably be targeted at medically stable, fairly healthy older adults. Since there were no falls or injuries during play, it is likely that the game could be performed independently by healthy older adults, perhaps after a few weeks of supervision to assure that the individual is stable.

The study has significant limitations. There was no control group, the type of data collected was limited and the dropout rate was higher than in many research studies. The decline in the Short Physical Performance Battery (SPPB) Score was statistically significant, as was the decline in the balance subscore. Given the nature of the dance training, this effect is unexpected. One potential explanation for this effect is chance. Also, there are differences between the balance tasks trained during the game and the balance tasks in the SPPB. The balance skills that are trained during the game are dynamic, in that they require stepping, while the balance skill tested in the SPPB is static, in that the feet do not move. However, we know of no reason that dynamic training would worsen static balance. Future studies should give careful attention to an array of static and dynamic balance tests. This preliminary study supports the need to proceed to formal clinical trials with comparison groups, careful measurement of physical and cognitive effects as well as more detailed assessments of adherence.

In summary, interactive video dance games have a potential role in activity promotion in healthy older adults. Such strategies may broaden the array of strategies available to increase participation rates in this high priority population.

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