Article

Gerontology & Geriatric Medicine
January-December 2015: 1–7

DOI: 10.1177/2333721415613201
ggm.sagepub.com
SAGE

Older Adults' Functional Performance and Health Knowledge After a Combination Exercise, Health Education, and Bingo Game

K. Jason Crandall, PhD, ACSM EP-C[1] and Katryn I. Steenbergen, BS[1]

Abstract

Combining exercise, health education, and the game of bingo may help older adults remain independent. The objective was to determine whether a 10-week health promotion program (Bingocize®) improves functional performance and health knowledge in older adults. Participants were assigned to experimental (n = 13) or control (n = 14) groups. The intervention was administered twice per week at two independent living facilities. Pre and postfunctional performance and health knowledge were measured. Mixed between–within subject ANOVA was used to detect differences between groups ($p < .05$). Improvements were found in all dependent variables except lower body flexibility, systolic blood pressure, and health knowledge. Adherence was 97.31% ± 2.59%. Bingocize® has the potential to help older adults remain independent by improving functional performance. Statistical improvements in health knowledge were not found, but future researchers may explore modifying the health education component or using a different measure of health knowledge to detect changes.

Keywords

exercise, older adults, games, health education, health promotion, functional performance, intervention

Manuscript received: March 4 2015; **accepted:** September 29, 2015.

Introduction

Quality of life for an aging population depends on their ability to remain functionally independent and able to manage their own life for as long as possible. Loss of mobility and independence leads to lower quality of life and a heavier burden on the health care system (Freiberger, Haberle, Spirduso, & Zijlstra, 2012). Exercise interventions and health education programs designed to improve physical and mental fitness have the potential to help reduce health care costs as well as maintain, or even improve, quality of life for older adults (Chodzko-Zajko et al., 2009). Interventions that reduce chronic disease risk and severity can decrease lifetime Medicare costs as much as 60%, yet adherence and retention of older adults to health promoting programs continue to be a challenge (Rula, Pope, & Hoffman, 2011). Half of all adults who start an exercise program will drop out after only a few months, whereas only 15% of adults 65 years and older are participating in enough regular exercise to enhance fitness (Dishman, 1988). Although a plethora of quality health education programs are accessible, the rates of chronic diseases linked to poor lifestyle choices continue to increase. The World Health Organization determined that only 50% of chronic disease patients adhere to therapeutic treatments, for example, medications, diet modifications, and/or physical activity, despite the benefits that treatments create.

The aforementioned facts led to the development of a combination bingo and exercise program called Bingocize® 1.0. The goal of the exercise component was to improve measures of functional performance. Functional performance is important for older adults to perform activities of daily living (ADL) and instrumental activities of daily living (IADL). Offered twice per week, each 45- to 60-min session included walking in place, light stretching, resistance training, and balance exercises. Participants completed two exercises and were allowed to rest while two numbers were called out for the bingo game. This pattern of two exercises, followed by two rolls of bingo, was continued until a participant won the game (prizes were awarded to the

[1]Western Kentucky University, Bowling Green, USA

Corresponding Author:
K. Jason Crandall, Assistant Professor, School of Kinesiology, Recreation, & Sport, Western Kentucky University, Bowling Green, KY 42101, USA.
Email: Jason.Crandall@wku.edu

winners). In a 10-week study, a group of older adults residing in two assisted living facilities achieved an adherence rate more than 80% and significantly improved muscular strength, flexibility, balance, and cardiorespiratory fitness as assessed using measures commonly used to track these abilities (Crandall, Fairman, & Anderson, 2015).

Encouraged by these successes and conversations with senior facility administrators, a health education component was added to Bingocize® 1.0 to create Bingocize® 2.0. Combining exercise and health education could potentially replace or augment existing evidence-based disease and disability prevention (EDDP) programs because aging services agencies (e.g., assisted living homes, senior community centers, etc.) often do not have the willingness, resources, or personnel to fully implement these programs. Bingocize® 1.0 frequently requested information on health topics such as nutrition, so program leaders often presented this information during the games. Thus, for Bingocize® 2.0, we designed a curriculum of health education that included topics often covered in existing self-management programs: nutrition, fall risk reduction, managing medications, stress management, and communication with physicians.

Most of the EDDP programs currently available to aging services administrators either focus on exercise *or* health education, and few studies have directly compared them. In one recent study, Pahor et al. (2014) compared the effects of long-term exercise versus health education alone. They compared two groups of older adults: one that participated in a long-term exercise program and one that participated in a health education only program. The exercise program significantly reduced major mobility disability over 2.6 years when compared with the health education program alone. However, they did not examine the potential additive benefits of a program combining *both* exercise and health education. Indeed, few studies have combined the two into one program, but there is some evidence for positive synergistic effects of the combination.

For example, Song et al. (2012) combined exercise training and self-management education in community-dwelling diabetic older adults. Triglycerides, body weight, body mass index (BMI), and diabetes self-management behavior showed significant differences compared with wait-listed controls who continued their usual activities. Park et al. (2011) administered an integrated exercise and health education program for older adults with hypertension. Exercise self-efficacy, social functioning, and systolic blood pressure (BP) were all significantly improved compared with controls who did not receive either exercise or health education programs. Thus, there is clearly a strong need for experiments that compare and contrast the benefits of multimodal health promotion programs versus single-domain interventions.

The success of any health promotion program hinges on adherence and retention, and combining exercise and health education in a fun and familiar context may be an effective strategy to reduce older adults' numerous barriers to participation. For example, many older adults believe health promotion programs are time-consuming (Schutzer & Graves, 2004). By combining exercise and health education programs, time requirements are reduced because fewer sessions may be required to achieve the desired effects. This includes the time required for travel to the program site, which is even greater for those using public transportation, as many older adults report lack of transportation as a barrier. Reducing the number of sessions eliminates extra trips to the program site.

In addition, older adults also tend to perceive exercise as a form of therapy rather than recreation. They think of exercise as a negative activity that leads to muscle pain and soreness rather than a positive or fun activity (Schutzer & Graves, 2004). However, group support has been found to be a motivator for older adults with Type II diabetes (Tomlin & Asimakopoulou, 2014). The unique addition of bingo addresses both of these barriers to older adults' participation in health promotion programs because the game is fun and done in a group setting. Indeed, participation in just bingo alone has been found to increase socialization and some aspects of cognitive performance in older adults with Parkinson's and Alzheimer's diseases (Sobel, 2001). It has also been effectively used to increase older adults' knowledge about their risks of medication use and possible drug interactions (Benza, Calvert, & McQuown, 2010).

Based on previous successes of Bingocize® 1.0 and a strong interest in adding a health education component to Bingocize® 1.0, the objectives of this study were to determine the efficacy of Bingocize® 2.0 for improving functional performance and health knowledge in community-dwelling older adults.

Method

Study Design and Participants

A two-group quasi-experimental pretest–posttest design was used in this study. Residents from a low-income independent living facility in a rural Kentucky community were recruited for the study. Additional participants were recruited from a hospital-based social group composed of older adults within the same rural Kentucky community. The researchers randomly assigned each *group* of residents to either the experimental ($n = 15$; independent living facility) or control conditions ($n = 14$; hospital social group). Individuals of both genders above the age of 55, who were able to participate in physical activity, and not currently active in a structured exercise program in the past 30 days were selected. Cognitive deficiencies were assessed using the Mini-Mental State Examination (MMSE) . Participants with cognitive deficiencies that inhibited them from giving informed consent (MMSE $\leq$ 20) or inhibiting their ability to comprehend the health education information were excluded from the study. A

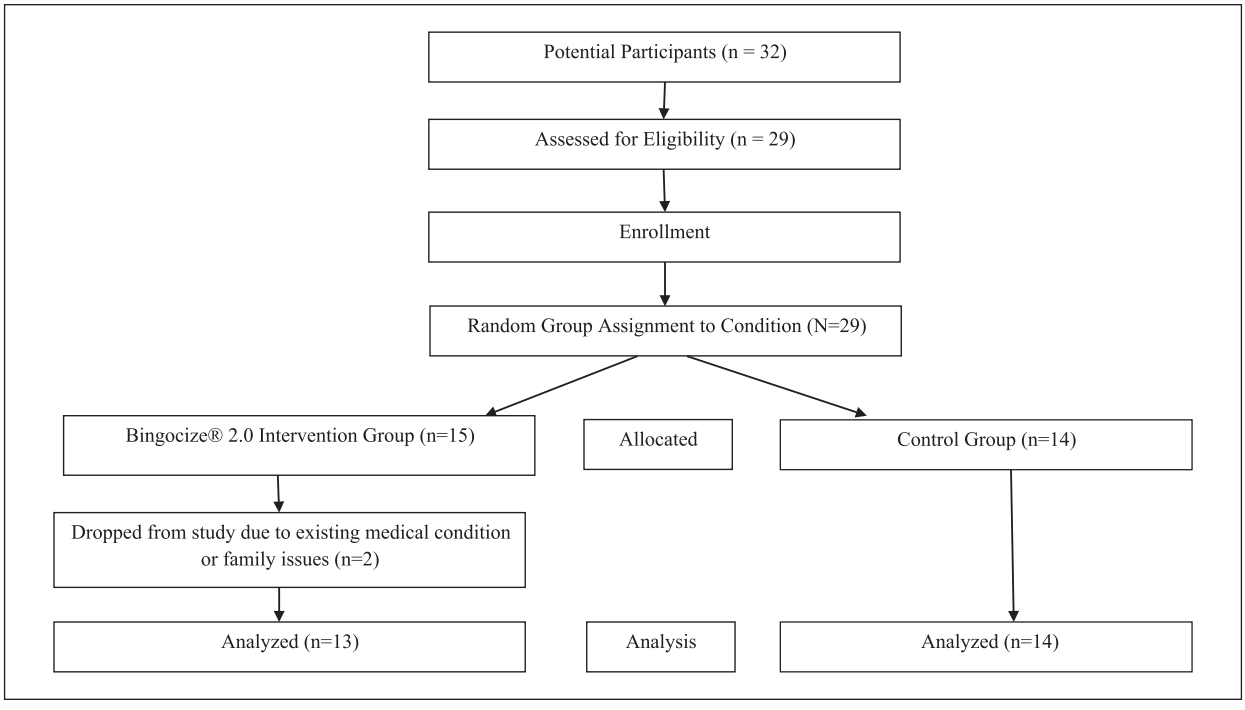

Figure 1. Flow of participants through study.

physician's release to participate in physical activity was required.

Two weeks prior to the start of the investigation, two informational sessions were conducted at a local community college and in the recreational building of an independent living facility. The informational sessions were used to explain the purpose of the investigation and establish the requirements of the exercise testing and study sessions. Of the 32 potential participants who attended the orientation meetings, three chose not to participate (see Figure 1 for the flow of participants through the study).

The remaining participants completed a demographic questionnaire, health history questionnaire, the MMSE, and an informed consent form. Individuals who chose to participate were compensated for their efforts (see Table 1 for baseline participant characteristics). The study protocol was approved by the institutional review board (IRB 530132-5).

Outcome Measures

All measurements were performed at the beginning and at the end of the 10-week intervention. Functional performance was assessed using the Senior Fitness Tests (SFT) battery (Keith, Clark, Stump, Miller, & Callahan, 2014). The SFT has been shown to be a valid and reliable battery of tests to assess functional performance in older adults. The SFT includes tests to measure lower and upper body muscular strength (chair stand, arm curl), cardiorespiratory endurance (2-min step test), lower and upper body flexibility (chair sit and reach, back scratch), agility (8 foot up-and-go), and dynamic balance (8 foot up-and-go). Height and body weight were measured for calculation of BMI. Resting systolic and diastolic BP was measured. All testing was conducted by a trained graduate student inside the independent living facility's designated recreational area. Exercise adherence was monitored by session attendance.

Health knowledge was assessed using the Health Education Inventory Questionnaire (HEIQ™) because of its previous use when determining the efficacy of chronic disease self-management programs (Osborne, Batterham, & Livingston, 2011). The HEIQ™ consists of 40 Likert-type questions (1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*), which were grouped into eight different domains: (a) positive and active engagement in life (five items, $\alpha = .86$), (b) health-directed behavior (four items, $\alpha = .80$), (c) skill and technique acquisition (five items, $\alpha = .81$), (d) constructive attitudes and approaches (five items, $\alpha = .81$), (e) self-monitoring and insight (seven items, $\alpha = .70$), (f) health service navigation (five items, $\alpha = .82$), (g) social integration and support (five items, $\alpha = .86$), and (h) emotional well-being (six items, $\alpha = .89$; Osborne, Elsworth, & Whitfield, 2007).

Intervention

The experimental group participated in the program in the recreational area of an independent living housing development twice per week for 60 min. The control group was told to continue with their normal ADL. A trained graduate student led each session. Sessions began with the participants sitting at tables with modified bingo cards and exercise equipment. The game is

Table 1. Baseline Participant Characteristics.

	Experimental $n = 13$	Control $n = 14$	p value
Age, *M* (*SD*)	77.38 (8.16)	73.29 (8.51)	.214
Sex			.114
Male	4	1	
Female	9	13	
Educational level (*n*)			.598
Less than high school	4	1	
High school	6	10	
Associate's degree	1	1	
Bachelor's degree	1	1	
Graduate degree	1	1	
Heart attack (*n*)	2	4	.410
High blood pressure (*n*)	12	8	.037*
High cholesterol (*n*)	6	11	.081
Shortness of breath (*n*)	3	1	.244
Diabetes (*n*)	5	6	.816
Cancer (*n*)	3	0	.057
Intermittent claudication (*n*)	0	2	.157
Body height (cm)	165.10 (9.40)	163.70 (5.92)	.527
MMSE	25.85 (2.70)	28.00 (1.92)	.024*
Body weight (kg)	83.16 (22.38)	77.48 (17.29)	.465
Body mass index (kg/m^2)	30.17 (6.61)	28.90 (5.66)	.594
Resting systolic blood pressure (mmHg)	138.31 (16.66)	146.71 (23.41)	.296
Resting diastolic blood pressure (mmHg)	81.23 (9.89)	77.29 (8.32)	.271

Note. MMSE = Mini-Mental State Examination.
*$p < .05$.

similar to a regular bingo game; however, the participants' bingo cards were modified so the letter/number combinations were replaced with either an answer to a health question or the word "MOVE." A spinning wheel with the printed choices "MIND," "MOVE," or "LEADER'S CHOICE" was spun by the session leader. If the wheel landed on "MIND," a health question was read to the participants. The participants then looked for the answer on their card. If they had the answer on their card, a chip was placed on the answer square. The leader provided the correct answer only after all participants attempted to find the answer on their cards. The session leader then had the opportunity to provide additional information about the answer by reading a paragraph relating to the topic on the back of the card.

If the session leader spun the wheel and it landed on "MOVE," the participants were asked to perform an exercise. There are red and blue "MOVE" squares, so the participant must have the color the wheel landed on *and* perform the exercise before allowed to put a chip on the square. "MOVE" was used rather than specific exercises to allow session leaders the flexibility to individualize the exercise component for their participants if necessary. If the arrow landed on "LEADER'S CHOICE," the leader could choose "MIND" or "MOVE." This allowed for more control over the progress of the game. The game continued until a participant won the game. Prizes (<US$1.00 each) were awarded to the winners of each bingo game.

Exercise component. The multimodal exercise component was identical to the one used for Bingocize® 1.0. Participants completed 12 to 15 different exercises each session (see Table 2 for a list of exercises). The selected exercises focused on improving cardiovascular (CV) fitness, muscular strength and endurance, flexibility, and balance using the American College of Sports Medicine guidelines for older adults (Chodzko-Zajko et al., 2009).

Intensity of exercise was monitored using a modified Borg's Perceived Exertion scale (1 = *no exertion*, 10 = *maximum exertion*; Buckley & Borg, 2011). Participants were encouraged to maintain a moderate intensity (five to six on the scale) when performing the exercises. The CV activities included walking and stepping in place or walking within the facility. Each CV bout lasted between 30 and 60 s.

The muscular strength and endurance exercises focused on functional movements and targeted major muscle groups. Beginning with one set of eight repetitions for each exercise, participants progressed until they are able to complete three sets of 15 repetitions by the end of the study period. Graded exercise bands (Black Mountain, Inc., Lakemoor, Illinois) were used to improve muscular strength and endurance.

Health education component. The focus of the health education component was to present topics relevant to older adults' health, including nutrition, exercise, managing medications, stress management, and communication with physicians. Questions were constructed using information

Table 2. Examples of Bingocize® 2.0 Exercises.

Program component	Exercises
Warm-up	Walking in place
Flexibility	Single arm crossover
	Tricep stretch
Cardiovascular fitness	Walking in place
	Walking in facility
Lower body strengthening	Heel raises with one hand on chair
	Leg extension
	Hip adduction/ abduction
	Ankle flex while standing
Upper body strengthening	Bicep curl
	Chest flies
	Chest press
	Lateral raises
Balance exercises	Side step
	Walking in place
	Staggered stance
	Grapevine
	Static balance (single leg stance)
Cool-down	See flexibility exercises

Note. Each session consists of at least 12 to 15 exercises.

from the Arthritis Foundation's "Put Pain in Its Place" program, the CDC, and the National Institute on Aging. Below is an example of one of the questions, the answer, and the associated information used to expound upon the answer.

> Question: If you lose weight while taking a medication, why should you contact your physician?
> Answer: Body weight can influence dosage.
> Associated Information: Changes in body weight can influence the amount of medicine you need to take and how long it stays in your body. Body circulation may slow down, which can affect how quickly drugs get to the liver and kidneys. Due to these changes, medicine may remain in your body longer and create a greater chance of interaction.

The game procedures were designed to use effective strategies that can help older adults retain health information . These strategies included repeating the information, using face-to-face communication, highlighting the short-term benefits of utilizing the information, and keeping the information focused on one health topic. Two weeks were spent integrating each health topic before moving to the next topic allowing the participants to interact with the material in different ways over multiple sessions.

The goal of the health education component was to affect the participants' long-term health behaviors. Therefore, the HEIQ™ was used to assess multiple domains of health knowledge instead of a self-constructed health knowledge test.

Statistical Analysis

Independent-samples *t* tests and Pearson chi-square analyses were used to compare baseline participant characteristics between the experimental and control groups. Mixed between–within subjects ANOVA was conducted to determine the effect of the Bingocize® 2.0 program on functional performance and health knowledge. The magnitude of any differences in the means was estimated using partial eta-squared (η_p^2). Alpha levels were set at $p < .05$. The statistical software Statistical Package for the Social Sciences (SPSS, Version 21.0, Chicago, Illinois) was used for statistical analyses.

Results

Of the 29 participants who began the study, two dropped out (86% retention) of the experimental group due to unrelated medical conditions or the need to care for grandchildren. Baseline participant characteristics were not significantly different between the two groups with the exception of high BP and MMSE scores. Because the mean MMSE scores for both groups were greater than the established minimum score of 20, cognitive deficiencies most likely did not affect group comparisons.

The Bingocize® 2.0 group demonstrated significant improvements in functional performance compared with the control group. There were Significant Group × Time interactions for diastolic BP, $\lambda = .815$, $F(1, 25) = 5.67$, $p = .025$, $\eta_p^2 = .19$; body weight, $\lambda = .636$, $F(1, 25) = 14.31$, $p = .001$, $\eta_p^2 = .36$; BMI, $\lambda = .634$, $F(1, 25) = 14.45$, $p = .001$, $\eta_p^2 = .37$; upper body, $\lambda = .459$, $F(1, 25) = 29.43$, $p = .001$, $\eta_p^2 = .54$; lower body, $\lambda = .729$, $F(1, 25) = 9.31$, $p = .005$, $\eta_p^2 = .27$; muscular strength, cardiorespiratory endurance, $\lambda = .756$, $F(1, 24) = 7.75$, $p = .010$, $\eta_p^2 = .24$; upper body flexibility, $\lambda = .771$, $F(1, 24) = 7.12$, $p = .013$, $\eta_p^2 = .229$; and agility/dynamic balance, $\lambda = .770$, $F(1, 23) = 6.68$, $p = .015$, $\eta_p^2 = .23$. Although approaching significance, there were no significant differences in lower body flexibility, $\lambda = .862$, $F(1, 24) = 3.84$, $p = .062$, $\eta_p^2 = .14$, or systolic BP, $\lambda = .981$, $F(1, 25) = 4.88$, $p = .491$, $\eta_p^2 = .02$ (see Table 3 for results). No significant main effects or interactions between the groups were found for the eight domains of health knowledge (see Table 4 for results). Mean adherence was 97.31% ± 2.59%.

Discussion

The objectives of this study were to determine the efficacy of a health promotion program when combining exercise, health education, and bingo for improving functional performance and health knowledge in community-dwelling older adults. The results determined that the intervention has the potential to improve measures of functional performance, body weight, BMI, and resting diastolic BP. Significant changes in health knowledge were not detected; although approaching statistical significance, lower body flexibility and systolic BP were not improved.

Table 3. Functional Performance Results.

Variables	Baseline			Postintervention	
	Experimental *M* (*SD*)	Control *M* (*SD*)	*p* value	Experimental *M* (*SD*)	Control *M* (*SD*)
Chair sit and reach (cm)	−22.83 (22.74)	−17.09 (22.91)	.570	−2.44 (8.33)	−5.08 (9.02)
Arm curl (repetitions)	16.46 (6.24)	20.29 (5.65)	.107	19.08 (6.00)	16.64 (5.36)
Chair stand (repetitions)	7.46 (5.71)	11.07 (4.63)	.082	8.69 (6.49)	9.92 (4.71)
Back scratch (cm)	−29.11 (22)	−17.02 (12.19)	.062	−22.38 (17.35)	−18.16 (13.72)
Step test (repetitions)	81.54 (27.89)	94 (29.64)	.272	94.54 (27.78)	83.54 (18.11)
8 foot up-and-go (s)	11.13 (5.84)	9.03 (1.95)	.234	9.67 (4.41)	9.46 (2.68)
DBP (mmHg)	81.23 (9.89)	77.29 (8.32)	.271	77.85 (7.91)	83.14 (12.73)
SBP (mmHg)	138.31 (16.66)	146.71 (23.40)	.296	140.85 (15.53)	144 (20.60)
Body weight (kg)	82.98 (10.15)	77.32 (17.25)	.465	80.91 (21.50)	77.76 (16.63)
Body mass index (kg/m^2)	30.17 (6.61)	28.90 (5.66)	.594	29.43 (6.31)	29.08 (5.48)

Note. DBP = diastolic blood pressure; SBP = systolic blood pressure.

Table 4. Health Education Inventory Questionnaire Results.

Variable	Baseline		Postintervention	
	Experimental *M* (*SD*)	Control *M* (*SD*)	Experimental *M* (*SD*)	Control *M* (*SD*)
Health directed behavior	2.38 (0.44)	1.96 (0.22)	1.96 (0.65)	1.96 (0.60)
Positive and active engagement in life	2.05 (0.38)	1.78 (0.40)	1.68 (0.51)	1.64 (0.52)
Self-monitoring and insight	2.00 (0.37)	1.77 (0.36)	1.76 (0.43)	1.72 (0.42)
Constructive attitudes and approaches	1.98 (0.42)	1.85 (0.38)	1.70 (0.41)	1.59 (0.46)
Skill and technique acquisition	2.14 (0.47)	1.90 (0.41)	1.88 (0.31)	1.80 (0.47)
Social integration and support	2.02 (0.39)	1.89 (0.25)	1.93 (0.40)	1.81 (0.49)
Health services navigation	2.01 (0.23)	1.80 (0.37)	1.78 (0.36)	1.62 (0.49)
Emotional distress	2.91 (0.45)	2.99 (0.47)	2.93 (0.72)	2.77 (0.57)

There were limitations to this study. First, the number of participants was small. Second, a control group did not participate in the original Bingocize® 1.0 program, so it is difficult to determine the novelty of the effect of the Bingocize® 2.0 program.

The use of data-based exercise training principles for the exercise component of the intervention along with high adherence and retention rates may have contributed to the significant improvements in functional performance. These results are consistent with other studies that have found improvements in strength, flexibility, balance, and mobility, as well as reductions in risk of falling, when using similar multimodal training programs (Pahor et al., 2014; Seco et al., 2013).

Because caloric intake and composition were not directly manipulated in this study, the significant reductions in body weight, BMI, and resting diastolic BP were unexpected. It is difficult to achieve significant decreases in these variables without changes in diet and increases in overall energy expenditure (Benton, Whyte, & Dyal, 2011). Participants increased overall energy expenditure and possibly changed their dietary intake and composition. During and after presentation of the nutrition information, the participants did inform the session leader of using the information to change their dietary habits. Regardless of the mechanisms responsible, the results of the intervention are consistent with a large body of evidence supporting reduced chronic disease risks in older adults after improvements in BP and body mass (Chodzko-Zajko et al., 2009).

The lack of significant improvements in health knowledge was surprising. Although anecdotal, many of the participants indicated learning and utilizing the health information in their daily lives throughout the intervention. We anticipated the program would improve the domains measured by the HEIQ™. However, it is likely the participants did improve their knowledge of the topics presented during the intervention. These improvements were not detected because the HEIQ™ was likely not a valid measure of the health knowledge presented during the intervention. Constructing a measure using the actual information presented during the intervention would be a more valid way to access changes in health knowledge. For example, Clifford, Pandit, and Agness (2014) successfully used a self-constructed pre and posttest survey instrument to assess the effectiveness of a trivia-based game to improve knowledge of antibiotic use in older adults and found improvements in knowledge of antibiotic use and knowledge of the symptoms of upper respiratory tract infections.

It is also possible modifications in the presentation of the health topic materials during the program are necessary for significant improvements in the domains measured by the HEIQ™ to occur. Spending more than 2 weeks on each health topic, redesigning the bingo cards, and/or expanding upon the answers to the questions are some of the changes that may result in significant improvements.

Conclusion

As the population grows older, effective, low-cost EDDP programs will be imperative (Rula et al., 2011). The results of this study show that Bingocize® 2.0 is a fun and social, health promotion program that positively affects measures of functional performance and chronic disease risk. The lack of significant improvements in health knowledge was discouraging, but future research is needed to determine a more valid measure of health knowledge and/or more effective strategies for enhancing the health education portion of the program.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr. Crandall has a financial interest in the Bingocize program.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

References

Benton, M. J., Whyte, M. D., & Dyal, B. W. (2011). Sarcopenic obesity: Strategies for management. *The American Journal of Nursing*, *111*(12), 38-44; quiz 45-46. doi:10.1097/01.NAJ.0000408184.21770.98

Benza, A. T., Calvert, S., & McQuown, C. B. (2010). Prevention BINGO: Reducing medication and alcohol use risks for older adults. *Aging & Mental Health*, *14*, 1008-1014. doi:10.1080/13607863.2010.501067

Buckley, J. P., & Borg, G. A. (2011). Borg's scales in strength training; from theory to practice in young and older adults. *Applied Physiology, Nutrition, and Metabolism*, *36*, 682-692. doi:10.1139/h11-078

Chodzko-Zajko, W. J., Proctor, D. N., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). American College of Sports Medicine position stand: Exercise and physical activity for older adults. *Medicine & Science in Sports & Exercise*, *41*, 1510-1530. doi:10.1249/MSS.0b013e3181a0c95c

Clifford, K. M., Pandit, N. S., & Agness, C. F. (2014). Use of an interactive trivia game to increase knowledge and awareness of appropriate antibiotic use in community-dwelling older adults: A pilot survey. *The Consultant Pharmacist*, *29*, 726-734. doi:10.4140/TCP.n.2014.726

Crandall, K. J., Fairman, C., & Anderson, D. (2015). Functional fitness in older adults after a combination multicomponent exercise program and bingo game. *International Journal of Exercise Science, 8*(1), 38-48.

Dishman, R. K. (1988) Determinants of participation in physical activity. In C. Bouchard, R. J. Shephard, T. Stephens, J. R. Sutton, & B. D. McPherson (Eds.), *Exercise, fitness and health: A consensus of current knowledge* (pp. 75-101). Champaign, IL: Human Kinetics.

Freiberger, E., Haberle, L., Spirduso, W. W., & Zijlstra, G. A. (2012). Long-term effects of three multicomponent exercise interventions on physical performance and fall-related psychological outcomes in community-dwelling older adults: A randomized controlled trial. *Journal of the American Geriatrics Society*, *60*, 437-446. doi:10.1111/j.1532-5415.2011.03859.x

Keith, N. R., Clark, D. O., Stump, T. E., Miller, D. K., & Callahan, C. M. (2014). Validity and reliability of the Self-Reported Physical Fitness (SRFit) survey. *Journal of Physical Activity & Health*, *11*, 853-859.

Osborne, R. H., Batterham, R., & Livingston, J. (2011). The evaluation of chronic disease self-management support across settings: The international experience of the health education impact questionnaire quality monitoring system. *Nursing Clinics of North America*, *46*, 255-270, v. doi:10.1016/j.cnur.2011.05.010

Osborne, R. H., Elsworth, G. R., & Whitfield, K. (2007). The Health Education Impact Questionnaire (heiQ): An outcomes and evaluation measure for patient education and self-management interventions for people with chronic conditions. *Patient Education and Counseling*, *66*, 192-201. doi:10.1016/j.pec.2006.12.002

Pahor, M., Guralnik, J. M., Ambrosius, W. T., Blair, S., Bonds, D. E., Church, T. S., . . . LIFE Study Investigators. (2014). Effect of structured physical activity on prevention of major mobility disability in older adults: The LIFE study randomized clinical trial. *Journal of the American Medical Association*, *311*, 2387-2396. doi:10.1001/jama.2014.5616

Park, Y. H., Song, M., Cho, B. L., Lim, J. Y., Song, W., & Kim, S. H. (2011). The effects of an integrated health education and exercise program in community-dwelling older adults with hypertension: A randomized controlled trial. *Patient Education and Counseling*, *82*, 133-137. doi:10.1016/j.pec.2010.04.002

Rula, E. Y., Pope, J. E., & Hoffman, J. C. (2011). Potential medicare savings through prevention and risk reduction. *Population Health Management*, *14*, S35-S44. doi:10.1089/pop.2010.0063

Schutzer, K. A., & Graves, B. S. (2004). Barriers and motivations to exercise in older adults. *Preventive Medicine*, *39*, 1056-1061. doi:10.1016/j.ypmed.2004.04.003

Seco, J., Abecia, L. C., Echevarria, E., Barbero, I., Torres-Unda, J., Rodriguez, V., & Calvo, J. I. (2013). A long-term physical activity training program increases strength and flexibility, and improves balance in older adults. *Rehabilitation Nursing*, *38*, 37-47. doi:10.1002/rnj.64

Sobel, B. P. (2001). Bingo vs. physical intervention in stimulating short-term cognition in Alzheimer's disease patients. *American Journal of Alzheimer's Disease & Other Dementias*, *16*, 115-120.

Song, M., Park, Y. H., Song, W., Cho, B. L., Lim, J. Y., Kim, S., & Choi, S. (2012). Combined exercise training and self-management education for community-dwelling older adults with diabetes in Korea. *Journal of Gerontological Nursing*, *38*, 38-48. doi:10.3928/00989134-20120906-95

Tomlin, A., & Asimakopoulou, K. (2014). Supporting behaviour change in older people with type 2 diabetes. *British Journal of Community Nursing*, *19*, 22-27.