

Physical Activity With and Without TV Viewing: Effects on Enjoyment of Physical Activity and TV, Exercise Self-Efficacy, and Barriers to Being Active in Overweight Adults

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Background: Physical activity (PA) is enjoyable, but there are barriers to participation. TV viewing is highly enjoyable with limited barriers. Exercising while viewing TV may impact enjoyment, exercise self-efficacy, and barriers to PA, compared with exercising without TV. **Methods:** 58 sedentary, overweight adults were randomized to 1 of 2 PA prescriptions: one that increased PA during TV viewing (TV Commercial Stepping), and another that focused solely on PA (Walking). Random effects models tested changes in enjoyment of TV and PA, exercise self-efficacy, and barriers to PA across time (baseline, 3, and 6 months) and PA prescription during a 6-month PA intervention. **Results:** At baseline, TV was more enjoyable than PA. Over the 6-month intervention, enjoyment of TV viewing did not change, but enjoyment of PA and exercise self-efficacy significantly increased, while barriers to PA significantly decreased for both groups compared with baseline ($P < .05$). **Conclusions:** While enjoyment of TV viewing remained constant, PA became more enjoyable, confidence to exercise increased, and barriers to being active were reduced for previously sedentary adults participating in a behavioral PA intervention. These findings highlight the importance of encouraging inactive adults to engage in some form of PA, whether it occurs with or without TV viewing.

Keywords: television, intervention, walking

Enjoyment and self-efficacy are key factors in determining engagement in a behavior.¹⁻³ One way to enhance meeting exercise goals and subsequently increase exercise self-efficacy is to engage in physical activity (PA) that is enjoyable.⁴ Viewing television (TV) is an activity that many adults enjoy^{5,6} and one that accounts for a considerable amount of time.^{7,8} The average adult spends 2.82 hours per day viewing TV;⁹ making it the most prominent leisure-time activity in the U.S.⁸ While most adults can find some type of PA they enjoy,^{10,11} the relative degree of enjoyment and other barriers to participation may be problematic because only 50% of U.S. adults engage in the recommended 150 minutes of PA per week.¹² Some of the most frequently reported reasons for not engaging in healthful PA are lack of time, lack of energy, and lack of motivation.¹³⁻¹⁵ Exercise self-efficacy, or the belief that one can successfully engage in exercise, has also emerged as a highly influential variable regarding the magnitude of engagement in exercise behaviors.^{16,17}

When developing behavioral-based interventions to promote PA, researchers should attempt to maximize the enjoyment of PA, enhance exercise self-efficacy, and reduce barriers to participation.¹⁸ Pairing PA with the enjoyable and entertaining experience of watching TV may impact the enjoyment and self-efficacy for PA. Moreover, by modifying a behavior that is very common in the population, and allowing the PA to be performed in the home while watching TV, this strategy could reduce barriers such as accessibility, convenience, time, costs, weather, travel, and self-consciousness that prevent sedentary adults from being physically active.

Children have reported increased enjoyment of PA, without decreasing the enjoyment of TV, when they had to exercise to gain access to TV.¹⁹ In adults, turning sedentary TV viewing into active TV viewing may also increase the enjoyment of TV through enhancing the TV experience. Research shows enjoyment of a single session of TV viewing tends to decrease over time because viewers adapt to the programming.⁵ Exercising during commercial interruptions may break up the monotony of a prolonged period of TV viewing, making it a more engaging and enjoyable experience.

TV Commercial Stepping, standing and “briskly” stepping in place for the duration of each commercial break, is one example of TV-related exercise.²⁰ Previously we published the behavioral outcomes (PA, TV viewing, diet, weight, and other anthropometrics) of a randomized controlled trial [ClinicalTrials.gov (NCT01342471)] that compared adults who paired PA with TV viewing (TV Commercial Stepping) to adults who exercised without TV (Walking).²⁰ During the 6-month PA intervention, previously sedentary adults in the TV Commercial Stepping group increased PA (4611 ± 1553 to 7605 ± 2471 steps per day) as much as those in the Walking group who walked 30 min/day during their leisure time (4909 ± 1335 to 7865 ± 1939 steps per day). Both groups also had equivalent reductions in TV viewing (4.2 ± 1.5 to 3.0 ± 1.5 hours per day for the TV Commercial Stepping group, and 4.1 ± 2.0 to 2.7 ± 1.4 hours per day for the Walking group) and equivalent changes in diet and anthropometric variables.²⁰

We have yet to report on the impact of TV Commercial Stepping or Walking on the enjoyment of TV viewing and PA, exercise self-efficacy, and barriers to being active. Research examining these relationships may provide insight into the sustainability of different strategies aimed to increase PA.²¹ Therefore, the current study examined the effects of the 2 different PA prescriptions: a novel one (ie, TV Commercial Stepping) compared with a standard one (ie, Walking), on secondary outcomes (enjoyment of TV viewing and PA, perceived exercise self-efficacy, and barriers to being active)

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across time. We hypothesized that both PA prescriptions would increase the enjoyment of PA, increase exercise self-efficacy, reduce barriers to being active, and that the enjoyment of TV would increase in those that paired PA with TV viewing time, but no change in enjoyment of TV was expected for those doing PA alone.

Methods

Participants

Sedentary, overweight adults were recruited from September 2010 through November 2010 by flyers posted in public buildings, newspaper advertisements, and word of mouth to participate in the Physical Activity and Leisure-time Study (PALS), a 6-month randomized trial designed to increase PA. Inclusion criteria were being between 35 to 65 years of age, and having a body mass index (BMI) between 25 and 45 kg/m². Participants were excluded if they watched less than 14 hours of TV per week, could not continuously walk 0.25 mile (402 m), had a resting blood pressure greater than 180 mm Hg systolic and/or 100 mm Hg diastolic, had other physical or medical limitations for engaging in PA, or were currently participating in a program to increase PA. The study was approved by the Institutional Review Board at The University of Tennessee, Knoxville and was registered at ClinicalTrials.gov (NCT01342471).

Intervention

Fifty-eight participants were randomized into 1 of 2 treatment groups: stepping in place during television commercials (TV Commercial Stepping) ($n = 29$) or 30-minutes of walking (Walking) ($n = 29$). All participants were instructed to increase their PA to at least 150 minutes/week. Participants in the TV Commercial Stepping group received the novel approach of short bouts of intermittent exercise through TV Commercial Stepping, and were instructed to stand and “briskly” step in place for the duration of each commercial break across at least 90 minutes of TV programming at least 5 days per week. Previously, we conducted a laboratory-based study which established that stepping in place at a “brisk” pace is a moderate-intensity activity,²² and that TV Commercial Stepping during 90 min of TV programming (~24 to 36 min of commercials) should approximate nearly the same volume of PA as 30 min of continuous walking.^{20,22} Participants in the Walking group received a standard PA recommendation and were instructed to walk “briskly” for at least 30 minutes (continuously or in bouts of at least 10 minutes) at least 5 days per week.

Over 6 months, participants in both groups received a standardized PA intervention using behavior modification principles. All participants attended monthly 60-minute individual meetings during the first 3 months, and participated in individual phone call sessions (30 minutes) each month. Participants received monthly newsletters in months 3 through 6. These 12 participant-investigator contacts focused on developing behavioral and cognitive strategies (goal setting, self-monitoring, stimulus control, preplanning, problem solving, cognitive restructuring, and relapse prevention) to help modify and maintain exercise behaviors. Adults in both groups were provided objective feedback of daily PA by wearing an ankle mounted Omron pedometer (Omron Healthcare, Inc. Bannockburn, Illinois). The only differences between the groups were the PA prescriptions and the recommended method of adding PA to their daily routine.

Demographics and Anthropometric Measures

Sex and age were recorded at baseline. While wearing light clothes, the participant's weight to the nearest 0.1 kg and body composition were assessed using a calibrated Tanita BC-418 body composition analyzer. Height was measured (without shoes) using a wall-mounted stadiometer. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²).

Leisure-time Behaviors, PA, and TV Viewing

PA was objectively measured using the Omron HJ 303 triaxial accelerometer-based pedometer worn on the lower leg just above the ankle throughout the 6-month intervention. Participants used an activity log to record their daily step totals, to document time spent engaged in intervention specific PA (ie, TV Commercial Stepping or Walking), and to record time spent viewing TV.

Enjoyment of TV Viewing and Enjoyment of PA

Enjoyment of TV viewing and enjoyment of PA were assessed at baseline, 3, and 6 months. Participants were asked to record the enjoyment of TV viewing and engaging in PA using a 10 cm visual analog scale (VAS) anchored by “very unpleasant” on one end (0 cm) and “very pleasant” on the other end (10 cm). The scale was then measured with a ruler (in cm) from the end anchored with “very unpleasant” to the place indicated by participants on the scale. Greater enjoyment was reflected by higher values on the scale. The single item VAS has been found to be reliable and valid to assess anxiety,²³ and pain,^{24,25} and is commonly used in measuring sensory or hedonic experiences.^{26,27}

Exercise Self-Efficacy

The 13-item Barriers Specific Self-Efficacy Scale¹ was used to assess participants' perceived confidence in their ability to exercise regularly (TV Commercial Stepping, or Walking) for the next 3 months in the face of commonly identified barriers to participation (eg, poor weather, vacation, personal stress, scheduling conflicts, pain or discomfort, etc.). For each item, participants indicated their confidence in their ability to execute the prescribed PA on a 100-point percentage scale, ranging from 0% (not at all confident) to 100% (highly confident) in increments of 10. Total exercise self-efficacy was calculated by averaging the confidence ratings of the items of the scale. With a maximum possible score of 100%, greater perceived self-efficacy for the prescribed PA was reflected by higher values on the scale. Exercise self-efficacy was assessed at baseline, 3, and 6 months. Internal consistency for the measure was excellent (0.93).

Barriers to Being Physically Active

The 21-item Barriers to Being Active Quiz²⁸ was used to assess what prevented participants from being active. Participants indicated the likelihood of items from 7 domains (3 items each): lack of time, social influences, lack of energy, lack of willpower, fear of injury, lack of skill, and lack of resources would interfere with PA at baseline, 3, and 6 months. Responses ranged from 0 (“very unlikely”) to 3 (“very likely”). An average score was obtained for the 21-items. Internal consistency for the measure was acceptable (0.78).

Statistical Analysis

Continuous variables were summarized as mean $\pm$ SD and categorical variables were reported as frequency and percent. Baseline differences between the TV Commercial Stepping and Walking groups for parametric normally distributed variables (age, BMI, walking (min/day), PA (steps/day), TV viewing (hr/day), enjoyment of PA, enjoyment of TV viewing, exercise self-efficacy score, and barriers to PA score) were examined using *t* tests. Wilcoxon rank-sum tests were used to assess baseline differences for nonparametric nonnormally distributed variables (number of TV's in home), and chi-square tests, where used for categorical characteristics (female, Caucasian, Obese, TV in Bedroom, and TiVo). To evaluate the change in self-reported enjoyment of TV viewing and PA, exercise self-efficacy, and barriers to being active across the study duration (baseline, 3, and 6 month), random effects models were used, which allowed subjects to vary with regards to their baseline level (random intercept) and individual trend across time (random trend). For outcomes where the subject-specific time trend did not differ from the overall time trend, only the random intercept model was used. Since the change across time for these outcomes of interest may be linear (ie, continuous rate of improvement from baseline to 3 month and 6 month) or curvilinear (ie, significant improvement from baseline to 3 month and sustained improvement to 6 month), both of these time trends were evaluated in the models. Specifically, the

models tested whether there was significant group by time (linear or curvilinear) interaction indicative of differences in the change across time for the 2 groups. A p-value of 0.05 was used to identify significant effects. SAS v9.4 (Cary, NC) was used for all statistical analysis. The analysis of the behavioral outcomes (PA, TV viewing, diet, weight, and other anthropometrics) comparing the TV Commercial Stepping and Walking groups were previously reported.²⁰

Results

Of 58 subjects, 46 were retained for follow-up at 6-months. Available data from all subjects were used in the analysis. Participant flow through the study is presented in a CONSORT flowchart (Figure 1). Participants were aged 52.0 ± 8.6 y, and had a BMI of 33.5 ± 4.8 kg/m². Participants self-reported watching 4.2 ± 1.8 h/day of TV, walking for 4.3 ± 5.8 min/day, and they took 4760 ± 1443 steps/day at baseline. On average, participants had 3 ± 1 (range 1 to 7) TVs in the home, 57% of the sample reported having a TV in the bedroom, and 29% reported using a device to record shows for later viewing. At baseline, participants enjoyed TV viewing (6.9 ± 1.4 cm) more than PA (4.1 ± 2.1 cm) according to the 10 cm VAS. Participants' exercise self-efficacy score was $50.5 \pm 22.3\%$, and had an average barrier score of 1.2 ± 0.4 . There were no significant differences between groups for any of the variables at baseline (Table 1).

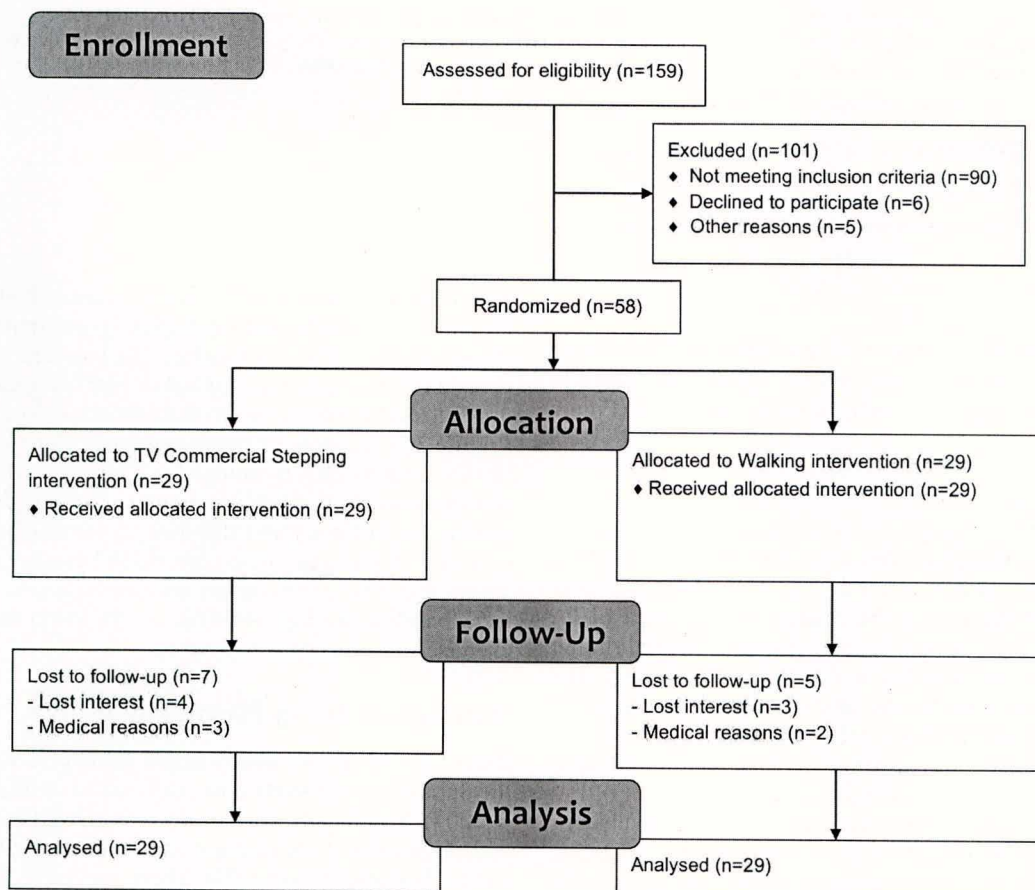


Figure 1 — CONSORT Flow Diagram. All randomized subjects contributed baseline data and were included in the analysis as random effects model can handle missing data.

Table 1 Baseline Characteristics of Participants in the TV Commercial Stepping and Walking Groups (n = 58)

Characteristics	TV commercial stepping	Walking	P
	(n = 29)	(n = 29)	
Age (years)	53.8 ± 6.8	50.2 ± 9.8	0.10
Female, n (%)	24 (82.8)	22 (75.9)	0.52
Caucasian, n (%)	27 (93.1)	29 (100.0)	0.49
BMI (kg/m ²)	34.2 ± 5.5	32.8 ± 3.9	0.28
Obese, n (%)	20 (71.4)	21 (77.8)	0.59
Walking (min/day)	3.9 ± 6.0	4.6 ± 5.6	0.62
Physical activity (steps/day)—Omron	4611.0 ± 1553.3	4909.1 ± 1334.6	0.44
TV viewing (hr/day)	4.2 ± 1.5	4.1 ± 2.0	0.78
Number of TVs in home	3.2 ± 1.4	2.8 ± 1.1	0.31
TV in bedroom, n (%)	17 (58.6)	16 (55.2)	0.80
Number of TV channels	185.2 ± 186.6	140.6 ± 134.4	0.23
TiVo, n (%)	8 (27.6)	9 (31.0)	0.77
Enjoyment of PA (10 cm VAS) ^a	3.9 ± 2.1	4.3 ± 2.2	0.48
Enjoyment of TV viewing (10 cm VAS)	6.7 ± 1.5	7.2 ± 1.3	0.15
Exercise self-efficacy score (100 point scale) ^b	45.6 ± 23.1	55.3 ± 20.7	0.10
Barriers to PA score (0–3 point range) ^c	1.2 ± 0.4	1.3 ± 0.4	0.36

Note. Continuous variables are presented as mean ± SD and categorical variables are presented as frequency and percent. *P*-values were obtained from *t*-tests (age, BMI, walking, PA, and TV viewing, enjoyment of PA, enjoyment of TV viewing, exercise self-efficacy score, barriers to PA score), Wilcoxon Rank-Sum tests (number of TV's in home), and chi-square tests (female, Caucasian, obese, TV in Bedroom, and TiVo).

Abbreviations: BMI, Body Mass Index; VAS, visual analog scale.

^a Higher values reflect greater enjoyment.

^b Higher values reflect greater exercise self-efficacy.

^c Higher values reflect greater barriers to being physically active.

Enjoyment of TV

There was no significant difference in enjoyment of TV viewing between the 2 intervention groups, and no significant change in enjoyment of TV viewing across time between the groups (Figure 2A).

Enjoyment of PA

Enjoyment of PA significantly increased across the duration of the study ($P < .0001$) for both intervention groups. However, there was no significant difference in the change in enjoyment of PA across time between the 2 groups (ie, both groups exhibited similar improvement in enjoyment of PA across time) (Figure 2B). The random effects model used for the analysis of enjoyment of PA included both a random intercept and random slope (time trend), which means that subjects varied with regards to their initial baseline enjoyment of PA and also their increase in enjoyment of PA. In addition, a significant negative correlation between a subject's baseline measurement and trend across time was found, indicating that the higher a subject's baseline enjoyment of PA, the less the increase in enjoyment of PA over time.

Exercise Self-Efficacy

Exercise self-efficacy increased significantly over the duration of the study and exhibited a curvilinear time trend ($P = .0007$).

Specifically, exercise self-efficacy increased significantly from baseline to 3 months and subsequently was maintained with only slight improvement at 6 months. The between group comparison revealed that groups experienced similar changes from baseline to 3 months ($P = .0668$) and from baseline to 6 months ($P = .0709$) (Figure 2C). Random intercept and linear slope were also included in the random effects model for exercise self-efficacy and the results indicated that subjects varied with regards to their baseline exercise self-efficacy and also their increase in self-efficacy across time. There was a negative correlation between subjects' baseline values and their trends across time; specifically, the higher a subject's baseline exercise self-efficacy, the lower the improvement in exercise self-efficacy across time.

Barriers to Being Physically Active

Barriers to being physically active decreased significantly across the duration of the study and exhibited a curvilinear time trend ($P = .0007$). Specifically, barriers decreased from baseline to 3 months and subsequently the number of barriers did not decrease significantly thereafter (Figure 2D). There was no significant difference in the amount of barriers between the 2 intervention groups, and also no significant difference in change in the amount of barriers across time between the groups. A random intercept and random slope model was specified for the analysis of barriers to PA, which means that subjects varied with regards to their baseline barriers to PA and also their decrease in barriers to PA across the study duration.

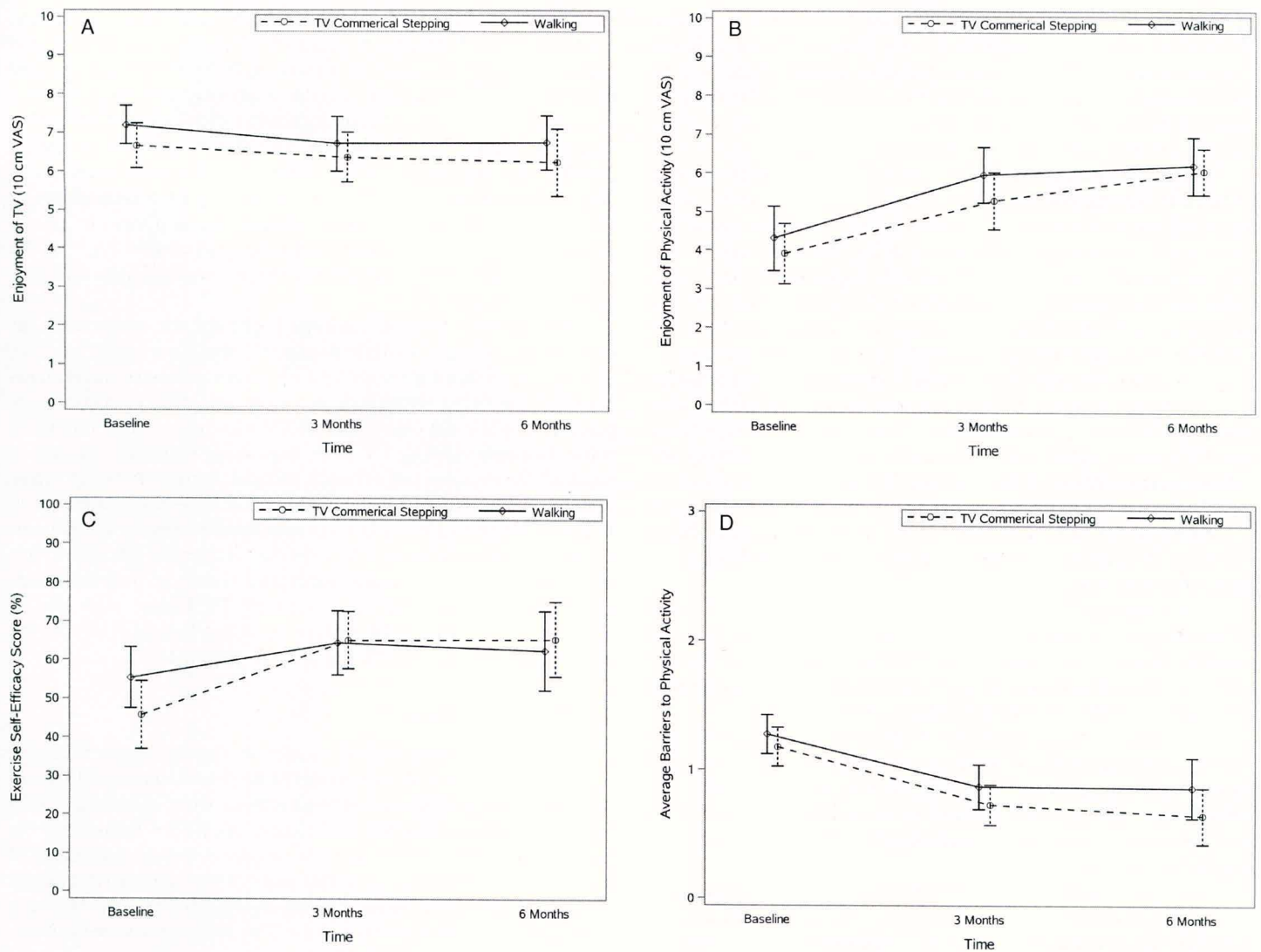


Figure 2 — Changes in the enjoyment of TV (A), the enjoyment of PA (B), exercise self-efficacy (C), and barriers to PA (D) of TV Commercial Stepping and Walking groups. Note. Data are the means across time (0, 3, and 6 months) for the 2 groups.

However, the correlation between subjects' baseline barriers to PA and their decrease in barriers across time was not significant.

Conclusions

The results of this study address an interesting question with implications for both real-world applications and behavioral theory. That is, does pairing an enjoyable sedentary activity (like TV watching) with exercise help to make exercise more enjoyable, and/or does it make the sedentary activity less enjoyable? Our results suggest that participation in either the TV Commercial Stepping group or the Walking group increased participants' enjoyment for PA, their self-efficacy for exercise, and reduced their perceived barriers to being active, but did not change the enjoyment of TV viewing. By the end of the 6-month intervention, participants in both groups enjoyed PA as much as TV viewing. TV Commercial Stepping became a dual-purpose activity that allowed participants to engage in 2 equally enjoyable activities, TV viewing and PA, at the same time. We feel that our novel method of increasing PA resulted in similar changes in enjoyment of PA and enjoyment of TV, self-efficacy

for exercise, and barriers to being active compared with those who received standardized instruction to meet PA recommendations, and that this finding is a major strength of our study, and our strategy.

Engaging in PA has been shown to generate feelings of enjoyment.^{10,29,30} To our knowledge this is the first investigation to examine whether viewing TV while exercising impacts enjoyment of PA and enjoyment of TV viewing in adults. A previous PA intervention in children found that when access to TV was contingent upon prior engagement in PA, children reported increased enjoyment of PA and no change in the enjoyment of TV.¹⁹ In our study, the major increase in the enjoyment of PA (and lack of change in the enjoyment of TV viewing) appeared to occur independent of whether the exercisers viewed TV or not. This is a significant finding because while enjoyment is an outcome of engagement in PA, it is also a determinant of PA participation and maintenance.² Research has shown that liking of PA was associated with accelerometer-assessed PA in children.³¹ Social Cognitive Theory posits that enjoyment contributes to the self-regulation of exercise behavior.³² If TV Commercial Stepping had reduced the enjoyment of PA (or the enjoyment of TV) in comparison with Walking, the likelihood of long-term maintenance

of TV Commercial Stepping would be low. It should be noted that Walkers may have increased their enjoyment of PA for different reasons than the TV Commercial Stepping group. There may be environmental factors that affected the enjoyment of the Walking group, since research indicates that exercising outdoors may be more enjoyable and motivating than being indoors.³³

Previously we reported that both of these PA prescriptions increased PA participation and decreased TV viewing.²⁰ In this study we report that enjoyment of PA increased but the enjoyment of TV viewing did not change. The reduction in TV viewing despite a lack of change in the enjoyment of TV viewing is potentially important. Often restricting access to a well-liked behavior may inadvertently increase an individual's motivation to participate in that behavior,³⁴ and after the intervention ends, participating in the previously-restricted behavior may then increase dramatically. It is important to note that in our study TV viewing was not a restricted behavior and the reduction in TV was an unanticipated outcome. It is possible that TV viewing habits were reduced due to the self-monitoring and subsequent awareness of the behavior. We have shown a reduction in TV viewing but, perhaps, no change in the motivation to watch TV, based on the lack of changes in the enjoyment of it. If this is the case, TV viewing may not rebound to baseline levels once the intervention is over.

Both groups significantly increased their exercise self-efficacy across the intervention with no significant differences between the groups. Previous work has shown that enjoyment of an activity and exercise self-efficacy are 2 of the strongest determinants of participation in PA, in sedentary adults.^{1,35,36}

At baseline, despite low levels of PA, participants reported few barriers to being active. Considering participants self-selected to participate in an intervention to increase PA, the lack of identified barriers may reflect their readiness to be active. We showed that both PA interventions had an equivalent positive impact on reducing barriers to PA.

The types of PA may have contributed to the maintenance of PA, the increased enjoyment and self-efficacy for PA, and the reduction in barriers. Walking and TV Commercial Stepping are moderate intensity activities that seemed well suited for previously sedentary participants interested in incorporating more PA into their lifestyle. Both forms of exercise are simplistic; involve relatively small behavior changes that can be worked into or around everyday behaviors, affording participants' flexibility as to when they obtain their PA. Researchers have postulated that when individuals achieve a sense of satisfaction through successfully making behavior changes that those changes result in more positive affective responses.^{37–39} The magnitude of the changes occurred quickly, with any significant increases or decreases happening by the 3-month evaluation, followed by a leveling off at the 6-month evaluation. Without additional follow-up it is unknown how long these positive changes would have been sustained, or whether they would have returned to baseline levels over time.

Some limitations must be noted. Our intervention was short-term and our sample size and diversity of the study population was limited; therefore, our results may not be generalizable to other groups. Since the health benefits of exercise are well known, the standard intervention group was the "control"—it is the standard of care to recommend exercise for everyone. As we were testing a novel intervention to increase PA against what is considered a standard intervention for increasing PA, a no-intervention control group was not included. Our study started with 58 participants, but lost 12 to attrition by 6 months (20% of the sample). Obtaining self-reported ratings of enjoyment for TV viewing and PA

from a single item VAS may have been vulnerable to demand characteristics. Both groups received 12 participant-investigator contacts during the 6-month intervention. Self-reporting greater enjoyment of PA over time would be an easy way to please the investigator. Because of the many components of the intervention (eg, goal setting, self-monitoring, stimulus control, preplanning, problem solving, cognitive restructuring, and relapse prevention) which focused on increasing and maintaining PA it is challenging to ascertain what was the most efficacious component in affecting the changes in the primary behavior outcome of PA,²⁰ or the secondary outcomes (enjoyment, exercise self-efficacy, and barriers to being active).

In conclusion, these findings highlight the importance of encouraging inactive adults to engage in some form of PA, whether the exercise occurs with or without TV viewing. Inactive individuals may find that being active becomes more enjoyable than originally perceived, while the enjoyment of TV viewing remains relatively static. Because viewing TV while exercising increased the enjoyment of PA, exercise self-efficacy, reduced barriers to being active as much as PA without TV, the likelihood of long-term maintenance of PA paired with TV could be promising considering the amount to time adults devote to TV viewing. However, PA promotion interventions may be equally successful if they provide individuals enjoyable PA alternatives to viewing TV. Future work should consider exploring the relationships between changes in enjoyment of PA and exercise self-efficacy and PA outcomes.

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