Twelve weeks of dance exergaming in overweight and obese adolescent girls: Transfer effects on physical activity, screen time, and self-efficacy

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Abstract

Background: Given the low levels of physical activity (PA) among adolescent girls in the US, there is a need to identify tools to motivate increased PA. Although there is limited evidence that adolescents transfer PA from one context to another, exergames (i.e., video games that require gross motor activity) may act as a gateway to promote overall PA outside game play. The purpose of this study was to examine potential transfer effects (i.e., influences on external behaviors and psychological constructs) of a 12-week exergaming intervention on adolescent girls’ PA, screen time, and self-efficacy toward PA, as well as the intrinsic motivation of exergaming.

Methods: Participants were 37 girls aged 14–18 years (65% African American, 35% white) who were overweight or obese (body mass index ≥ 85th percentile) and were recruited from the community via school, physicians, news media, and social media websites. Adolescents were randomly assigned to a 12-week group exergaming intervention (thirty-six 60 min sessions of group-based dance exergaming in a research laboratory using Kinect for Xbox 360 (Microsoft Corporation, Redmond, WA, USA)) or to a no-treatment control group. Outcome variables included objectively measured PA (total) and self-reported leisure-time PA (discretionary time only) 1 week before vs. 1 week after the intervention; selected type and intensity of PA when placed in a gym setting for 30 min (“cardio free choice”); screen time; self-efficacy toward PA; and intrinsic motivation toward exergaming.

Results: Attendance at the exergaming sessions was high (80%). Compared with the control group, the intervention group self-reported an increase in PA (p = 0.035) and fewer hours watching television or videos (p = 0.01) after the intervention, but there were no significant differences in sedentary, light, moderate, or vigorous PA measured by accelerometry. The intervention group significantly improved self-efficacy toward PA (p = 0.028). The intervention group highly rated intrinsic motivation toward exergaming.

Conclusion: Exergaming for 12 weeks was associated with positive impacts on adolescent girls’ self-reported PA, television viewing, self-efficacy, and intrinsic motivation. Future research is warranted to leverage exergames as an enjoyable, motivating, and effective PA tool.

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Keywords: Active video games; Leisure activity; Motivation; Screen time; Self-efficacy; Television

1. Introduction

The average American adolescent spends 62 h each week in front of a screen.1 In contrast, only 8% of 12- to 15-year-olds meet National Physical Activity Guidelines of 1 h of daily moderate-to-vigorous physical activity (PA).2 with adolescent girls having particularly low levels of PA.3 Insufficient PA is a major barrier to obesity, which affects 18% of adolescent girls in the USA4 and 61% of obese adolescents with at least 1 risk factor for cardiovascular disease.5

Leveraging adolescents’ interest in video games is an innovative approach to combating pediatric obesity and physical inactivity, but motivation to be physically active remains a major barrier.5 New-generation video games (i.e., exergames) require whole body movement, thereby yielding light to moderate levels of energy expenditure and elevated heart rate, which could potentially contribute to weight loss and cardiovascular health benefits.6 Exergames, or active video games, are popular among youth: in a study of 1241 adolescents (age: 16.80 ± 0.05 years, mean ± SD), 24% reported playing exergames with an average play time of 50 min per session 2 days per week.7 It is important that systematic reviews and meta-analyses indicate that exergaming can reach criteria of moderate- to vigorous-intensity activity.8–10 Whole body movement while exergaming, such as during dance exergames, can reach levels of moderate

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Exergaming transfer effects

intensity, and exergaming that involves lower body movement produces higher energy expenditure than exergaming that uses just the arms.

Despite the extensive evidence that exergaming can reach levels of moderate-intensity PA, it is not known whether being physically active by means of an exergame may influence an adolescent to become more physically active outside game play (i.e., “transfer effects”). There is limited evidence that adolescents transfer PA from one context to another. Prior data indicate that obese children aged 10–17 years experienced significantly increased self-reported PA and decreased screen time after a 12-week exercise trial involving 2 supervised and 1 home-based 45 to 60 min exercise sessions per week. However, these exercises involved traditional gym equipment, including aerobic and resistance exercises. One randomized within-subjects trial in 26 male adolescents found higher levels of energy expenditure measured by indirect calorimetry during a 1 h exergaming session on the Kinect for Xbox 360 vs. a 1 h seated video game, yet there were no significant condition differences measured by accelerometer on boys’ PA levels over 3 subsequent days. The potential influence of a longer duration of exergaming on adolescents’ activity choices, screen behaviors, or habitual PA is not known.

In addition to limited evidence of behavioral transfer from exergaming, there is also limited evidence of psychological transfer of exergaming to improve adolescents’ psychosocial health. Specifically, both self-efficacy and intrinsic motivation have been identified as targeted mediators to promote adolescent girls’ PA. Exergaming, particularly in a group setting, may increase self-efficacy related to PA and exergaming, as well as intrinsic motivation. According to social cognitive theory, behavioral change results from links among behaviors (e.g., exergame play), the environment (e.g., social interaction), and psychosocial variables (e.g., self-efficacy). Group cohesion in digital game play may appeal to obese youth, who are less likely to engage in traditional sports owing to weight criticism. Group exergame play may, therefore, improve the poor psychosocial health often experienced by overweight youth and thereby facilitate increased total PA levels.

The aim of this study was to examine potential transfer effects, that is, influences of exergaming on external behaviors (PA levels, screen time) and psychological constructs (self-efficacy), of a 12-week exergaming intervention, as well as adolescents’ intrinsic motivation related to exergaming.

2. Methods

2.1. Participants

Forty-two overweight or obese adolescent girls participated in an exergaming intervention or were placed in a no-treatment care control group. Participants were recruited from the greater Baton Rouge, LA, area via schools, health clinics, community events, e-mail listservs, news media, and social media websites. Participants were female, between 14 and 18 years of age, and postmenarcheal; had a body mass index percentile $\geq 85$; and were free of serious medical conditions that contraindicated exercise or video game play. Thirty-seven participants had complete data for the accelerometer and were included in the present analysis.

2.2. Procedures

These data were collected as secondary outcomes in a trial designed to examine the effects of exergaming on body composition and cardiovascular risk factors; a complete description of the intervention and study methods is published elsewhere. Study procedures were approved by the Pennington Biomedical Research Center Institutional Review Board. Parents and adolescents provided written consent and assent, respectively. Participants completed a baseline clinic visit. At the end of the clinic visit, participants were randomly assigned to the intervention or a no-treatment control group.

In the intervention condition, participants attended 60 min group exergaming sessions 3 times per week for 12 weeks, whereas the control group was instructed to maintain current level of activity for 12 weeks. The intervention occurred outside school time in a dance studio at Pennington Biomedical, where 3 to 4 exergaming stations were available, each equipped with the Kinect for Xbox 360 gaming console (Microsoft Corporation, Redmond, WA, USA), a television, and the following exergames: Just Dance (Just Dance 3, Just Dance 4, Just Dance 2014, and Just Dance Greatest Hits; Ubisoft, Rennes, France) and Dance Central (Dance Central 2 and Dance Central 3; Microsoft Game Studios, Redmond, WA, USA). Exergames focused on dancing were selected to encourage whole body movement and moderate-intensity energy expenditure. Three “gaming coaches” were present to supervise the sessions, and 2–12 participants were present at any given time. Participants self-selected the games, songs, dance mode, intensity level, and dance partner. All participants completed final measurements in Week 13, which was 1 week after the intervention ended.

2.3. Measures

2.3.1. Anthropometry

Height and weight were measured using standardized clinic procedures.

2.3.2. PA

Intervention participants wore Omron GoSmart pedometers (Omron Healthcare Inc., Bannockburn, IL, USA) during exergaming and recorded steps at the end of each session. Accelerometry (ActiGraph GT3X+; ActiGraph Inc., Fort Walton Beach, FL, USA) was used to assess habitual PA at baseline and follow-up. Participants were instructed to wear the accelerometer on a belt around their waist during all waking hours for 7 full days. Accelerometers were worn 1 week prior to the intervention and 1 week after the end of intervention (therefore after exergaming sessions had ended). Whereas the accelerometer captured total daily PA, the Godin–Shephard Leisure-Time Physical Activity Questionnaire was used to specifically capture PA during leisure time (i.e., discretionary time). This self-report instrument has been validated against the Caltrac accelerometer (Muscle Dynamics, Torrance, CA, USA) ($r = 0.45$; $p < 0.01$) and other self-report surveys (e.g., $r = 0.61$ with the Baech Physical Activity Questionnaire).
Participants estimated the number of sessions of PA in the prior week based on mild, moderate, or strenuous levels of intensity and were provided with examples to illustrate intensity level.

Exercise transfer effects were examined at baseline and at follow-up via behavioral observation (“cardio free choice”). Participants were alone in a room for 30 min with a variety of exercise equipment, including a treadmill, stationary bike, elliptical machine, upper extremity trainer, Cardio Kids Star Walker (Kidsfit, Huger, SC, USA), ski/snowboard machine, jump rope, hula hoop, abdominal floor mat, stability ball, and exergaming console. The observer gave the following instructions: “This room contains various exercise equipment. This equipment includes (items listed and pointed out). You will be allowed to play in this room for 30 min. You may use this time however you wish. There is a clock on the wall if you wish to monitor your time. I will be sitting in the adjoining observation room and recording your activity through this mirror.” Participants self-selected how to use the 30 min period while an assessor observed through a 2-way mirror and recorded the participant’s choice of equipment in 15 s intervals. All assessors were extensively trained on this observation method, and 15% of visits were rated by 2 assessors as inter-rater reliability checks. The 2 assessors averaged 89% agreement across all observations. This assessment method was adapted from the System for Observing Play and Leisure Activity in Youth. Finally, participants wore an accelerometer during the 30 min cardio free choice to objectively quantify levels of PA.

Participants answered a self-report survey with 16 multiple choice questions to retrospectively report typical media use and familiarity with exergames. Exergaming questions were developed for this study and included the following: “Have you ever played the Kinect for Xbox 360 games? If yes, how often do you play the Kinect?” Response options included “just once or twice”, “every now and then”, “once a week”, “a few times a week”, “just about every day”, and “none, I’ve never played the Kinect before”. These questions were repeated for Dance Central and Just Dance games. Media use questions were from the National Health and Nutrition Examination Survey (2009–2010) questionnaire and were similar to reliable and valid self-report questions used in prior studies. Examples include “During the past 30 days, on average how many hours did you sit and watch television or videos?” and “Over the past 30 days, on average how many hours did you use a computer or play computer games outside of school?”

Self-efficacy toward PA was measured using the PA component of the Self-Efficacy for Healthy Eating and Physical Activity measure, a 13-item self-report survey with items based on a 5-point Likert scale. Items measure confidence to exercise given specific obstacles, such as “I can be physically active during my free time on most days” or during adverse conditions or time constraints. Each statement is followed by a scale from 1 to 5, from disagree a lot to agree a lot. Cronbach’s $\alpha$ for internal consistency of the survey is good at $\alpha > 0.70$.

Finally, intervention participants completed an exit survey that contained the Intrinsic Motivation Inventory to assess their enjoyment and experience of playing the exergames. The instrument contains 11 questions using the 7-point Likert scale from 1 to 7, from not at all true to very true, and includes questions such as “I enjoyed doing this activity very much”. The instrument has demonstrated adequate reliability and internal consistency ($\alpha = 0.85$). Each intervention participant was asked additional questions, such as whether she thought exergaming was PA, whether exergaming made her more physically active, and whether she would continue playing the exergames after the study ended.

### 2.4. Statistical analysis

Step counts during exergaming sessions were classified as moderate-intensity activity if greater than or equal to 100 step/min. Accelerometry data were processed using 15 s epochs, and valid wear time was considered to be at least 10 h for at least 3 days. Established cut-points were used to classify accelerometer data as follows: sedentary $\leq 25$ counts per min (cpm); 26 cpm $< light activity $< 574$ cpm; 574 cpm $< moderate activity $< 1003$ cpm; and vigorous activity $\geq 1003$ cpm. A linear mixed-effect model was used to obtain estimated mean of the 2 conditions after adjusting for body mass index and mean wear time (only for accelerometer data). The $t$ tests based on the linear model were used to examine both differences at baseline and differences in change between each condition for screen time, self-reported PA, accelerometer-measured PA, self-efficacy, and intrinsic motivation toward exergaming. Analyses were conducted using SAS Version 9.4 (SAS Institute Inc., Cary, NC, USA).

### 3. Results

#### 3.1. Participant characteristics

Table 1 shows the participant characteristics at baseline. Participants did not vary by condition for baseline self-reported or accelerometer-measured PA, self-efficacy scores, or media use.

| Participant baseline characteristics (mean ± SD) | Intervention ($n = 19$) | Control ($n = 18$) |
|-------------------------------------------------|-------------------------|-------------------|
| **Age (year)**                                  | 15.3 ± 1.3              | 16.1 ± 1.3        |
| **Race**                                        |                         |                   |
| African American (%)                            | 68                      | 61                |
| White (%)                                       | 32                      | 39                |
| **Height (cm)**                                 | 160.1 ± 6.3             | 164.7 ± 6.1       |
| **Weight (kg)**                                 | 98.2 ± 28.5             | 103.0 ± 26.9      |
| **Body mass index Z-score**                     | 2.2 ± 0.5               | 2.2 ± 0.5         |
| **Body mass index percentile**                  | 97.7 ± 2.6              | 97.4 ± 3.0        |
| **Self-reported physical activity (per week)*    |                         |                   |
| Day                                             | 2.8 ± 2.5               | 2.6 ± 1.7         |
| Mild bout*                                      | 3.7 ± 3.5               | 2.8 ± 3.5         |
| Moderate bout*                                  | 3.2 ± 3.1               | 2.5 ± 3.5         |
| Strenuous bout*                                 | 2.9 ± 4.9               | 2.6 ± 3.6         |
| Screen time (h/day)*                            | 2.9 ± 1.7               | 3.1 ± 2.3         |
| Television viewing                              | 0.8 ± 1.1               | 1.0 ± 2.1         |
| Video game play                                 | 1.7 ± 2.8               | 1.5 ± 2.1         |

* $n = 18$ for the intervention group for indicated variables.
* Number of estimated 15-min bouts.
use. There was a baseline difference by condition for proportion of time spent playing Kinect vs. other choices in the cardio free choice (64.0% ± 29.7% for intervention vs. 36.3% ± 38.8% for control; \( p = 0.019 \)).

3.2. PA during exergaming intervention

Attendance averaged 80.1% ± 22.9% for the 36 exergaming sessions in the intervention condition. Participants took on an average of 2766 ± 865 step/h exergaming session (range 1363–4816 step/session; Fig. 1). Only 0.7% of all exergaming sessions reached the moderate-intensity category on average for 1 h (≥100 step/min on average).

3.3. Media use

The majority of adolescents (64.9%) had a television in the bedroom. Approximately half the participants had previously played the Kinect (45.9%), including 13 “just once or twice” or “every now and then”; 3 reported “once a week” or “a few times a week”, and 1 reported “just about every day”. Almost half (48.6%) had played Dance Central before, including 9 “every now and then” and 9 “just once a week” to “a few times a week”. Finally, the majority (78.4%) had played Just Dance before; 21 reported playing “just once or twice” or “every now and then”, 6 reported “once a week” or “a few times a week”, and 2 reported “just about every day”.

There was a significant increase in watching television or videos reported 1 week prior to the intervention vs. 1 week after the intervention in the control condition (+0.90 h/day) vs. the intervention (−0.13 h/day) (\( p = 0.01 \)) but no difference by condition for time spent using the computer or playing computer games or playing video games outside of school.

3.4. Habitual free-living PA

Participants in the intervention group reported an increase in days per week of PA of >60 min (+1.0 day/week in the intervention group vs. –0.3 day/week in the control group; \( p = 0.035 \)), but there was no difference in self-reported mild, moderate, or strenuous levels of PA. There were no significant differences by condition in accelerometer-measured sedentary, light, moderate, or vigorous PA in the 1 week after the intervention (Fig. 2A). The average proportion of time spent in each category in the overall sample averaged across both time points was 70.8% sedentary, 26.6% light, 2.2% moderate, and 0.4% vigorous.

3.5. Cardio free choice intensity and selection

There were no significant differences by condition for change in accelerometer-measured sedentary, light, moderate, or vigorous PA during the 30 min cardio free choice observation (Fig. 2B). The average proportion of time spent in each category in the overall sample averaged across the 2 time points was 16.4% sedentary, 57.6% light, 13.4% moderate, and 12.6% vigorous.

There was no significant change in proportion of time spent playing Kinect in either condition (12.1% ± 34.9% for intervention, –9.1% ± 38.2% for control). However, the intervention participants spent significantly more time playing Kinect after the intervention (76.0% ± 25.4% for intervention vs. 45.0% ± 43.9% for control; \( p = 0.012 \)).

3.6. Self-efficacy and intrinsic motivation

There was no difference by condition in Self-Efficacy for Healthy Eating and Physical Activity score. However, there was a significant difference by condition for self-efficacy related to PA (“I can be physically active during my free time on most
By contrast, the present study examined this 12-week exergaming trial used a treatment. Taking into consideration that the adolescents in the intervention group reported a decrease in television viewing after a 12-week exergaming intervention. It was promising that the intervention had ended. A prior experiment involving a single exergaming session and did not increase time spent playing video games or using other equipment after the intervention, indicating that they had a higher preference toward the exergame even after being exposed to 36 h of exergaming. However, there was a similar difference at baseline, and the change was not statistically significant. Furthermore, there was no difference in self-selected intensity of play by the adolescents had free choice of intensity and game play among selected dance exergames. As such, the intervention was well attended by adolescent girls, which responds to the call for entertaining exergames that promote sustained game play. However, allowing the adolescents to self-select intensity resulted in low levels of PA, with less than 1% of sessions qualified as moderate-intensity PA for the whole hour. The pedometer steps were captured over 1 full hour of gaming, so it is not known whether cadence (step/min) was higher at shorter intervals throughout each session. Furthermore, the pedometer may not completely capture PA during dancing, which involves upper body movement rather than the traditional steps associated with walking. Upper body movement contributes to total energy expenditure during exergaming, especially when movement of both arms is encouraged. Such as in dance-based exergaming, the adolescents had very low levels of moderate-to-vigorous PA both during the free-living period and when placed in a gym with cardio equipment. Placing the adolescents in a group setting with peers and coaches and providing them with access to dance exergames were not sufficient to achieve moderate PA levels during the gaming sessions or 1 week after the intervention had ended.

A unique assessment of this intervention was the cardio free choice, during which adolescents were placed in a gym and could choose among several exercise equipment options as well as intensity of play. Compared with the control group, the intervention group spent proportionately more time playing the Kinect vs. other equipment after the intervention, indicating that they had a higher preference toward the exergame even after being exposed to 36 h of exergaming. However, there was a similar difference at baseline, and the change was not statistically significant. Furthermore, there was no difference in self-selected intensity of play by condition. There is limited evidence that adolescents transfer PA from one context to another.

### 4. Discussion

The primary aim of this study was to examine transfer effects on adolescent girls’ PA, screen time, and self-efficacy after a 12-week exergaming intervention. It was promising that the intervention group reported a decrease in television viewing and did not increase time spent playing video games or using the computer after the intervention. These are among the first results indicating that involving adolescents in a screen-based PA intervention reduced their amount of screen time outside the intervention. Taking into consideration that the adolescents in this study reported higher television viewing and similar gaming habits at baseline than previously reported in adolescent populations, when designing health interventions that use screens, it is important not to inadvertently increase screen time such that the adolescent’s use exceeds recommendations.

Results were mixed for transfer effects of exergaming on adolescents’ PA: there was no objective evidence of an increase in PA levels in the 1 week after the exergaming intervention, which contradicted the girls’ self-reported increase. There are minimal data available on whether a structured exergaming intervention acts as a “gateway” to promote PA once the intervention ends. A prior experiment involving a single exergaming session in 26 male adolescents did not result in differences in accelerometry-measured energy expenditure in the 3-day period after the exergaming. However, this 3-day period included the exergaming session and may reflect a compensatory response whereby adolescents have no net change in total energy expenditure. By contrast, the present study examined PA for the 1 week after the exergaming sessions ended. Because the exergaming was played in a lab setting, once the intervention ended the adolescents no longer had access to the same setting, equipment, or social interaction and support from the other participants and the coaches to continue their PA. The higher PA self-reported by adolescents in the intervention may be a result of social desirability. Additionally, although adolescents were asked to report on the 1 week prior to the final visit, which did not include exergaming sessions, the adolescents may have taken into account the PA during the exergaming intervention, whereas the accelerometry data were collected after the exergaming intervention had been completed.

Whereas prior exergaming interventions prescribed exergaming routines, this 12-week exergaming trial used a novel approach that balanced structure with choice. Specifically, the intervention provided a structured gaming environment with peer and coach support and required adolescents to participate for approximately 180 min/week over 12 weeks, but the adolescents had free choice of intensity and game play among selected dance exergames. As such, the intervention was well attended by adolescent girls, which responds to the call for entertaining exergames that promote sustained game play. However, allowing the adolescents to self-select intensity resulted in low levels of PA, with less than 1% of sessions qualified as moderate-intensity PA for the whole hour. The pedometer steps were captured over 1 full hour of gaming, so it is not known whether cadence (step/min) was higher at shorter intervals throughout each session. Furthermore, the pedometer may not completely capture PA during dancing, which involves upper body movement rather than the traditional steps associated with walking. Upper body movement contributes to total energy expenditure during exergaming, especially when movement of both arms is encouraged such as in dance-based exergaming. The adolescents had very low levels of moderate-to-vigorous PA both during the free-living period and when placed in a gym with cardio equipment. Placing the adolescents in a group setting with peers and coaches and providing them with access to dance exergames were not sufficient to achieve moderate PA levels during the gaming sessions or 1 week after the intervention had ended.

A unique assessment of this intervention was the cardio free choice, during which adolescents were placed in a gym and could choose among several exercise equipment options as well as intensity of play. Compared with the control group, the intervention group spent proportionately more time playing the Kinect vs. other equipment after the intervention, indicating that they had a higher preference toward the exergame even after being exposed to 36 h of exergaming. However, there was a similar difference at baseline, and the change was not statistically significant. Furthermore, there was no difference in self-selected intensity of play by condition. There is limited evidence that adolescents transfer PA from one context to another.
The adolescents in the intervention group reported high intrinsic motivation to play the exergames, and they significantly increased self-efficacy toward PA. Furthermore, the exit survey indicated that the adolescents highly enjoyed the exergaming and would likely play the exergames again. Improving these psychosocial constructs is important because there is evidence that self-efficacy and enjoyment mediate the effect of PA interventions on adolescent girls’ PA.13,34 Intrinsic motivation is particularly relevant as an influence on PA levels during exergame play.35,36 These are among the first results to indicate increased self-efficacy and high enjoyment in a context where adolescents self-selected game play and intensity. A 20-week exergaming intervention among adolescents aged 15–19 years observed improved self-efficacy toward PA,15 and high levels of intrinsic motivation to play the exergame,17 but the gaming routine was prescribed and adolescents did not choose intensity of play. Similarly, a 10-week group dance-based exergaming intervention that monitored heart rate to ensure that adolescents were in a targeted zone improved adolescent girls’ perceived competence to exercise regularly.37 Giving adolescents an opportunity to choose their own intensity of play may have further increased their feelings of competency and enjoyment.

The study findings may be applied to practical settings such as physical education courses, where teachers allow students to self-select intensity and type of game play. It is important that 100% of the exergaming participants noted that they would be willing to play the exergame in a school physical education class. However, there is mixed evidence whether exergaming does3 or does not37,38 substantially contribute to PA levels during physical education courses. The present study indicates that when given a choice, adolescents will choose a low intensity of PA while exergaming, but this experience will lead to improvements in self-efficacy with high levels of enjoyment and motivation. Future research should identify ways to provide adolescents with choice of game play in an enjoyable and confidence-building manner while ensuring adequate levels of moderate-intensity PA.

There were several strengths and limitations of the study. A key strength was the sample of youth at high risk for chronic disease: all participants were overweight or obese, and the majority were ethnic minorities. Both objective and self-report measures were used to assess transfer effects, which is understudied in the PA and gaming literature. Adolescents were allowed to self-select intensity, which leads to excellent external validity for effectiveness but limited internal validity for efficacy given the range of intensities of play. Another limitation is the use of pedometers to assess PA during dance exergaming, which may not have captured the complete range of motion, and the small sample size limits generalizability.

5. Conclusion

Exergaming for 12 weeks was associated with positive impacts on adolescent girls’ television viewing, self-efficacy, and intrinsic motivation. Evidence for transfer effects on PA was limited: although adolescents self-reported higher PA after the intervention ended, the accelerometry data did not indicate a significant difference. Exergaming was a highly enjoyed activity, yet future research should investigate ways to improve adolescents’ experiences and responses to exergaming to increase the effectiveness of exergaming as a PA promotion tool.

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Authors’ contributions

AES conceived of the study, designed and coordinated the study, performed statistical analysis and interpretation, and wrote the initial draft of the manuscript; RAB performed the randomization and statistical analysis; DSH provided medical oversight; PTK and RLN provided scientific guidance for the design and coordination of the study and interpretation of results. All authors provided critical feedback to the manuscript, read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

None of the authors declare competing financial interests.

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