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Physical activity and sociodemographic correlates of adolescent exergamers

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Abstract

Purpose—Exergame use (or active video games that promote physical activity (PA)) has the potential to increase PA in youth, but there is a scarcity of information about PA of youth who are current exergamers. The current study examined PA behaviors in exergamers versus non-exergamers.

Methods—Adolescents (n=2,793; mean age=14.4±2.0 years) participating in EAT 2010 (Eating and Activity in Teens) self-reported sociodemographic characteristics and exergaming and PA behavior. Height and weight were measured.

Results—Both male and female exergamers tended to be younger and Black compared to non-exergamers (p<0.001). Generally, exergamers did not report significantly more PA than non-exergamers, except for female exergamers who engaged in more vigorous PA than female non-exergamers (p<0.01; 1.3±0.05 vs. 1.6±0.06 hours/wk, respectively).

Conclusions—PA behavior in exergamers is similar to PA behavior in non-exergamers. However, when targeting vigorous PA, exergaming may be an innovative and appealing intervention strategy for adolescent girls.

Keywords

active video games; sedentary behavior; screen time

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Implications and Contributions: Adolescent boys who participate in active video games (exergamers) did not report significantly greater PA than male non-exergamers. Interestingly, female exergamers had greater levels of vigorous PA than female non-exergamers. When targeting vigorous PA, exergaming may be an innovative and viable intervention for adolescent girls.

Introduction

More than 70% of U.S. adolescents are not meeting the recommended PA guidelines of 60 minutes of daily moderate-to-vigorous PA,¹ but 60% of this population participates in two hours of video games daily.² Not all of the time spent engaging in video games has negative health consequences; recently, there has been an increase of exergames or video games that promote PA (e.g., Nintendo Wii or Dance Dance Revolution). These exergames typically elicit energy expenditure comparable to mild-to-moderate intensity PA,³ which is sufficient to improve general health outcomes.⁴ Exergames also appeal to youth's interest in video games⁵ and may provide a supplement to more traditional types of PA.⁴ Most of the current literature examines exergaming interventions and their effect on PA.⁴ However, there is not a clear understanding of "who" typically participates in exergaming and how much PA these youth engage in. The aims of this study were to identify sociodemographic characteristics of exergamers and examine associations with PA in adolescent boys and girls.

Methods

Data for the current study are from EAT 2010⁶ (Eating and Activity in Teens), which examined weight-related factors in 2793 ethnically/racially diverse adolescents from the Minneapolis/St. Paul, Minnesota, USA metropolitan area. Participants were recruited from 20 public middle and high schools. Mean age was 14.4±2.0 years (range=12-17 years) and participants were equally divided by sex. At schools, trained research staff administered self-reported surveys and measured adolescents' height and weight. Validated and reliable survey measures on hours of weekly mild, moderate, and vigorous PA; daily weekday and weekend exergaming; and sociodemographic factors (sex, race/ethnicity, and socio-economic status (SES)) were analyzed. SES was assessed using an algorithm that accounted for parental education and employment and eligibility for public assistance and free/reduced school meals. Study procedures were approved by the University of Minnesota's IRB Human Subjects Committee and the participating school districts' research boards. Parents/guardians and students provided consent and assent, respectively, for students to participate in the study.

Sociodemographic characteristics of exergamers and non-exergamers were examined (Table 1). Sex moderated the relationship between exergaming and PA, therefore separate linear regression models were stratified by sex. Age, race/ethnicity, and SES were included as covariates in all models. Analyses were conducted using SAS V9.2.

Results

Half (48.5%) of boys and 42.5% of girls reported weekly exergaming use. Boys spent more time using exergames than girls (12.6±11.5 vs. 11.3±10.7 hours/week, respectively; $p<0.01$). Exergamers, regardless of sex, were younger than non-exergamers ($p<0.001$). Race/ethnicity differences were present ($p<0.001$); among both sexes, a higher percentage of exergamers were Black compared to non-exergamers. Significant SES differences were present among

females ($p=0.02$), but not among males ($p=0.09$). A greater proportion of girls from middle SES were exergamers and a greater proportion of low SES girls were non-exergamers.

Linear models stratified by sex were fitted for weekly hours of total PA (Table 2). No significant differences were observed between male exergamers and non-exergamers for total ($p=0.06$), mild ($p=0.18$), moderate ($p=0.10$), or vigorous ($p=0.24$) PA. Female exergamers reported significantly more vigorous PA compared to female non-exergamers ($p<0.01$; 1.58 ± 0.06 vs 1.34 ± 0.05 hours/week, respectively). However, no other significant differences were observed among females.

Discussion

We assessed exergaming and its association with PA in a diverse sample of adolescents. Exergamers in our study were younger and more likely to be Black than non-exergamers. This is not surprising since the most active users of video games are 11-14 year-olds and Black adolescents.² Unlike intervention research,⁴ our epidemiological study did not report greater mild-to-moderate PA among exergamers compared to non-exergamers. After thoroughly searching the current literature, we could not identify any U.S. epidemiological studies that examined the relationship between exergaming and PA. There are a plethora of empirical articles and review papers that explore the effect of exergaming interventions on physical activity, but this current study addresses a more basic question of understanding who are the adolescents who engage in exergaming and what are their PA behavior.

Although we did not observe a difference in mild-to-moderate PA, female but not male exergamers engaged in more vigorous PA than same-sex non-exergamers. Our results are similar to a study of Canadian adolescents, which found exergaming contributed to increased minutes of moderate PA among females only.⁷ Our significant findings for vigorous PA among adolescent girls suggest that exergaming may play a role in increasing vigorous activity or may serve as a gateway to more vigorous activities. It has been postulated⁸ that adolescent girls tend to choose exergames that they enjoy, which may increase their motivation, lead to playing at a greater intensity and possibly cross-over to higher intensity activities. Previous research supports this mediation of enjoyment to increase energy expenditure⁹ and it is possible that enjoyment coupled with other unexamined factors (e.g., motivation, availability of PA resources, participation in organized sports) may be responsible for the greater level of vigorous PA among female exergamers in our study. Additionally, adolescent female exergamers may view exergaming as exercise/PA more than their male counterparts,⁸ thus further contributing to their motivation to participate, especially among females who don't engage in traditional sports. Choosing exergames that appeal to female adolescents may be a viable intervention to increase vigorous PA in this population. However, this intervention may only apply to middle SES females, who report greater exergaming behavior, and not low SES females.

Several limitations must be noted. Data were cross-sectional; therefore, temporal inferences cannot be made and it is unknown from our data how exergames are contributing to the observed differences in vigorous activity. PA behavior was self-reported which may allow for over-reporting of vigorous activity; however, due to the large sample size and budgetary

constraints, the use of valid, self-reported PA measures was the best method for this study. Finally, differences in other modes of PA were not included in our analyses. Our PA assessment asked about exergaming use and total amount of PA separately, but participants were not instructed to exclude exergaming. Therefore, the total amount of PA may include exergaming and our data do not specify exergaming as the primary modality contributing to this higher level. Future research is encouraged to examine frequency, mode, and intensity of other organized and leisure-time activities.

With the increase in dance-focused exergames (e.g., Dance Dance Revolution), almost 50% of females play video games.¹⁰ Our study provides evidence that exergaming may be an innovative and appealing intervention strategy to possibly increase vigorous PA in adolescent girls. Regular vigorous PA is part of the national PA guidelines and can lead to greater fitness and reduced risk for chronic diseases. Adolescent girls' engagement in exergames may improve their PA enjoyment, address barriers such as availability and accessibility, and serve as a gateway to more PA.

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Abbreviations

PA physical activity

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Table 1Demographic Characteristics Stratified by Sex and Exergaming Status^a

	Males				Females			
	Non-exergamers (n=672)		Exergamers (n=633)		Non-exergamers (n=854)		Exergamers (n=630)	
	Mean (SD)		Mean (SD)	p-value	Mean (SD)		Mean (SD)	p-value
Age, years	15.5 (2.0)		14.5 (1.9)	<0.001	15.2 (1.9)		14.3 (1.8)	<0.001
BMI, z-score ^b	0.7 (1.2)		0.8 (1.2)	0.22	0.7 (1.0)		0.8 (1.0)	0.26
	n	%	n	p-value	n	%	n	p-value
Race/ethnicity				<0.001				<0.001
White	158	23.6	119	18.9	142	16.7	105	16.7
Black	180	26.8	198	31.4	232	27.4	196	31.2
Hispanic	130	19.4	86	13.6	149	17.6	107	17.0
Asian	135	20.1	124	19.6	201	23.7	94	14.9
Mixed/Other	68	10.1	104	16.5	124	14.6	127	20.2
Socio-economic Status (SES)				0.09				0.02
High	167	25.9	128	21.3	142	17.0	114	18.8
Mid	250	38.8	264	43.9	292	35.0	257	42.3
Low	227	35.3	209	34.8	400	48.0	236	38.9

^a Exergaming status was determined by the hours spent playing interactive video games, such as Wii Sport, Wii Fit, and Dance Dance Revolution on an average weekday and weekend day. Participants who engaged in any exergaming (>0 hours/week) were classified as “exergames” and those without any exergaming were labelled as “non-exergamers” (test-retest r=0.73).

^b BMI z-score is presented for descriptive purposes only.

Table 2Mean Weekly Hours of Physical Activity^a Stratified by Sex and Exergaming Status^{b,c}

Physical Activity	Males			Females		
	Non-exergamers (n=672)		p-value	Non-exergamers (n=854)		p-value
	Weekly Hours (SE)	Exergamers (n=633)		Weekly Hours (SE)	Exergamers (n=630)	
Total	5.42 (0.14)	5.81 (0.15)	0.06	4.68 (0.12)	5.00 (0.14)	0.08
Mild	1.61 (0.07)	1.75 (0.07)	0.18	1.80 (0.07)	1.82 (0.08)	0.86
Moderate	1.69 (0.06)	1.84 (0.06)	0.10	1.54 (0.05)	1.60 (0.06)	0.46
Vigorous	2.12 (0.06)	2.23 (0.07)	0.24	1.34 (0.05)	1.58 (0.06)	<0.01

^a Participants were asked three questions to assess how many hours were spent in strenuous (or vigorous), moderate-, and mild-intensity physical activity during a typical week. Responses (0 to >6 hours/week) were recoded to create time spent at each intensity level, which were then summed to create a score that represented the total time spent in physical activity.

^b Exergaming status was determined by the hours spent playing interactive video games, such as Wii Sport, Wii Fit, and Dance Dance Revolution on an average weekday and weekend day. Participants who engaged in any exergaming (>0 hours/week) were classified as “exergamers” and those without any exergaming were labelled as “non-exergamers” (test -retest r=0.73).

^c Age, race/ethnicity, and SES were included as covariates in all models.