

Physical Activity and Screen-Media-Related Parenting Practices Have Different Associations with Children's Objectively Measured Physical Activity

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Abstract

Background: Children's physical activity (PA) is inversely associated with children's weight status. Parents may be an important influence on children's PA by restricting sedentary time or supporting PA. The aim of this study was to investigate the association of PA and screen-media-related [television (TV) and videogame] parenting practices with children's PA.

Methods: Secondary analyses of baseline data were performed from an intervention with 9- to 12-year-olds who received active or inactive videogames ($n=83$) to promote PA. Children's PA was assessed with 1 week of accelerometry at baseline. Parents reported their PA, TV, and videogame parenting practices and child's bedroom screen-media availability. Associations were investigated using Spearman's partial correlations and linear regressions.

Results: Although several TV and videogame parenting practices were significantly intercorrelated, only a few significant correlations existed between screen-media and PA parenting practices. In linear regression models, restrictive TV parenting practices were associated with greater child sedentary time ($p=0.03$) and less moderate-to-vigorous PA (MVPA; $p=0.01$). PA logistic support parenting practices were associated with greater child MVPA ($p=0.03$). Increased availability of screen-media equipment in the child's bedroom was associated with more sedentary time ($p=0.02$) and less light PA ($p=0.01$) and MVPA ($p=0.05$) in all three models.

Conclusion: In this cross-sectional sample, restrictive screen-media and supportive PA parenting practices had opposite associations with children's PA. Longitudinal and experimental child PA studies should assess PA and screen-media parenting separately to understand how parents influence their child's PA behaviors and whether the child's baseline PA or screen media behaviors affect the parent's use of parenting practices. Recommendations to remove screens from children's bedrooms may also affect their PA.

Introduction

Children's physical activity (PA) often declines with age¹ and has been identified as a behavioral target for childhood obesity prevention and treatment² as well as a method for promoting cardiovascular health.³ Parents influence children's behavior through their parenting styles and parenting practices.⁴ Parenting practices are parental behaviors used for child rearing, intended to influence children's attitudes, values, and actions. They are often considered in specific contexts, such as feeding, academics, or discipline. Eating,⁵⁻⁷ PA,^{8,9} and screen-media-use¹⁰ parenting practices were associated with corresponding healthy lifestyle behaviors among children.

For example, PA logistic support parenting practices were associated with greater child's PA,^{8,9,11-13} whereas restrictive television (TV) viewing parenting practices were associated with lower child TV viewing.^{10,14,15}

Varied definitions and instruments have been used to assess PA parenting practices through child¹⁶ or parent report.^{9,17,18} Some of these instruments included restriction of screen media (TV viewing, computer, and videogame playing), particularly TV viewing, as a major part of the scale¹⁸ or as a subfactor of the scale.¹⁷ Screen-media use may influence children's PA through a displacement effect,¹⁹ that is, children who participate in less-sedentary behaviors, such as TV viewing, may be more physically active. However, the relationship between children's screen-media

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use and PA is not clear. A meta-analysis found the association between children's screen-media-use behaviors and PA was negatively associated (mean effect sizes, -0.1 to -0.14).¹⁹ However, this association was weak, providing only minimal support for the displacement effect hypothesis. Our qualitative studies with Hispanic parents of preschool children found that parents reported they restricted TV viewing for their child to encourage them to be more physically active.²⁰ It is not known whether this parenting strategy ultimately affects preschool children's PA. Even less is known about whether parents of older children (9–12 years of age) implement screen-media parenting practices to influence their child's PA (e.g., do parents who restrict their child's sedentary behaviors hope to thereby encourage their child to be more physically active?). If that were true, parents who wanted to promote PA for their child may be expected to use both restrictive TV parenting practices and supportive PA parenting practices. We explored this by testing the following two hypotheses: (1) supportive PA and restrictive screen-media parenting practices correlate positively and (2) both supportive PA parenting practices and restrictive screen-media parenting practices are positively associated with objectively measured child PA and negatively associated with objectively measured sedentary time.

Methods

This was a secondary analysis of baseline data from a study that evaluated the effect of active videogames on 9- to 12-year-olds' PA. The details of the original study have been published elsewhere²¹ and are only briefly described here. Participants were recruited in 2010 from multiple sources. Inclusionary criteria were 9–12 years of age, 50th to 99th percentile BMI, fluent in English, parent who agreed to allow the child to play videogames, and having a TV in the household from which Wii™ games could be played. Children were excluded if they already had a Wii console, a medical problem that prevented them from being physically active or playing videogames, past medical or family history of seizures, not providing at least 5 days of PA data at the baseline assessment, and living further than 15 miles from the USDA/ARS Children's Nutrition Research Center in Houston, TX. Eighty-four children were recruited and enrolled in the 13-week study. The baseline data used for the current analysis were collected before randomization. The study was approved by the Baylor College of Medicine Institutional Review Board (Houston, TX), and participants provided written informed parent consent and child assent. All participants had complete baseline data, but 1 child was removed from analyses because they were simultaneously participating in another research intervention.

Measures

Children's physical activity. Accelerometers (ActiGraph GT3X; ActiGraph, LLC, Pensacola, FL) were worn by children for 7 days at baseline. Children were instructed to wear the monitor on their right hip at all times including

while sleeping, except when bathing, swimming, or playing contact sports. The monitors recorded at 10-second epochs. Data between midnight to 6 am were removed because it was considered sleep time. In addition, periods of 60 minutes or more of continuous zeros were considered nonwear time and were removed from analyses. PA data were considered valid if the minimum criterion of 600 minutes each day for 5 days was met. The Evenson cut points,²² sedentary ≤ 100 counts/min, light PA (LPA) > 100 – 2295 counts/min, and moderate-to-vigorous PA (MVPA) ≥ 2296 counts/min, identified as most accurate for children,²³ were used. All 83 participants had valid accelerometer data and were included in these analyses.

Children's BMI z-score. Child weight was measured using a Seca Alpha 882 digital scale (Seca Corporation, Hanover, MD) without shoes or outerwear, and height was measured with a Perspective Enterprises stadiometer (PE-AIM-101; Perspective Enterprises, Portage, MI) using standard procedures²⁴ at baseline. BMI z-scores were calculated using the CDC's national norms.²⁵

Behavior-specific parenting practices. At baseline, one parent per child (86.7% mothers) completed self-report questionnaires to assess their PA and screen-media parenting practices. PA parenting practices were assessed using the Activity-related Parenting Practices Scale,⁹ a seven-item scale with two subfactors: logistic support (e.g. enrolling children in activities and attending the activities with the child: three items) and explicit modeling (e.g. how much parent's personally enjoy PA and use PA as a family recreation: four items). The scale has been associated with PA in 9-year-old girls.⁹ The internal consistency of the subscales in the original study was $\alpha = 0.74$ for father's logistic support, $\alpha = 0.69$ for father's modeling, $\alpha = 0.61$ for mother's logistic support, and $\alpha = 0.75$ for mother's modeling.⁹ Cronbach's alphas in this sample were 0.69 for logistic support and 0.71 for explicit modeling. Because the response options were different for each item, responses were standardized according to Davison and colleagues.⁹

TV parenting practices were assessed by a 15-item scale with three subscales: restrictive (restricting amount or content viewed by the child; five items); social coviewing (viewing TV together with child for enjoyment; five items); and instructive parental mediation (explaining the meaning of TV programs or characters to children; five items).²⁶ A four-point response scale assessed the frequency of parental use of each practice (never, rarely, sometimes, or often). This scale was originally developed and validated in a sample of Dutch parents of 5- to 12-year-old children²⁶ with reported internal consistencies of $\alpha = 0.79$, 0.79 , and 0.8 for restrictive, social coviewing, and instructive parental mediation, respectively. It has been used to assess TV parenting practices in US samples.^{27,28} Cronbach's alphas in this sample were $\alpha = 0.78$ for restrictive, $\alpha = 0.87$ for social coviewing, and $\alpha = 0.81$ for instructive parental mediation.

Because of a lack of established scales to assess videogame parenting practices, we modified the items of the TV parenting scale to reflect videogame use with the same three subscales and response options. Internal consistencies in this sample were $\alpha=0.86$, 0.97 , and 0.92 for restrictive, social coplaying, and instructive mediation subscales, respectively.

Child's bedroom media availability was reported by the parent for the item "Does your participating child have any of the following in their bedroom (yes/no response)": TV; computer; VCR or DVD player; internet connection; and videogame console. The "yes" responses were summed; possible scores ranged from 0 to 5.

Statistical Analyses

Descriptive statistics [percent, mean, and standard deviation (SD)] were calculated for the child's PA, BMI z-score, demographics, and parenting practices scales. The PA and screen-media parenting practice data were skewed and therefore Spearman's correlations between-screen media and PA-related parenting practice subscales were investigated, controlling for the child's age, gender, and ethnicity. PA outcomes were normally distributed. Associations of PA, TV, and videogame parenting practices with children's sedentary, LPA, MVPA, and counts per minute (CPM) were investigated by separate linear regression models including the child's bedroom media availability (because of small sample size), controlling for age, gender (boy/girl), race [black (reference), white, Hispanic, and other], child BMI z-score and parental education [not completed college, college graduate, or above (reference)]. We assessed the correlation of average temperature per month of data collection and child PA and found no significant correlations. We therefore opted not to control for average temperature in our analyses. The moderating effect of child gender on parenting practices was investigated in models including gender, parenting practices, and interaction terms of gender by parenting practice subscales.

Results

The 83 children included in this secondary analysis reported an average age of 11.3 ± 1.8 years; 52% were male; 43% were African American, 13% white, 12% Hispanic, 6% other, and 25% reported mixed ethnic heritage. The majority of families (57.3%) reported a family income between \$20,000 and \$59,999, and 46.9% of parents reported having completed college or higher degree. Children spent most of their time in sedentary activities, with a mean of 653.5 (SD, 79.44) sedentary minutes/day. On average, only 26.2 (SD, 16.94) minutes/day were spent in MVPA and 394.9 (SD, 67.38) doing LPA (Table 1).

Most of the TV and videogame parenting practices were significantly correlated with each other in theoretically congruent directions (Table 2). For example, pa-

Table 1. Descriptive Characteristics of the Sample

Child characteristics	Mean (SD)
Child weight (kg)	48.60 (11.70)
Child height (cm)	148.45 (10.52)
Child BMI z-score	1.14 (0.64)
Sedentary behaviors (min/day)	653.53 (79.44)
Light PA (min/day)	394.89 (67.38)
MVPA (min/day)	26.24 (16.94)
Activity counts per minute (per day)	321.29 (110.28)

Data were collected in Houston, Texas, from January to November 2010.

SD, standard deviation; kg, kilograms; cm, centimeters; PA, physical activity; MVPA, moderate-to-vigorous physical activity.

rental TV social covieving (0.43 ; $p < 0.001$), instructive mediation (0.37 ; $p < 0.001$), and restrictive practices (0.58 ; $p < 0.001$) were significantly correlated with the corresponding subfactor for videogame parenting practices. However, none of the screen-media-related parenting practices were significantly correlated with media availability in the child's room. For the PA parenting practices, logistic support and explicit modeling were significantly correlated (0.36 ; $p < 0.001$), but the only significant correlations between screen-media-related parenting practices and PA parenting practices was logistic support for PA and instructive TV parenting practices (0.26 ; $p < 0.05$) as well as parent explicit modeling of PA and videogame-restrictive parenting practices (0.26 ; $p < 0.05$). Restrictive TV parenting was not significantly correlated with PA logistic support (0.13 ; $p > 0.05$ for TV), thus not supporting hypothesis 1.

The regression models of PA, TV, and videogame parenting practices' association with children's PA explained 23.3–33.0% of the variance in children's sedentary, LPA, MVPA, and activity CPM. Parents who reported higher PA logistic support had children with greater MVPA and total activity CPM (Table 3), thus supporting the first part of hypothesis 2. Higher restrictive TV parenting practices were associated with more child sedentary time, less MVPA, and less CPM, thus not supporting the second part of hypothesis 2. Videogame parenting practices were not significantly associated with child PA, except restrictive videogame parenting practices, which approached significance as inversely associated with children's MVPA [95% confidence interval (CI): -2.0 , 0.0 ; $p = 0.05$]. Availability of media in the child's bedroom was associated with more sedentary time and less LPA, MVPA, and CPM in all three models (Table 3). The moderating effects of child gender were explored in all three models by interaction terms, but none were significant (data not shown).

Table 2. Spearman's Partial Correlations of Parenting Practices in the Context of Television Viewing, Videogame Playing, and Physical Activity

Variable	No. of items	Cronbach's alpha	Mean (SD)	Possible range	1	2	3	4	5	6	7	8	9
1. TV parenting practices social co-viewing	5	0.87	17.71 (2.530)	1-20	1	0.33**	0.06	0.43***	0.31**	0.18	0.15	0.07	-0.02
2. TV parenting practices instructive mediation	5	0.81	17.07 (2.784)	1-20		1	0.39***	0.16	0.37***	0.33**	0.26*	0.11	-0.02
3. TV parenting practices restrictive	5	0.78	16.57 (3.171)	1-20			1	-0.13	0.27*	0.58***	0.13	0.21	-0.16
4. VG parenting practices social coplaying	5	0.97	11.49 (4.955)	1-20				1	0.61***	0.22	0.01	0.21	0.21
5. VG parenting practices instructive mediation	5	0.92	12.27 (4.494)	1-20					1	0.62***	0.08	0.16	0.06
6. VG parenting practices restrictive	5	0.86	14.27 (4.572)	1-20						1	0.03	0.26*	-0.03
7. PA parenting practices logistic support	3	0.69	9.00 (2.53)	1-12							1	0.36***	-0.02
8. PA parenting practices explicit modeling	4	0.71	10.23 (2.56)	1-17								1	-0.12
9. Available media in child's bedroom	5	0.76	1.69 (1.569)	0-5									1

Partial bivariate Spearman correlations, controlling for child age, gender, and race.

***Significant at $p < 0.001$; **Significant at $p < 0.01$; *Significant at $p < 0.05$.

TV, television; VG, videogame; PA, physical activity.

Table 3. The Association of Physical Activity, Television, and Video-Game Parenting Practices with Children's Objectively Measured Physical Activity

	SED			LPA			MVPA			CPM		
	Adjusted R-square=0.303			Adjusted R-square=0.311			Adjusted R-square=0.234			Adjusted R-square=0.233		
	Unstand. estimate	95% CI	p-value	Unstand. estimate	95% CI	p-value	Unstand. estimate	95% CI	p-value	Unstand. estimate	95% CI	p-value
PA parenting practices												
Available media in child's bedroom	12.55	(2.3, 22.8)	0.02	-12.32	(-21.0, -3.6)	0.01	-2.33	(-4.6, -0.1)	0.05	-16.86	(-31.7, -2.0)	0.03
PA parenting practices logistic support	-4.55	(-11.5, 2.4)	0.21	3.79	(-2.1, 9.7)	0.22	1.75	(0.2, 3.3)	0.03	11.00	(0.9, 21.1)	0.04
PA parenting practices explicit modeling	1.91	(-4.2, 8.0)	0.54	-1.45	(-6.6, 3.7)	0.58	-0.09	(-1.4, 1.2)	0.90	-1.62	(-10.4, 7.2)	0.72
TV parenting practices												
Available media in child's bedroom	12.66	(2.6, 22.7)	0.02	-12.42	(-21.1, -3.8)	0.01	-2.35	(-4.6, -0.1)	0.04	-17.05	(-31.7, -2.4)	0.03
TVPP social coviewing	3.56	(-3.9, 11.0)	0.35	-3.62	(-10.0, 2.8)	0.27	0.18	(-1.5, 1.8)	0.83	-2.23	(-13.0, 8.6)	0.69
TVPP instructive mediation	-4.75	(-11.6, 2.1)	0.18	3.01	(-2.9, 8.9)	0.32	0.81	(-0.7, 2.3)	0.30	6.51	(-3.4, 16.5)	0.20
TVPP restrictive	6.02	(0.8, 11.2)	0.03	-4.04	(-8.5, 0.4)	0.08	-1.62	(-2.8, -0.5)	0.01	-10.90	(-18.4, -3.4)	0.01
Videogame parenting practices												
Available media in child's bedroom	14.45	(3.8, 25.1)	0.01	-13.22	(-22.4, -4.1)	0.01	-2.91	(-5.2, -0.6)	0.02	-21.31	(-36.9, -5.7)	0.01
VGPP social coplaying	-2.13	(-6.3, 2.0)	0.32	0.99	(-2.6, 4.6)	0.59	0.46	(-0.4, 1.4)	0.32	4.15	(-1.9, 10.2)	0.19
VGPP instructive mediation	-3.14	(-8.7, 2.4)	0.27	2.60	(-2.2, 7.4)	0.29	0.36	(-0.9, 1.6)	0.57	1.81	(-6.4, 10.0)	0.67
VGPP restrictive	3.18	(-1.3, 7.7)	0.17	-2.12	(-6.0, 1.8)	0.29	-1.01	(-2.0, 0.0)	0.05	-4.51	(-11.0, 2.1)	0.19

Separate linear regression models for PA, TV, and videogame parenting practices and their association with children's objectively measured sedentary time, light PA, moderate-to-vigorous PA, and counts per minutes of activity. Each model controlled for the child's age, gender, race and BMI z-score, as well as parent education. Significant associations ($p < 0.05$) are bolded. SED, sedentary; LPA, light physical activity; MVPA, moderate-to-vigorous physical activity; CPM, counts per minute; PP, parenting practices; PA, physical activity; TV, television; VG, videogame.

Discussion

Parents influence their children's behaviors by a combination of parenting practices across multiple contexts.⁴ Yet, in this ethnically diverse sample, parental use of supportive PA parenting practices and restrictive screen-media parenting practices were not correlated as would be expected if parents intentionally used screen-media restriction to promote PA for children. Higher parental logistic support for PA was associated with greater child MVPA and CPM, similar to several other studies,^{8,9,11} but this association has not been consistently reported.²⁹ In the present study, the more restrictive TV parenting practices parents reported using, the less MVPA and CPM, and the more sedentary time the child had during baseline assessment, whereas restrictive videogame parenting practices approached significance for less child MVPA. Because the parenting practices are self-reported by parents, it is possible that parents may be providing socially desirable responses. However, one other study has investigated parental restriction of screen-media use along with other home environment variables as potential influences on primary school-aged children's objectively measured activity.¹⁴ Similar to the present study's findings, children in the low-active group were more likely to have parents who had rules that TV viewing must be supervised.

Parents may decide to restrict children's screen-media use for many reasons, including to restrict the content, promote PA or other activities (e.g., school work or chores), or promote a healthier lifestyle. Parent-child interactions are bidirectional and dynamic^{4,30}; therefore, in this cross-sectional sample, the direction of the influence of parental TV restriction on children's increased sedentary time and decreased MVPA cannot be determined. It is possible that parents, whose children were very active, were less likely to restrict their TV viewing time. On the other hand, parents whose children were more sedentary may be more likely to restrict their TV viewing and those children may replace their TV viewing with other sedentary behaviors, such as computer use or reading, rather than physical activity. Alternatively, this may suggest that parenting practices that restrict children's screen-media use and parenting practices that support PA do not have similar effects of promoting children's PA. Future research is needed to more fully explore these relationships in longitudinal samples that can better assess the bidirectional association of child behaviors with parental use of parenting practices.

Although restrictive TV parenting practices were associated with greater sedentary time and less MVPA in this sample, several studies have demonstrated that restrictive TV parenting practices were associated with less TV viewing among children,^{10,14,15} which is, in itself, a desirable outcome; however, this was not assessed in this study. Some TV reduction interventions have successfully improved children's weight status,^{31,32} and this effect was mediated by children's dietary intake in one of the studies,³¹ suggesting that TV reduction is important for obesity prevention and treatment initiatives.

This study examined the role of parenting practices on children's PA. Parents are the gatekeepers of the home and influence whether a child has screen-media equipment available in their bedroom. It would have been reasonable to expect that parents who use more restrictive TV or videogame parenting practices would also limit access to screen-media equipment in their child's bedroom. However, in this sample, there were no significant correlations between restrictive parenting practices and the availability of screen-media equipment in the child's bedroom (Table 2). Others have also found that parents who are concerned about their child's TV viewing use inconsistent strategies while interacting with their child around screen-media use and availability.³³ However, several studies have found associations between the presence of a TV in a child's bedroom and the child's TV viewing³⁴⁻³⁶ and weight status.³⁷ Here, we report that increased availability of screen media in the child's bedroom was negatively associated with children's LPA, MVPA, and CPM for all three parenting practice models (Table 3). Few other studies have investigated the association of having a TV or other screen-media equipment available in the bedroom and children's objectively measured PA,³⁸ which could explain an alternate mechanism for its association with children's weight status. Recommendations to remove the TV from children's bedrooms³⁷ may positively affect the child's PA, thus improving their weight status.

The strengths of this study included an ethnically diverse sample, separate assessments of PA and screen-media parenting practices, and objectively measured PA and sedentary behaviors by accelerometers. Of note, the children in this study were less active, compared to US national norms for activity CPM,¹ which may have implications for the parenting practices used with them. Limitations included a self-selected sample from one US city for an intervention study and therefore not representative of the general population; children's TV viewing and other sedentary behaviors were not assessed in this sample, limiting our understanding of what children did during their sedentary time; context-specific parenting practices were measured by parent self-report, potentially introducing social desirability in the responses; test-retest reliabilities of the parent-reported measures are not known; the internal reliabilities of the PA parenting scales were marginal, reducing the ability to interpret the associated findings; the sample size was small, limiting our ability to simultaneously assess the association of PA, TV and videogame parenting practices on children's PA; and the study design was cross-sectional.

Conclusion

Parents with greater support for PA did not report higher use of parenting practices that restricted their child's screen-media use. Greater reported use of restrictive TV parenting practices was associated with lower amounts of child PA. These findings have several potential explanations, such as (1) child behaviors may drive parenting behaviors and vice versa (bidirectional interactions), (2) parental use of specific

parenting practices within one context, such as screen-media use, has complex effects on a child's behavior in another context, such as PA, or (3) the effect of parenting practices may be moderated by child characteristics or behaviors. Longitudinal and experimental child PA studies should assess PA and screen-media parenting separately to understand how parents influence their child's PA behaviors as well as whether the child's baseline PA or screen-media behaviors affect the parent's use of parenting practices. Additionally, findings from this study suggest that recommendations to remove screen-media equipment from children's bedrooms may also increase their PA.

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