



The Effect of Screen Viewing Duration and Self-Efficacy in Limiting Screen Viewing on Loneliness in Adolescent-Parent Dyads: An Application of the Actor-Partner Interdependence Model

Rumei Yang, MS^{a,b,*}, Eunjin Lee Tracy, PhD^c, Francine Bench Jensen, MSN, RN^{a,d}, Yun Jiang, PhD, MS, RN^e, Lauri Linder, PhD, APRN, CPON^{a,f}

^a University of Utah College of Nursing, Salt Lake City, UT, United States of America

^b School of Nursing, Nanjing Medical University, Nanjing, Jiangsu, China

^c University of Utah, Department of Psychology, Salt Lake City, UT, United States of America

^d Utah Valley University, Orem, UT, United States of America

^e University of Michigan School of Nursing, Ann Arbor, MI, United States of America

^f Primary Children's Hospital, Salt Lake City, UT, United States of America

ARTICLE INFO

Article history:

Received 17 November 2018

Revised 22 March 2019

Accepted 7 May 2019

Keywords:

Screen viewing

Self-efficacy

Loneliness

Adolescent

Parent

ABSTRACT

Purpose: To examine the influence of parents' screen viewing (SV) duration and self-efficacy in limiting SV on their adolescents' loneliness, and to explore the influence of adolescents' SV duration and self-efficacy in limiting SV on parents' loneliness.

Design and methods: A cross-sectional survey with 1573 adolescent-parent dyads from the Family Life, Activity, Sun, Health, and Eating Study were included in this study. The actor-partner interdependence models were used to examine the effect of each dyadic partner's SV duration and self-efficacy in limiting SV on their own and their dyadic partner's loneliness within adolescent-parent dyads.

Results: There were no significant actor and partner effects of SV duration on loneliness for both parents and adolescents (all $p_s > 0.05$). Adolescents' self-efficacy in limiting SV was associated with less loneliness of their own (adolescents' actor effect: $\beta = -0.35$, $SE = 0.04$, $p < .01$) and that of their parents (adolescents' partner effect: $\beta = -0.15$, $SE = 0.04$, $p = .001$). Parents' self-efficacy in limiting SV was negatively associated with their own loneliness (parents' actor effect: $\beta = -0.25$, $SE = 0.05$, $p < .01$), but not with their adolescents' loneliness (parents' partner effect: $\beta = -0.06$, $SE = 0.05$, $p = .189$).

Conclusions: Adolescents' own self-efficacy in limiting SV has a significant impact on their parents' loneliness. Parents' self-efficacy in limiting SV, however, did not influence their adolescents' loneliness.

Practice implications: Our results highlight the importance of providers screening for loneliness as part of the plan of care for adolescents and parents who might have excessive SV, with close attention given to those who possess less self-efficacy in controlling their SV.

© 2019 Elsevier Inc. All rights reserved.

Introduction

Screen viewing (SV) including television (TV), computer, mobile or smart phone, and video games is a prevalent form of sedentary behavior among adolescents and adults. SV has gained increasing attention for its significant contribution to the poor health of both adolescents and adults (Carson et al., 2011). Existing evidence suggests that many adolescents far exceed the recommended two hours per day of recreational screen viewing time (Currie et al., 2008; Rideout et al., 2010; Salmon

and Shilton, 2004; Tremblay et al., 2011). Excessive SV is reported to be detrimental to sleep, interpersonal relationships, mental health, body weight, and contributes to all-cause mortality for adolescents (Jago et al., 2013; Jolin and Weller, 2010; Strasburger et al., 2010; Yi et al., 2012) and adults (Grøntved and Hu, 2011).

Research assessing the impact of SV on mental health focuses primarily on depression and anxiety (Grøntved et al., 2015; Hayward et al., 2016; Kremer et al., 2014; Primack et al., 2009; Rhodes et al., 2012), but less on loneliness for both adults and adolescents (Hoare et al., 2016). Loneliness is common among people of all ages, with a reported prevalence of 80% in adolescents, and decreases through middle adulthood (Hawley and Cacioppo, 2010). Loneliness has been linked to a variety of adverse mental health outcomes including social isolation, suicide, anger, anxiety, and reduced self-esteem (Ferreira-Alves et al.,

* Corresponding author at: University of Utah College of Nursing, 10 S 2000 E, Salt Lake City, UT 84112. School of Nursing, Nanjing Medical University, No. 140 Han-Zhong Road, Nanjing 210029, China.

E-mail address: Rumei.yang@hsc.utah.edu (R. Yang).

2014; Hawley and Cacioppo, 2010). Recently, emerging studies show a positive association between increased SV and greater perceptions of loneliness among Chinese adolescents (Wang et al., 2018; Wu et al., 2015). Although loneliness is closely related to depression (association ranged from 0.38 to 0.71) (Ferreira-Alves et al., 2014), many lonely people are not clinically depressed (Cole and Carpentieri, 1990; Donovan et al., 2017; Perissinotto et al., 2012). Evidence has also shown that loneliness predicts depression, but the reverse is not true (Cacioppo et al., 2010). This distinction suggests that loneliness should be viewed as a different concept, and loneliness might have more practical implications than depression. Therefore, a link between SV and loneliness might provide an early intervention opportunity for both adolescents and adults.

Parents are important influences on adolescents' SV and health (Cillero and Jago, 2010; Jago et al., 2012; Jago et al., 2014; Marsh et al., 2014). Evidence is consistent that children whose parents often have SV rules or who role model less SV themselves are less likely to have excessive SV (Bounova et al., 2016; Cillero and Jago, 2010). In contrast, children whose parents have excessive TV watching are five times more likely to have excessive TV watching (Jago et al., 2013). The rationale behind this association is that excessive SV can reduce parent-child interactions (Chen et al., 2008; Skaug et al., 2018a; Zhao et al., 2018) and influence family functioning (Hinkley et al., 2014). Parental self-efficacy, referring to a belief of one's capability (Bandura, 1982) to limit SV is one form of parental influence that is relatively less studied; however, in many studies it has proven to be a powerful predictor of reduced SV in their children (Campbell et al., 2010; Hinkley et al., 2013; Jago et al., 2013; Carson and Janssen, 2012; Xu et al., 2015). For example, Jago et al. (2013) reported that parental self-efficacy in limiting SV was related to approximately 30% less likelihood that their children would exceed two hours of the recommended TV viewing time (Jago et al., 2013). Nevertheless, of the studies focusing on self-efficacy, the focus often was parental self-efficacy in limiting their children's SV (Campbell et al., 2010; Carson and Janssen, 2012; Hinkley et al., 2013; Jago et al., 2015; Solomon-Moore et al., 2017; Vandewater et al., 2005), rather than their own SV. More importantly, adolescents' own self-efficacy in limiting SV is entirely overlooked. A recent study by Solomon-Moore et al. (2017) found that parental self-efficacy in limiting their children's SV is not associated with their own SV, suggesting that parents can behave differently toward their own SV versus limiting their children's SV. This result suggests there is an important distinction between limiting one's own SV versus others' SV. This distinction can potentially influence how children perceive their parents' SV guidance suggestions and accordingly influence whether they want to comply with these suggestions. Therefore, it is important to consider adolescents' self-efficacy in limiting their SV in order to better understand how parents' and adolescents' SV are associated.

Despite that parents' and adolescents' SV are more likely to be interconnected, less attention has been paid to whether adolescents can influence their parents, or whether mutual influence between parents and adolescents exists. Ample evidence suggests that parents' and adolescents' SV are reciprocal (Skaug et al., 2018a; Xu et al., 2015), and parents' and adolescents' SV-related mental health concerns (i.e. loneliness) can be highly interdependent because they share the same home environment (Maitland et al., 2013), yet few studies have considered SV as a dyadic process. Specifically, few studies have simultaneously addressed the reciprocal influence of SV (i.e. SV duration or self-efficacy in limiting SV) on mental health (i.e. loneliness) from a dyad perspective. These are important knowledge gaps to address in order to inform future intervention studies.

In the current study, we used actor-partner interdependence models (APIMs; Campbell and Kashy, 2002; Cook and Kenny, 2005; Kenny et al., 2006) to explore whether both adolescent-parent dyads' SV duration and self-efficacy in limiting SV would be associated with their own and their partner's loneliness, and to compare which dyadic partner exerts a greater influence on the outcome of the other than another does.

We hypothesized that a higher duration of SV among both parents and adolescents would be associated with more loneliness for themselves and their partners, whereas greater self-efficacy in limiting SV would be associated with decreased loneliness for themselves and their partners. As shown in Fig. 1, the APIM simultaneously estimates effects of parents' and adolescents' independent variables on their own dependent variables, namely actor effects (a_p , a_t), and effects of the partner's independent variables on the person's dependent variables, namely partner effects (p_p , p_t). Within the study context, the actor effect represented whether each dyadic member's SV duration or self-efficacy in limiting SV can influence their own loneliness. In contrast, the partner effect reflected whether one dyadic member's SV duration or self-efficacy in limiting SV can affect their dyadic partner's loneliness.

Methods

Data source and sample

A cross-sectional analysis was conducted using data from the 2014 Family Life, Activity, Sun, Health, and Eating (FLASHE) study, a nationally representative sample of adolescent-parent dyads in the U.S. FLASHE was designed to monitor cancer-related risk behaviors (Nebeling et al., 2017). Adolescent-parent dyads were eligible for the FLASHE study if the parent was ≥ 18 years of age, the adolescent was 12–17 years age, and both lived together at least 50% of the time (Nebeling et al., 2017). FLASHE data are de-identified and publicly available. The original FLASHE was reviewed and approved by the U.S. Government's Office of Management and Budget, National Cancer Institute's Special Studies IRB and Westat's IRB (Nebeling et al., 2017; Oh et al., 2017).

A total of 5027 dyads were invited to participate in the FLASHE study, and 1945 dyads were enrolled. A total of 1573 dyads completed all study variables of interest and were included in the current study.

Measures

Instrument items in the FLASHE were modified from the source theories and existing literature and were further refined through cognitive interview and usability testing (Nebeling et al., 2017). Specific details of the FLASHE instruments have been previously reported (Nebeling et al., 2017).

SV duration

Parent and adolescent participants were asked to rate the duration of their own SV behaviors in the past 7 days across the media categories of computer, cell phone, gaming device and TV (excluding time spent on work or school). Computer use for both parents and adolescents included the use of social media, internet, instant messaging, and online video games. Cell phone use for parents mainly consisted of behaviors involving gaming, internet or videos, whereas adolescent behaviors were primarily texting or talking. Gaming device use for both parents and adolescents included games on gaming consoles like Xbox, Wii, PlayStation and handheld gaming devices like Nintendo DS, iPod, etc. TV use was measured by reported time spent watching movies, sports or other activities. Response options for parents were 1 (not at all), 2 (less than ½ hour), 3 (½ hour to 2 h), 4 (2 to 4 h), 5 (4 to 6 h), and 6 (6+ hours), whereas response options for adolescents were 1 (not at all), 2 (<1 h), 3 (1–2h), 4 (2 to 3 h), and 5 (3+ hours). In order to make parents' ratings compatible with adolescents' ratings, all dyad's responses were recoded into 0 (not at all), 1 (<2 h), and 2 (2+ hours), with a cutoff point of 2 h a day as an important indication of excessive screen viewing for adolescents as reflected in a variety of prior studies (Schaun et al., 2018). The mean scores were computed and analyzed in the APIM model to reflect overall SV duration (range 0–2), with a higher score indicating more SV duration.

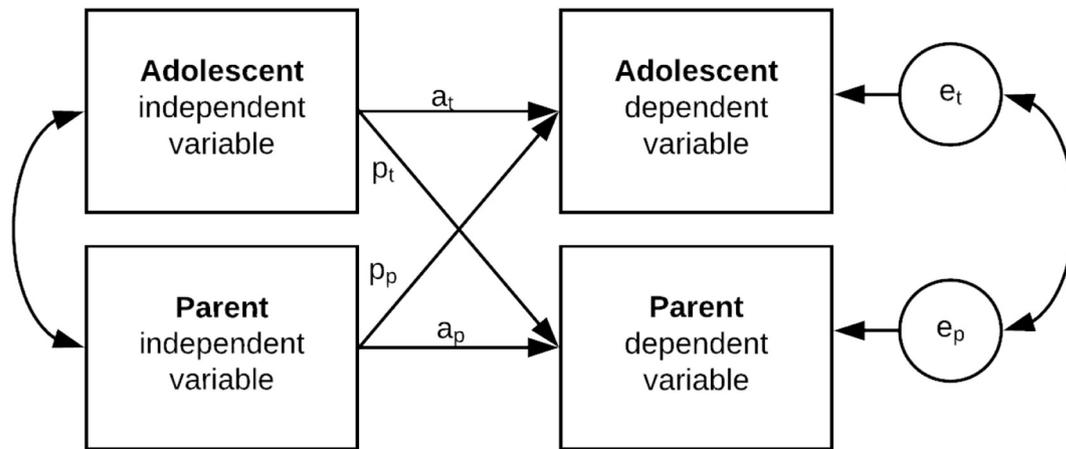


Fig. 1. Actor-Partner Interdependence Model with distinguishable dyads to test associations between dyads independent variable and dyads dependent variable. a_t and a_p = actor effects for adolescents and parents, respectively; p_t and p_p = partner effects for adolescents and parents, respectively.

Self-efficacy in limiting SV

Based on self-determination theory, self-efficacy in limiting SV is defined as one's confidence in one's own ability to limit electronic device use. Adolescents and parents reported their own self-efficacy in limiting SV using the following item: "I feel confident in my ability to limit how much time I spend using electronic devices" on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale, with a higher score indicating higher self-efficacy in limiting SV.

Loneliness

Participant dyads' perceived loneliness was measured using two items that were modified from the UCLA Loneliness Scale (Russell et al., 1978). Specifically, each dyadic member rated their own loneliness using the items "I feel left out" and "I feel isolated from others" on a 1 (*never*) to 5 (*always*) scale, with a higher score denoting greater loneliness. In the present study, the correlation between these two items were $r = 0.83$ ($p < .05$) for both adolescents and parents. The sum scores of loneliness were computed to measure overall loneliness on a range of 1 to 10.

Sociodemographic variables

The present study included demographic information about parents' age, gender, the highest level of education, marital status, race/ethnicity, self-rated health status, and household income, and adolescents reported their age, gender, race/ethnicity.

Analyses

The present study utilized multilevel models (Raudenbush & Bryk, 2001) in IBM SPSS Mixed (Version 25; 2017) for data analyses and to account for the data structure, wherein individuals were nested within dyads. Independent variables of SV duration and self-efficacy in limiting SV were grand mean centered. In this study, distinguishability occurs because one member of the dyad was the adolescent child and the other one was his or her parent. Within-dyad similarity was described by correlation coefficients (equivalent to the intraclass correlations) (Nebling et al., 2017). We used the APIM (Campbell and Kashy, 2002; Cook and Kenny, 2005; Kenny et al., 2006) to examine actor effect and partner effect within adolescent-parent dyads. Model 1 was an unadjusted model; Model 2 adjusted for covariates, including parent gender, parent education, parent self-rated health status, and annual household income. In this study, the two-intercept approach was used to examine simple slopes for each level of adolescents and parents.

Results

Descriptive information about participants and variables

Participant characteristics

Table 1 presents demographic characteristics of 1573 adolescent-parent dyads. For adolescents, about 50% were females with a mean age of 14.47 years ($SD = 1.61$, range 12–17). For parents, about 86% were aged between 35 and 59 years, 75% were women, and 72% were married.

SV duration

The average score of SV duration, self-efficacy in limiting SV, and loneliness for parents was 1.10 ($SD = 0.30$), 3.49 ($SD = 1.15$), and 4.20 ($SD = 2.02$), respectively, and 0.85 ($SD = 0.33$), 3.88 ($SD = 1.09$), and 4.22 ($SD = 1.99$), respectively, for adolescents (Table 1).

Table 2 shows descriptive information of SV behaviors. TV viewing and computer use were the primary forms of SV behaviors in both adolescents and parents. About half of non-school adolescents, referring to those who were not attending school at the time of completing the survey, spent >2 h per day on computer and TV, whereas, the majority of school-attending adolescents spent <2 h per day on computer and TV. About 24% of adolescents spent more than two hours per day on computer and 36% watched more than two hours of TV per day, while 68% of parents spent >2 h per day on computer and 58% on TV per day.

Within-dyad similarity

Adolescents' and parents' reports of SV duration ($r = 0.37$, $p < .05$), self-efficacy in limiting SV ($r = 0.20$, $p < .05$) and loneliness were positively correlated ($r = 0.38$, $p < .05$), suggesting within-dyad similarities.

Actor and partner effects of SV duration on loneliness within adolescent-parent dyads

Table 3 shows results of using the APIM predicting loneliness from SV duration. There were no significant actor and partner effects for both adolescents and parents. Adolescents' SV duration was not associated with their own loneliness nor that of their parents' loneliness (adolescents' actor effect $a_{t,svf}$: $\beta = 0.08$, $SE = 0.11$, $p = .450$; adolescents' partner effect $p_{t,svf}$: $\beta = -0.12$, $SE = 0.11$, $p = .260$, Model 1). Associations between parents' SV duration and their own loneliness (parents' actor effect $a_{p,svf}$: $\beta = 0.11$, $SE = 0.12$, $p = .379$, Model 1) and their adolescents' loneliness (parents' partner effect $p_{p,svf}$: $\beta = -0.09$, $SE = 0.13$, $p = .484$, Model 1) also were not significant. Model 2 suggested the same results.

Table 1
Demographic characteristics of adolescents and parents ($n = 1573$ dyads).

	n	%
Adolescent race/ethnicity		
Hispanic	154	9.8
Non-Hispanic Black alone	251	16
Non-Hispanic White alone	1005	63.9
Other	146	9.3
Parent age (years)		
18–34	177	11.3
35–44	684	43.5
45–59	666	42.3
60+	44	2.8
Parent gender		
Male	392	24.9
Female	1179	75.0
Adolescent gender		
Male	779	49.5
Female	788	50.1
Dyad type		
Mother–daughter	603	38.5
Mother–son	571	36.5
Father–daughter	184	11.8
Father–son	207	13.2
Parent highest level of education		
High school or less	287	18.2
Some college or higher	1279	81.3
Parent marital status		
Married	1132	72.0
Divorced, widowed, or separated	189	12.0
Never Married	146	9.3
Member of an unmarried couple	90	5.7
Parent race/ethnicity		
Hispanic	115	7.3
Non-Hispanic Black alone	255	16.2
Non-Hispanic White alone	1097	69.7
Other	90	5.7
Parent self-rated health		
Excellent	502	16.0
Very good	1300	41.3
Good	962	30.6
Fair	314	10.0
Poor	48	1.5
Annual household income		
\$0 to \$99,999	1225	77.9
\$100,000 or more	328	20.9
Mean		SD
Adolescent age (years)	14.47	1.61
Self-efficacy in limiting SV		
Adolescent	3.49	1.15
Parent	3.88	1.09
Loneliness		
Adolescent	4.20	2.02
Parent	4.22	1.99
Average SV duration		
Adolescent	1.10	0.30
Parent	0.85	0.33

Note: SV = screen viewing.

Actor and partner effects of self-efficacy in limiting SV on loneliness in adolescent-parent dyads

Table 4 presents results of self-efficacy in limiting SV on loneliness using the APIM model. Adolescents' self-efficacy in limiting SV was associated with less loneliness of their own (adolescents' actor effect $a_{l,se}$: $\beta = -0.35$, $SE = 0.04$, $p < .01$, Model 1) and that of their parents (adolescents' partner effect $p_{l,se}$: $\beta = -0.15$, $SE = 0.04$, $p = .001$, Model 1). Parents'

self-efficacy in limiting SV was negatively associated with their own loneliness (parents' actor effect $a_{p,se}$: $\beta = -0.25$, $SE = 0.05$, $p < .01$, Model 1), but not with their adolescents' loneliness (parents' partner effect $p_{p,se}$: $\beta = -0.06$, $SE = 0.05$, $p = .189$, Model 1). Given a significant adolescents' partner effect ($p_{l,se}$), the impact of the adolescents' self-efficacy in limiting their SV to their parents' loneliness was greater than that of the parents' self-efficacy in limiting their own SV to the adolescents' loneliness. Model 2 suggested the consistent results.

Discussion

This study is among the first to examine the extent to which the SV duration and self-efficacy in limiting SV affects each dyadic member's own loneliness and that of their partners from a dyadic perspective. Five main results emerged from our study.

First, with respect to specific SV duration in dyads, 24% of adolescents reported excessive computer use (>2 h) and 36% reported excessive TV watching (>2 h), in comparison to 68% excessive computer use (>2 h) and 58% excessive TV watching (>2 h) among parents. The prevalence of excessive TV viewing in our adolescent sample was relatively lower than that of 58.8% in Brazilian adolescents (Schaan et al., 2018). In addition, the prevalence of reporting excessive SV was greater among adolescents who were not attending school. However, caution must be taken in the interpretation of our result because only a small proportion of the study sample (5.6%) was not attending school at the time the survey was completed.

Second, we did not find significant effects of SV duration on loneliness within the parent-adolescent dyads, suggesting that each dyadic member's SV duration might not contribute to his or her own loneliness nor their partner's loneliness. This finding is in contrast to studies in diverse populations of Chinese, Canadian, Danish, Austrian, and American adolescents (Grøntved et al., 2015; Hayward et al., 2016; Kremer et al., 2014; Maras et al., 2015; Primack et al., 2009; Wang et al., 2018; Wu et al., 2015) where SV duration is associated with a high risk for loneliness and depression. However, our results are consistent with those of Casiano, Kinley, Katz, Chartier, and Sareen (2012) and Hume et al. (2011) who also failed to identify a negative association between SV and loneliness among Canadian and Australian adolescents. The authors attributed the discrepancy to variations in study design, characteristics of sample, and measurement tools (Casiano et al., 2012; Maras et al., 2015). Our results might be explained by the restricted coding of SV responses and possible recall bias introduced by self-reporting. These two factors could lead to an underestimation of the actual amount of SV duration in adolescent-parent dyads. For example, to make parents' reports of SV duration comparable with adolescents' reports, we treated parents who reported SV of 2–4 h, 4–6 h, and 6+ hours as the same category of over 2 h. This approach could limit our ability to distinguish subgroups of individuals with SV > 2 h, leading to a phenomenon of restriction of range that could attenuate the relationship between SV duration and loneliness (Book et al., 2007; Segrin et al., 2018). Nevertheless, given a lack of evidence on the appropriate cutoff point of excessive SV time for adults (Schaan et al., 2018), our decision of a cutoff point of 2 h is reasonable. A third possible reason is that duration or time spent viewing screens may not be an optimal indicator of SV. It is reported that the quality and content of SV might impact people's mental health more than the simple measurement of SV time (Primack et al., 2009; Skaug et al., 2018b). Future research using objective, real-world measures of SV that consider the quality and content of SV is needed to determine if there are possible does-response associations between SV and loneliness in adolescent-parent dyads.

Third, consistent with our prior hypothesis, we found significant actor effects of self-efficacy in limiting SV on loneliness for both adolescents and parents, indicating higher levels of self-efficacy associated with lower levels of loneliness. Unlike SV duration, self-efficacy in limiting SV is an internalized form of control. By implication, self-efficacy in limiting SV might relate to individuals' perceptions about whether

Table 2
Descriptive information about screen viewing behaviors for adolescents and parents (n = 1573 dyads).

	Parent (n = 1573)		Adolescents (n = 1573)		Non-school adolescents (n = 88)		Elementary school adolescents (n = 27)		Middle/high school adolescents (n = 1455)	
	n	%	n	%	n	%	n	%	n	%
Computer										
Not at all	22	1.4	263	16.7	14	15.9	6	22.2	257	17.7
2 h or less per day	483	30.7	814	51.7	36	40.9	15	55.6	799	54.9
>2 h per day	1064	67.6	383	24.3	37	42.0	6	22.2	377	25.9
Phone										
Not at all	409	26.0	348	22.1	26	29.5	13	48.1	335	23.0
2 h or less per day	846	53.8	732	46.5	44	50.0	10	37.0	722	49.6
>2 h per day	306	19.5	387	24.6	18	20.5	3	11.1	384	26.4
Television										
Not at all	60	3.8	117	7.4	9	10.2	3	11.1	114	7.8
2 h or less per day	582	37.0	793	50.4	41	46.6	18	66.7	775	53.3
>2 h per day	916	58.2	565	35.9	38	43.2	6	22.2	559	38.4
Gaming devices										
Not at all	1046	66.5	408	25.9	29	33.0	6	22.2	402	27.6
2 h or less per day	431	27.4	718	45.6	35	39.8	14	51.9	704	48.4
>2 h per day	90	5.7	349	22.2	24	27.3	7	25.9	342	23.5

Note: Non-school adolescents are those who were not attending school at the time of completing the survey.

particular forms of SV are important or necessary to them. This difference could possibly help explain why there was a significant effect of self-efficacy in limiting SV but a non-significant effect of SV duration on loneliness. Although previous studies did not directly examine the association between self-efficacy and loneliness for both adolescents and parents, studies have broadly agreed that excessive SV is associated with poorer mental health including greater loneliness (Carson et al., 2011; Wang et al., 2018; Wu et al., 2015). Self-efficacy is regarded as an important protective factor for excessive SV among adolescents (Jago et al., 2013; Jago et al., 2015; Smith et al., 2010). This finding provides additional evidence supporting the link between self-efficacy in limiting SV and loneliness among adolescents and parents.

More importantly, we demonstrated a significant adolescent partner effect, where adolescents' self-efficacy in limiting SV has a greater impact on their parents' loneliness than that of parents on adolescents' loneliness. This is a new finding that has not been previously described. Although prior evidence broadly agrees that parents play a central role in influencing their children's SV behaviors (Gustafson and Rhodes, 2006; Jago et al., 2012; Jago et al., 2014; Marsh et al., 2014; Smith et al., 2010; Solomon-Moore et al., 2017) and excessive SV is associated with an increased risk of mental health issues among adolescents (Grøntved et al., 2015; Hayward et al., 2016; Kremer et al., 2014; Primack et al., 2009), few studies have considered whether adolescents' self-efficacy in limiting SV can be an important contributor to their

parents' loneliness. According to Hinkley et al. (2014), Primack et al. (2009), and Skaug et al. (2018a), prolonged SV influences the quality of social and family interactions, which may affect parents' perceptions of loneliness. In contrast, adolescents who have higher levels of self-efficacy in limiting SV may be associated with improved adolescent-parent interactions and thus is associated with less parental loneliness. Our new finding provides direction for future studies examining adolescent behaviors as contributing to parents' health.

Finally, in contrast to our expectation, we did not find a significant parents' partner effect, suggesting parents' self-efficacy in limiting adolescent SV is not associated with adolescent's loneliness. This finding appears to be counterintuitive. Prior research focusing on parental influence on children's SV found that parents' self-efficacy to limit children and adolescents' SV is an important protective factor for children and adolescents' healthy SV and is associated with significant reduction in the likelihood that their children have excessive SV (Jago et al., 2015; Smith et al., 2010). Moreover, self-efficacy is an important mediator of the association between parental control and children's TV viewing behaviors (Jago et al., 2015). Given the prevalent evidence in favor of the negative association between SV and loneliness and depression (Grøntved et al., 2015; Hayward et al., 2016; Kremer et al., 2014; Maras et al., 2015; Primack et al., 2009; Wang et al., 2018; Wu et al., 2015), we would expect a significant parents' partner effect in which parents' self-efficacy to limit SV could be negatively associated with adolescents'

Table 3
Actor and partner effects of screen viewing duration on loneliness in adolescent-parent dyads.

	Model 1				Model 2			
	β	SE	t	p	β	SE	t	p
Intercept for adolescents	4.18	0.06	74.74	0.000	2.80	0.31	9.02	0.000
Intercept for parents	4.25	0.06	76.94	0.000	2.76	0.31	8.91	0.000
Adolescents								
Actor effect (adolescents→adolescents)	0.08	0.11	0.76	0.450	0.02	0.03	0.67	0.500
Screen viewing duration $a_{L,svf}$								
Partner effect (adolescents→parents)	-0.12	0.11	-1.13	0.260	-0.03	0.03	-0.95	0.343
Screen viewing duration $p_{L,svf}$								
Parents								
Actor effect (parents→parents)	0.11	0.12	0.88	0.379	0.02	0.02	0.75	0.452
Screen viewing duration $a_{P,svf}$								
Partner effect (parents→adolescents)	-0.09	0.13	-0.70	0.484	-0.03	0.03	-1.25	0.213
Screen viewing duration $p_{P,svf}$								

Note: $a_{L,svf}$ and $a_{P,svf}$ = actor effects of screen viewing duration for adolescents and parents, respectively; $p_{L,svf}$ and $p_{P,svf}$ = partner effects of screen viewing duration for adolescents and parents, respectively. Model 2 adjusted for parent gender, parent education, annual household income, and parent health status.

Table 4
Actor and partner effects of self-efficacy in limiting screen viewing on loneliness in adolescent-parent dyads.

	Model 1				Model 2			
	β	SE	t	p	β	SE	t	p
Intercept for adolescents	4.15	0.05	79.82	0.000	2.78	0.30	9.13	0.000
Intercept for parents	4.24	0.05	82.21	0.000	2.85	0.30	9.38	0.000
Adolescents								
Actor effect (Adolescents→Adolescents)								
Self-efficacy in limiting screen viewing $a_{t,se}$	-0.35	0.04	-7.84	0.000	-0.33	0.04	-7.03	0.000
Partner effect (Adolescents→Parents)								
Self-efficacy in limiting screen viewing $p_{t,se}$	-0.15	0.04	-3.37	0.001	-0.13	0.04	-3.06	0.002
Parents								
Actor effect (Parents→Parents)								
Self-efficacy in limiting screen viewing $a_{p,se}$	-0.25	0.05	-5.31	0.000	-0.21	0.04	-4.40	0.000
Partner effect (Parents→Adolescents)								
Self-efficacy in limiting screen viewing $p_{p,se}$	-0.06	0.05	-1.36	0.173	-0.03	0.05	-0.65	0.516

Note: $a_{t,se}$ and $a_{p,se}$ = actor effects of self-efficacy in limiting screen viewing for adolescents and parents, respectively; $p_{t,se}$ and $p_{p,se}$ = partner effects of self-efficacy in limiting screen viewing for adolescents and parents, respectively. Model 2 adjusted for parent gender, parent education, annual household income, and parent health status.

loneliness. Contrary to the existing evidence, our findings of non-significant parents' partner effect, together with above-mentioned significant adolescents' partner effect, imply parental influence is important, but not as much as adolescents' influence on their parents. Adolescents' self-efficacy plays a more critical role on parents' loneliness than that of parents' self-efficacy on adolescents' loneliness. One possible explanation for the discrepancy between previous studies and this study might be due to the advantages of the APIM analytic strategies. Previous studies predominately examined single relationships without considering the dyadic contributions to SV and related health outcomes (Grøntved et al., 2015; Hayward et al., 2016; Jago et al., 2013; Jago et al., 2015; Johnson et al., 2015; Kremer et al., 2014; Maras et al., 2015; Primack et al., 2009; Smith et al., 2010; Staiano et al., 2017; Wang et al., 2018; Wu et al., 2015). As suggested by Cook and Kenny (2005), it is important to treat dyads rather than individuals as the unit of analysis because of the interdependent nature of parent and adolescent relationships. In order to verify this speculation, we experimentally used parents' self-efficacy in limiting SV to predict adolescents' loneliness and found a significant effect; however, this effect was not retained when adolescents' self-efficacy in limiting SV was adjusted for in the model. These results indicate the importance of accounting for non-independence in dyad studies. Another possible explanation might be related to the developmental characteristics of adolescents in our sample. Adolescents in this study were older than children included in other studies (e.g. 3–5-year-old children in Jago et al. (2013) and 5–6-year-old children in Solomon-Moore et al. (2017)). Adolescents might have developed a certain level of autonomy and independence that can make them less influenced by their parents' self-efficacy behaviors. Future research using longitudinal data is needed to verify the current finding.

Limitations

Several limitations to this study should be noted. First, due to the cross-sectional nature of this study, the findings should not be interpreted as evidence of causality. Second, this study relied on self-reported data and consequently may introduce recall bias or social desirability bias. Thirdly, our sample primarily included adolescents who reported being in middle school and high school, and therefore, the results may not be generalizable to other populations. Finally, a single-item measure of self-efficacy in limiting SV might lack psychometric properties, including reliability. Low reliability could attenuate relationships among variables, making it more challenging to find significant results. Future studies could include a scale addressing additional aspects of self-efficacy rather than using a single item addressing perceived confidence in limiting screen viewing time.

Implications

This study provides a foundation for clinical practice by showing SV as a dyadic phenomenon. Although parents' self-efficacy in limiting SV did not influence their adolescents' loneliness in this study, parents remain an important source of support for adolescents such as supporting their involvement in social activities. A dyad-based intervention focusing on adolescent-parent interactions on SV and their self-efficacy in controlling their SV might have great potential to improve loneliness within adolescent-parent dyads. Parents' self-efficacy in limiting SV may not be a strong external influence on adolescents' loneliness; however, it is still an important internal influence on their own loneliness. In addition, we want to emphasize that parents can play an important role helping adolescents build internal strength such as self-efficacy in coping with SV and SV-related health problems.

This study also highlights the importance of providers screening for loneliness as part of the plan of care for adolescents and parents who might have excessive SV, particularly for those who might have less self-efficacy in controlling their SV. Researchers have predominantly focused on the parental impact on adolescents' SV and SV-related health concerns, whereas adolescents' impact on their parents' health has been overlooked. Therefore, it is important for healthcare providers to acknowledge that adolescents' confidence in controlling SV can have a greater influence on parents' loneliness. Providers should consider assessing self-efficacy in limiting SV in adolescents and parents as a clinical marker of vulnerability for loneliness. Interventions to improve adolescents' self-efficacy in limiting SV can provide a useful target to improve adolescents' and parents' loneliness.

Conclusions

This result advances previous knowledge by supporting SV behavior as a dyadic phenomenon. There are several contributions to the current research. First, there are no significant actor and partner effects of SV duration on loneliness for both adolescents and parents. Second, parents' loneliness was not only influenced by their own self-efficacy in limiting SV but also their adolescents' self-efficacy in limiting SV. In contrast, adolescents' loneliness was only influenced by their own self-efficacy in limiting SV rather than that of their parents. Taken all together, we presume that parental influence on adolescents might not be as significant as would be suggested by previous studies. Instead, adolescents might contribute greatly to parents' mental health such as loneliness. Nevertheless, this does not necessarily mean that parents are not important to assist adolescents in coping with SV-related health problems. Parents can play an important role to support building adolescents' internal strength to cope with excessive SV.

Declarations of Competing Interest

None.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

None.

References

- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37(2), 122–147.
- Book, A. S., Quinsey, V. L., & Langford, D. (2007). Psychopathy and the perception of affect and vulnerability. *Criminal Justice and Behavior*, 34(4), 531–544. <https://doi.org/10.1177/0093854806293554>.
- Bounova, A., Michalopoulou, M., Agelousis, N., Kourtessis, T., & Gourgoulis, V. (2016). The parental role in adolescent screen related sedentary behavior. *International Journal of Adolescent Medicine and Health*, 30(2). <https://doi.org/10.1515/ijamh-2016-0031>.
- Cacioppo, J. T., Hawkey, L. C., & Thisted, R. A. (2010). Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago Health, Aging, and Social Relations Study. *Psychology and Aging*, 25(2), 453–463. <https://doi.org/10.1037/a0017216>.
- Campbell, K., Hesketh, K., Silverii, A., & Abbott, G. (2010). Maternal self-efficacy regarding children's eating and sedentary behaviours in the early years: Associations with children's food intake and sedentary behaviours. *International Journal of Pediatric Obesity*, 5(6), 501–508. <https://doi.org/10.3109/17477161003777425>.
- Campbell, L., & Kashy, D. A. (2002). Estimating actor, partner, and interaction effects for dyadic data using PROC MIXED and HLM: A user-friendly guide. *Personal Relationships*, 9, 327–342. <https://doi.org/10.1111/1475-6811.00023>.
- Carson, V., & Janssen, I. (2012). Associations between factors within the home setting and screen time among children aged 0–5 years: A cross-sectional study. *BMC Public Health*, 12, 539. <https://doi.org/10.1186/1471-2458-12-539>.
- Carson, V., Pickett, W., & Janssen, I. (2011). Screen time and risk behaviors in 10- to 16-year-old Canadian youth. *Preventative Medicine*, 52(2), 99–103. <https://doi.org/10.1016/j.ypmed.2010.07.005>.
- Casiano, H., Kinley, D. J., Katz, L. Y., Chartier, M. J., & Sareen, J. (2012). Media use and health outcomes in adolescents: Findings from a nationally representative study. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, 21(4), 296–301.
- Chen, M. Y., Liou, Y. M., & Wu, J. Y. (2008). The relationship between TV/computer time and adolescents' health-promoting behavior: A secondary data analysis. *Journal of Nursing Research*, 16(1), 75–85. <https://doi.org/10.1097/01.JNR.0000387292.99300.92>.
- Cillero, I. H., & Jago, R. (2010). Systematic review of correlates of screen-viewing among young children. *Preventive Medicine*, 51(1), 3–10. <https://doi.org/10.1016/j.ypmed.2010.04.012>.
- Cole, D. A., & Carpentieri, S. (1990). Social status and the comorbidity of child depression and conduct disorder. *Journal of Consulting and Clinical Psychology*, 58(6), 748–757. <https://doi.org/10.1037//0022-006X.58.6.748>.
- Cook, W. L., & Kenny, D. A. (2005). The actor-partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development*, 29(2), 101–109. <https://doi.org/10.1080/0165025044000405>.
- Currie, C., Gabbhainn, S. N., Godeau, E., Roberts, C., Smith, R., Currie, D., & Barnekow, V. (Eds.). (2008). *Inequalities in young people's health: HBSC international report from the 2005/2006 survey*. World Health Organization. Edinburgh: Scotland.
- Donovan, N. J., Wu, Q., Rentz, D. M., Sperling, R. A., Marshall, G. A., & Glymour, M. M. (2017). Loneliness, depression and cognitive function in older US adults. *International Journal of Geriatric Psychiatry*, 32(5), 564–573. <https://doi.org/10.1002/gps.4495>.
- Ferreira-Alves, J., Magalhães, P., Viola, L., & Simoes, R. (2014). Loneliness in middle and old age: Demographics, perceived health, and social satisfaction as predictors. *Archives of Gerontology and Geriatrics*, 59(3), 613–623. <https://doi.org/10.1016/j.archger.2014.06.010>.
- Grøntved, A., & Hu, F. B. (2011). Television viewing and risk of type 2 diabetes, cardiovascular disease, and all-cause mortality: A meta-analysis. *Journal of the American Medical Association*, 305(23), 2448–2455. <https://doi.org/10.1001/jama.2011.812>.
- Grøntved, A., Singhammer, J., Froberg, K., Møller, N. C., Pan, A., Pfeiffer, K. A., & Kristensen, P. L. (2015). A prospective study of screen time in adolescence and depression symptoms in young adulthood. *Preventive Medicine*, 81, 108–113. <https://doi.org/10.1016/j.ypmed.2015.08.009>.
- Gustafson, S. L., & Rhodes, R. E. (2006). Parental correlates of physical activity in children and early adolescents. *Sports Medicine*, 36, 79–97. <https://doi.org/10.2165/00007256-200636010-00006>.
- Hawkey, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine*, 40(2), 218–227. <https://doi.org/10.1007/s12160-010-9210-8>.
- Hayward, J., Jacka, F. N., Skouteris, H., Millar, L., Strugnell, C., Swinburn, B. A., & Allender, S. (2016). Lifestyle factors and adolescent depressive symptomatology: Associations and effect sizes of diet, physical activity and sedentary behavior. *Australian & New Zealand Journal of Psychiatry*, 50(11), 1064–1073. <https://doi.org/10.1177/0004867416671596>.
- Hinkley, T., Salmon, J., Okely, A. D., & Crawford, D. (2013). The correlates of preschoolers' compliance with screen recommendations exist across multiple domains. *Preventive Medicine*, 57(3), 212–219. <https://doi.org/10.1016/j.ypmed.2013.05.020>.
- Hinkley, T., Verbestel, V., Ahrens, W., Lissner, L., Molnár, D., Moreno, L. A., ... Veidebaum, T. (2014). Early childhood electronic media use as a predictor of poorer well-being: A prospective cohort study. *The Journal of the American Medical Association Pediatrics*, 168(5), 485–492. <https://doi.org/10.1001/jamapediatrics.2014.94>.
- Hoare, E., Milton, K., Foster, C., & Allender, S. (2016). The associations between sedentary behaviour and mental health among adolescents: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 13(108). <https://doi.org/10.1186/s12966-016-0432-4>.
- Hume, C., Timperio, A., Veitch, J., Salmon, J., Crawford, D., & Ball, K. (2011). Physical activity, sedentary behavior, and depressive symptoms among adolescents. *Journal of Physical Activity and Health*, 8, 152–156. <https://doi.org/10.1016/j.jsams.2009.10.297>.
- Jago, R., Stamatakis, E., Gama, A., Carvalho, I. M., Nogueira, H., Rosado, V., & Padez, C. (2012). Parent and child screen-viewing time and home media environment. *American Journal of Preventive Medicine*, 43(2), 150–158. <https://doi.org/10.1016/j.amepre.2012.04.012>.
- Jago, R., Sebire, S. J., Edwards, M. J., & Thompson, J. L. (2013). Parental TV viewing, parental self-efficacy, media equipment and TV viewing among preschool children. *European Journal of Pediatrics*, 172(11), 1543–1545. <https://doi.org/10.1007/s00431-013-2077-5>.
- Jago, R., Thompson, J. L., Sebire, S. J., Wood, L., Pool, L., Zahra, J., & Lawlor, D. A. (2014). Cross-sectional associations between the screen-time of parents and young children: Differences by parent and child gender and day of the week. *International Journal of Behavioral Nutrition and Physical Activity*, 11(1), 54. <https://doi.org/10.1186/1479-5868-11-54>.
- Jago, R., Wood, L., Zahra, J., Thompson, J. L., & Sebire, S. J. (2015). Parental control, nurturance, self-efficacy, and screen viewing among 5- to 6-year-old children: A cross-sectional mediation analysis to inform potential behavior change strategies. *Childhood Obesity*, 11(2), 139–147. <https://doi.org/10.1089/chi.2014.0110>.
- Johnson, L., Chen, T., Hughes, S. O., & O'Connor, T. M. (2015). The association of parent's outcome expectations for child TV viewing with parenting practices and child TV viewing: An examination using path analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 70. <https://doi.org/10.1186/s12966-015-0232-2>.
- Jolin, E. M., & Weller, R. A. (2010). Television viewing and its impact on childhood behaviors. *Current Psychiatry Reports*, 13(2), 122–128. <https://doi.org/10.1007/s11920-011-0175-5>.
- Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: Guilford press.
- Kremer, P., Elshaug, C., Leslie, E., Toumbourou, J. W., Patton, G. C., & Williams, J. (2014). Physical activity, leisure-time screen use and depression among children and young adolescents. *Journal of Science and Medicine in Sport*, 17, 183–187. <https://doi.org/10.1016/j.jsams.2013.03.012>.
- Maitland, C., Stratton, G., Foster, S., Braham, R., & Rosenberg, M. (2013). A place for play? The influence of the home physical environment on children's physical activity and sedentary behaviour. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 99. <https://doi.org/10.1186/1479-5868-10-99>.
- Maras, D., Flament, M. F., Murray, M., Buchholz, A., Henderson, K. A., Obeid, N., & Goldfield, G. S. (2015). Screen time is associated with depression and anxiety in Canadian youth. *Preventive Medicine*, 73, 133–138. <https://doi.org/10.1016/j.ypmed.2015.01.029>.
- Marsh, S., Foley, L. S., Wilks, D. C., & Maddison, R. (2014). Family based interventions for reducing sedentary time in youth: A systematic review of randomized controlled trials. *Obesity Reviews*, 15(2), 117–133. <https://doi.org/10.1111/obr.12105>.
- Nebeling, L. C., Hennessy, E., Oh, A. Y., Dwyer, L. A., Patrick, H., Blanck, H. M., ... Yaroch, A. L. (2017). The FLASH study: Survey development, dyadic perspectives, and participant characteristics. *American Journal of Preventive Medicine*, 52(6), 839–848. <https://doi.org/10.1016/j.amepre.2017.01.028>.
- Oh, A. Y., Davis, T., Dwyer, L. A., Hennessy, E., Li, T., Yaroch, A. L., & Nebeling, L. C. (2017). Recruitment, enrollment, and response of parent-Adolescent dyads in the FLASH study. *American Journal of Preventive Medicine*, 52(6), 849–855. <https://doi.org/10.1016/j.amepre.2016.11.028>.
- Perissinotto, C. M., Zenzer, I. S., & Covinsky, K. E. (2012). Loneliness in older persons: A predictor of functional decline and death. *Archives of Internal Medicine*, 172(14), 1078–1084. <https://doi.org/10.1001/archinternmed.2012.1993>.
- Primack, B. A., Swanson, B., Georgiopoulos, A. M., Land, S. R., & Fine, M. J. (2009). Association between media use in adolescence and depression in young adulthood: A longitudinal study. *Archives of General Psychiatry*, 66(2), 181–188. <https://doi.org/10.1001/archgenpsychiatry.2008.532>.
- Raudenbush, S. W., & Bryk, A. S. (2001). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage.
- Rhodes, R. E., Mark, R. S., & Temmel, C. P. (2012). Adult sedentary behavior: A systematic review. *American Journal of Preventive Medicine*, 42(3), e3–e28. <https://doi.org/10.1016/j.amepre.2011.10.020>.
- Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). Generation M2: Media in the lives of 8- to 18-year-olds. *Kaiser Family Foundation* Retrieved from <https://kaiserfamilyfoundation.files.wordpress.com/2013/04/8010.pdf>.
- Russell, D., Peplau, L. A., & Ferguson, M. L. (1978). Developing a measure of loneliness. *Journal of Personality Assessment*, 42(3), 290–294. <https://doi.org/10.1207/s15327752jpa4203.11>.

- Salmon, J., & Shilton, T. (2004). Endorsement of physical activity recommendations for children and youth in Australia. *Journal of Science and Medicine in Sport*, 7(3), 405–406. [https://doi.org/10.1016/S1440-2440\(04\)80036-7](https://doi.org/10.1016/S1440-2440(04)80036-7).
- Schaan, C. W., Cureau, F. V., da Silva, M. S., Sparrenberger, K., Kohl III, H. W., & Schaan, B. D. (2018). Prevalence of excessive screen time and TV viewing among Brazilian adolescents: A systematic review and meta-analysis. *J Pediatr (Rio J)*. doi: <https://doi.org/10.1016/j.jped.2018.04.011>
- Segrin, C., Badger, T. A., Sikorskii, A., Crane, T. E., & Pace, T. W. (2018). A dyadic analysis of stress processes in Latinas with breast cancer and their family caregivers. *Psycho-Oncology*, 27(3), 838–846. <https://doi.org/10.1002/pon.4580>.
- Skaug, S., Englund, K. T., & Wichstrøm, L. (2018a). Young children's television viewing and the quality of their interactions with parents: A prospective community study. *Scandinavian Journal of Psychology*, 59(5), 503–510. <https://doi.org/10.1111/sjop.12467>.
- Skaug, S., Englund, K. T., Saksvik-Lehouillier, I., Lydersen, S., & Wichstrøm, L. (2018b). Parent-child interactions during traditional and interactive media settings: A pilot randomized control study. *Scandinavian Journal of Psychology*, 59(2), 135–145. <https://doi.org/10.1111/sjop.12420>.
- Smith, B. J., Grunseit, A., Hardy, L. L., King, L., Wolfenden, L., & Milat, A. (2010). Parental influences on child physical activity and screen viewing time: A population based study. *BMC Public Health*, 10(1), 593. <https://doi.org/10.1186/1471-2458-10-593>.
- Solomon-Moore, E., Sebire, S. J., Macdonald-Wallis, C., Thompson, J. L., Lawlor, D. A., & Jago, R. (2017). Exploring parents' screen-viewing behaviours and sedentary time in association with their attitudes toward their young child's screen-viewing. *Preventive Medicine Reports*, 7, 198–205. <https://doi.org/10.1016/j.pmedr.2017.06.011>.
- Staiano, A. E., Beyl, R. A., Hsia, D. S., Katzmarzyk, P. T., & Newton, R. L., Jr. (2017). Twelve weeks of dance exergaming in overweight and obese adolescent girls: Transfer effects on physical activity, screen time, and self-efficacy. *Journal of Sport and Health Science*, 6(1), 4–10. <https://doi.org/10.1016/j.jshs.2016.11.005>.
- Strasburger, V. C., Jordan, A. B., & Donnerstein, E. (2010). Health effects of media on children and adolescents. *Pediatrics*, 125(4), 756–767. <https://doi.org/10.1542/peds.2009-2563>.
- Tremblay, M. S., Leblanc, A. G., Janssen, I., Kho, M. E., Hicks, A., Murumets, K., ... Duggan, M. (2011). Canadian sedentary behaviour guidelines for children and youth. *Applied Physiology, Nutrition and Metabolism*, 36(1), 59–64. <https://doi.org/10.1139/H11-012>.
- Vandewater, E. A., Park, S. E., Huang, X., & Wartella, E. A. (2005). "No-you can't watch that" parental rules and young children's media use. *American Behavioral Scientist*, 48(5), 608–623. <https://doi.org/10.1177/0002764204271497>.
- Wang, H., Zhong, J., Hu, R., Fiona, B., Yu, M., & Du, H. (2018). Prevalence of high screen time and associated factors among students: A cross-sectional study in Zhejiang, China. (2018). *BMJ Open*, 8(6), e021493. <https://doi.org/10.1136/bmjopen-2018-021493>.
- Wu, X., Tao, S., Zhang, Y., Zhang, S., & Tao, F. (2015). Low physical activity and high screen time can increase the risks of mental health problems and poor sleep quality among Chinese college students. *PLoS One*, 10(3), e0119607. <https://doi.org/10.1371/journal.pone.0119607>.
- Xu, H., Wen, L. M., & Rissel, C. (2015). Associations of parental influences with physical activity and screen time among young children: A systematic review. *Journal of Obesity*, 2015, 546925. <https://doi.org/10.1155/2015/546925>.
- Yi, X., Yin, C., Chang, M., & Xiao, Y. (2012). Prevalence and risk factors of obesity among school-aged children in Xi'an, China. *European Journal of Pediatrics*, 171(2), 389–394. <https://doi.org/10.1007/s00431-011-1566-7>.
- Zhao, J., Zhang, Y., Jiang, F., Ip, P., Ho, F. K. W., Zhang, Y., & Huang, H. (2018). Excessive screen time and psychosocial well-being: The mediating role of body mass index, sleep duration, and parent-child interaction. *The Journal of Pediatrics*, 202, 157–162. <https://doi.org/10.1016/j.jpeds.2018.06.029>.