Electronic screens in children's bedrooms and adiposity, physical activity and sleep: Do the number and type of electronic devices matter?

Jean-Philippe Chaput, PhD,^{1,2} Geneviève Leduc, PhD,¹ Charles Boyer, MA,¹ Priscilla Bélanger, MA,¹ Allana G. LeBlanc, MSc,^{1,3} Michael M. Borghese, MSc,^{1,4} Mark S. Tremblay, PhD^{1,2}

ABSTRACT

OBJECTIVE: To examine whether the number and type of electronic screens available in children's bedrooms matter in their relationship to adiposity, physical activity and sleep.

METHODS: A cross-sectional study was conducted involving 502 children aged 9-11 years from Ottawa, Ontario. The presence (yes/no) of a television (TV), computer or video game system in the child's bedroom was reported by the parents. Percentage body fat was measured using bioelectrical impedance. An accelerometer was worn over seven days to assess moderate-to-vigorous physical activity (MVPA), total sedentary time, sleep duration and sleep efficiency. Screen time was self-reported by the child.

RESULTS: After adjustment for age, sex, ethnicity, annual household income and highest level of parental education, children with 2-3 screens in their bedroom had a significantly higher percentage of body fat than children with no screen in their bedroom. However, while children with 2-3 screens in their bedroom engaged in more screen time overall than those with no screen, total sedentary time and MVPA were not significantly different. Sleep duration was not related to the number of screens in the bedroom, but sleep efficiency was significantly lower in children with at least 2 screens in the bedroom. Finally, children having only a TV in their bedroom had significantly higher adiposity than those having no screen at all. In contrast, the presence of a computer in children's bedrooms was not associated with higher adiposity than that of children with no screen.

CONCLUSIONS: A higher number of screens in a child's bedroom was associated with higher adiposity, more total screen time and lower sleep efficiency. Having a TV in the bedroom appears to be the type of screen presence associated with higher levels of adiposity. Given the popularity of screens among children, these findings are increasingly relevant to health promotion strategies.

KEY WORDS: Television; computer; video games; body fat; exercise; sedentary behaviour

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2014;105(4):e273-e279.

The presence of electronic screen devices in a child's bedroom has gained in popularity, and children report using these technologies late at night.¹⁻³ For example, 71% of American (US) children and youth report having a television (TV) in their bedroom.² Many studies have found associations between screen time in children's bedroom (mainly TV) and obesity,^{4,5} lower physical activity levels,^{6,7} more sedentary behaviour^{8,9} and poor sleeping habits.^{10,11} It is thus not surprising that the American Academy of Pediatrics recommends that parents remove TV sets and internet-connected electronic devices from children's bedrooms.¹²

Apart from the presence of a TV in the child's bedroom, studies examining the influence of other forms of electronic screen devices on adiposity and movement behaviours are scarce. More important, it is largely unknown whether the type and number of screens in children's bedrooms are important to consider in relation to body fat, physical activity level and sleep hygiene. For example, Chahal et al.⁶ recently showed that access to and night-time use of electronic entertainment and communication devices were significantly associated with shorter sleep duration, excess body weight, poorer diet quality and lower physical activity levels in children. Generating new knowledge in this area is

important in our efforts to better tailor effective messaging and interventions aimed at improving children's health.

Therefore, the objective of this study was to examine whether the number and type of screens available in the bedrooms of children matter in their relationship to adiposity, physical activity and sleep. We hypothesized that the presence of a TV, the leading activity for children other than sleeping,² and a greater

Author Affiliations

1. Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON
2. Department of Pediatrics, Faculty of Medicine, University of Ottawa, Ottawa, ON
3. Population Health, Faculty of Graduate and Postdoctoral Studies, University of Ottawa, Ottawa, ON
4. School of Human Kinetics, Faculty of Health Sciences, University of Ottawa, Ottawa, ON

Correspondence: Jean-Philippe Chaput, Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, 401 Smyth Rd, Ottawa, ON K1H 8L1, Tel: 613-737-7600, ext.3683, E-mail: jpchaput@cheo.on.ca

Acknowledgements: We thank Claire Francis, Jessica McNeil, Hadiza Amedu-Ode and Nina Azoug-Boneault for their role in data collection for the Canadian site of ISCOLE (International Study of Childhood Obesity, Lifestyle and the Environment) and the Coordinating Center of ISCOLE in Baton Rouge, Louisiana, specifically Drs. Peter Katzmarzyk and Timothy Church. We also thank the study participants along with their parents, teachers and school principals for their involvement in the study. ISCOLE was funded by the Coca-Cola Company. The funder had no role in study design, data collection and analysis, decision to publish or preparation of this manuscript.

Conflict of Interest: None to declare.

number of electronic screen devices available in the child's bedroom would each be associated with poorer health outcomes.

METHODS

Participants

The International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) is a multi-national, cross-sectional study conducted in 12 countries. More details on the study design and methods can be found elsewhere.¹³ The current study analyzed data from the Canadian ISCOLE site. Data were collected in 26 Ottawa (Ontario) schools on 567 children in the 5th grade (57.1% female; 9-11 years of age) between September 2012 and May 2013. Schools were stratified into four groups: English Public (n=393), French Public (n=60), English Catholic (n=75) and French Catholic (n=39). All schools within each stratum were invited to participate, and the first ones to respond were included in the study (first come first serve), in agreement with the rules of our research ethics boards. The response rate was 50% (children with consent to participate divided by envelopes distributed). This project was approved by the Research Ethics Board at the Children's Hospital of Eastern Ontario and the participating school boards. Written informed parental consent and child assent were obtained for all participants.

Screens in children's bedrooms

The presence of electronic screen devices in children's bedrooms was parent-reported using a neighbourhood and home environment questionnaire. The parents/guardians were asked to indicate whether the following were in their child's bedroom: 1) TV, 2) computer, 3) video game system (non-hand-held; Playstation, Xbox, etc.). The answer options for each item were "yes" or "no", and the presence of screens in children's bedrooms was treated as a dichotomous variable in the analyses. There were only five missing answers for this question; therefore, children with incomplete data were removed from the analyses.

Assessment of adiposity

A variety of anthropometric measurements were taken according to standardized procedures by trained study staff in schools during school hours.¹³ Body weight and percent body fat (% BF) were measured using a portable Tanita SC-240 Body Composition Analyzer (Tanita: Arlington Heights, IL) after removal of all outer clothing, heavy pocket items, shoes and socks. Two measurements were obtained, and the average was used in analysis (a third measurement was obtained if the first two measurements were more than 0.5 kg or 2.0% apart, for body weight and % BF respectively, and the closest two were averaged for analysis). The Tanita SC-240 showed acceptable accuracy for estimating % BF when compared with dual-energy X-ray absorptiometry, supporting its use in field studies.¹⁴ Body mass index (BMI; body weight [kg]/height [m²]) and BMI z-scores were also calculated on the basis of World Health Organization reference data.¹⁵ Furthermore, age- and sex-specific BMI percentiles were computed according to the US Centers for Disease Control and Prevention growth charts, and children were categorized as normal weight (BMI $\geq$ 5th and <85th percentile), overweight (BMI $\geq$ 85th and <95th percentile) or obese (BMI $\geq$ 95th percentile).

Assessment of physical activity, sedentary behaviour and sleep

The Actigraph GT3X+ accelerometer (ActiGraph LLC: Pensacola, FL) was used to objectively monitor physical activity, sedentary behaviour and sleep.¹³ Children wore the device on a belt around the waist at the right mid-axillary line 24 hours per day for 7 consecutive days. Children were asked to remove the device only for aquatic activities and showering/bathing. Study staff instructed children on how to wear the device and conducted an in-person compliance check 2-4 days after initialization to ensure that the child was following the accelerometer wear protocol. In addition, two compliance phone calls (one weekday and one weekend day) were made to the parents/guardians to ensure that the device was being worn properly and to answer any questions about it. A valid recording for determining physical activity averages required at least 4 days (including at least 1 weekend day) of at least 10 hours of wake/wear time per day.^{16,17} Data were collected at a sampling rate of 80 Hz, downloaded in 1-second epochs, and were aggregated to 15-second epochs.¹⁸ Moderate-to-vigorous physical activity (MVPA) was defined as all minutes showing $\geq$ 2,296 counts per minute and total sedentary time as all minutes showing <100 counts per minute, consistent with widely used cut-offs.¹⁸

Sleep duration and sleep efficiency measures were obtained with the use of a fully automated algorithm for 24-h waist-worn accelerometers, which was recently validated for ISCOLE.¹⁹ Sleep efficiency is defined as the percentage of total sleep time divided by the total time in bed. The weekly sleep averages were calculated using only days on which valid sleep was accumulated (total sleep >0 min) and only for participants with at least 3 nights of valid sleep, including a weekend day. A total of 60 children did not provide valid accelerometry data and were excluded from the analyses; thus, 502 children were included in the current cross-sectional analytical sample. Descriptive characteristics of participants with incomplete accelerometer data were not significantly different from those included in the current analyses.

We also collected information about screen time to explore whether the presence of electronic screens in the bedroom was associated with total screen time. Daily screen time was assessed according to the child's report of time spent watching television, playing video/computer games or using a computer for something not school-work-related on weekdays and weekend days, and an aggregated weighted mean score over the 7 days was computed.¹³ Self-report methods of quantifying screen time have been reported to have acceptable reliability and validity in children.²⁰

Covariates

Demographic questionnaires completed by parents were used to determine children's age, sex, ethnicity (White/Caucasian, African American, Asian, First Nations, East Indian, "don't know" or "other"), total annual family income (eight options ranging from less than \$14,999 to \$140,000 or more) and the highest level of parental education (six options: less than high school, some high school, high school diploma/GED [General Educational Development test], diploma or 1-3 years of college, bachelor's degree or graduate degree [master's or

Table 1. Descriptive characteristics of participants

	Overall (n=502)	Number of screens in the bedroom			p value
		No screen (n=385)	1 screen (n=74)	2-3 screens (n=43)	
Age (years)	10.0±0.4	10.0±0.3	10.2±0.4*	10.0±0.4†	<0.01
Sex (%)					
Boys	41.0	40.8	41.9	41.1	0.98
Girls	59.0	59.2	58.1	58.9	
Ethnicity (%)					
White/Caucasian	66.8	69.5	66.2	42.8	0.04
African American	2.4	2.1	2.7	4.8	
Asian	10.0	9.1	14.9	9.5	
First Nations	0.4	0.5	0.0	0.0	
East Indian	0.8	1.0	0.0	0.0	
Don't know	0.2	0.3	0.0	0.0	
Other	19.4	17.5	16.2	42.9	
Body mass index category‡					
Obese	11	10	12	21	<0.01
Overweight	12	10	19	14	
Normal	77	80	69	65	
Annual household income (%)					
Less than \$14,999	2.9	1.9	4.2	10.0	<0.01
\$15,000-\$29,999	5.6	5.1	2.8	15.0	
\$30,000-\$39,999	3.0	2.4	4.2	7.5	
\$40,000-\$59,999	7.0	5.5	8.5	17.5	
\$60,000-\$89,999	13.8	12.3	18.3	20.0	
\$90,000-\$109,999	14.2	16.0	7.1	10.0	
\$110,000-\$139,999	14.8	15.2	18.3	5.0	
\$140,000 and above	38.7	41.6	36.6	15.0	
Highest level of parental education (%)					
Less than high school	0.4	0.3	0.0	2.3	<0.01
Some high school	1.6	0.8	1.4	9.3	
High school diploma/GED	7.2	4.6	16.4	14.0	
Diploma or 1-3 years of college	19.4	16.8	19.2	41.9	
Bachelor's degree	31.1	33.3	30.1	14.0	
Graduate (Master's or PhD)/professional degree	40.3	44.2	32.9	18.5	

Data are presented as mean±SD unless otherwise indicated. Statistical significance was assessed by analysis of variance with continuous variables and by a chi-squared test with categorical variables. A Tukey post-hoc test was used to contrast mean differences.

* Significantly different from no screen in the bedroom.

† Significantly different from one screen in the bedroom.

‡ Obesity is defined as a body mass index (BMI) ≥95th percentile, overweight as a BMI ≥85th and <95th percentile, and normal as a BMI ≥5th and <85th percentile.

PhD/professional degree]). Biological maturity was estimated using the maturity offset method, which estimates an individual's age from peak height velocity.²¹ These variables were collected to provide descriptive characteristics of participants and to be used as covariates in the analyses. However, we decided not to include biological maturity in the models, given that this variable was not associated with the exposure or outcome.

Statistical analysis

The descriptive characteristics of children having “no screen”, “1 screen” and “2-3 screens” (we decided to combine 2 and 3 screens together to maintain statistical power) in their bedroom were compared by analysis of variance (ANOVA) with continuous data and by a chi-squared test for categorical data. A Tukey post-hoc test was also used to contrast mean differences. Furthermore, an analysis of covariance (ANCOVA), followed by a Tukey post-hoc test, was used to compare means of adiposity, MVPA, total sedentary time, screen time, sleep duration and sleep efficiency of children according to the number of screens in their bedroom. Models included age, sex, ethnicity, annual household income and highest level of parental education as covariates. Finally, an ANCOVA was also used to compare the above-mentioned variables according to the type of screen available in children's bedrooms. Models included the same covariates. Comparisons with the presence of a video game system in the bedroom were not possible because only five children had a video game system only in their bedroom.

Thus, comparisons with the type of screen available in the bedroom were with either a TV or a computer. Multi-level modeling was applied to take into account clustering of children in schools to avoid biased estimates of standard deviations. A 2-tailed *p* value of less than 0.05 was considered to indicate statistical significance. All statistical analyses were performed using JMP version 11 (SAS Institute: Cary, NC) and SPSS version 21 (IBM: Armonk, NY).

RESULTS

There was no statistically significant sex interaction between screens in children's bedroom and the outcome variables, therefore data for both sexes were pooled to maximize power. Descriptive characteristics of the sample according to the number of screens available in the bedroom are shown in Table 1. Children with 2-3 screens in their bedroom were less likely to be White/Caucasian, were more obese and had a lower socio-economic status. No differences were found between boys and girls with regard to the number of screens in their bedroom.

As shown in Figure 1, children with 2-3 screens in their bedroom had a higher % BF than children with no screen. A similar pattern was observed with other adiposity indicators, such as waist circumference and BMI z-score (data not shown). However, while children with 2-3 electronic screen devices in their bedroom spent more time on screen time activities during the day than those with no screen, total sedentary time and

Figure 1. Adiposity level (A), moderate- to vigorous-intensity physical activity (MVPA) (B), total sedentary time (C), screen time (D), sleep duration (E) and sleep efficiency (F) of children according to the number of screens in their bedroom.

Data are presented as means $\pm$ SD. Screens in children's bedrooms were either a TV, a computer or a video game system. Comparisons were assessed by ANCOVA, followed by a Tukey post-hoc test to determine which groups were significantly different. The model was adjusted for age, sex, ethnicity, annual household income and highest level of parental education.

* $p < 0.05$ vs. no screen in the bedroom; † $p < 0.05$ vs. 1 screen in the bedroom. $n = 385$ (no screen), $n = 74$ (1 screen) and $n = 43$ (2-3 screens).

MVPA were not significantly different. Finally, sleep duration was not associated with the number of screens in children's bedrooms, although sleep efficiency was significantly lower in children with at least 2 screens in the bedroom (but not with 1 screen).

The % BF of children according to the type of screen in the bedroom is shown in Figure 2. The adiposity of children having

only a TV in their bedroom was 4 percentage points higher than those having no screen in their bedroom. In contrast, the presence of a computer in children's bedrooms was not associated with a higher adiposity than no screen at all. Differences with other outcome variables (e.g., MVPA, total sedentary time, screen time, sleep duration and sleep efficiency) were not significantly different.

Figure 2. Percent body fat of children according to the type of screen available in their bedroom.

Data are presented as means $\pm$ SD. Type of screen was either a TV or a computer. Comparisons with the presence of a video game system in the bedroom were not possible because only five children had a video game system only in their bedroom. Comparisons were assessed by ANCOVA. The model was adjusted for age, sex, ethnicity, annual household income and highest level of parental education.

* $p < 0.05$ vs. no screen in the bedroom.

$n = 385$ (no screen), $n = 32$ (TV alone) and $n = 34$ (computer alone).

DISCUSSION

Collectively, a higher number of screens in a child's bedroom is associated with a higher % BF but not with lower levels of MVPA or total sedentary time. Additionally, we observed that sleep duration was not related to the number of screens in children's bedrooms, although sleep efficiency was significantly lower with the presence of 2 or more screens. Finally, our findings suggest that having a TV in the bedroom is the type of electronic device presence that is more strongly associated with a higher level of adiposity. Thus, our results reinforce the idea that screens, particularly TVs, should not be placed in a child's bedroom.

Our results agree with previous investigations showing that the presence of TV in children's bedrooms is associated with increased risk of excess body weight.^{4-6,22} However, previous studies have focused on TV only, and the current study is the first to suggest that the presence of computers in the bedrooms may not be as important as the presence of a TV in its association with adiposity. Although replication studies will be needed to confirm this observation, it is nevertheless interesting and intriguing. For example, studies consistently show that TV viewing promotes overconsumption of food, while results of studies linking computer use with food intake are mixed.²³⁻²⁵ Although speculative, increased food intake associated with TV viewing may be a plausible explanation for its relationship to excess body fat.

The observation that screens in children's bedrooms were not associated with objectively measured MVPA and total sedentary time is contrary to some previous findings^{6,26} but in agreement with others.^{8,27} Conflicting findings in this area may be in part explained by the large inter-individual variation and the fact that such an "unhealthy" behaviour may be compensated for by other healthier behaviours to maintain energy balance and body weight control.

The finding that sleep duration was not shorter with the presence of electronic screen devices in the child's bedroom is not in line with some previous studies.^{3,6,11,28} For example, Nuutinen et al.²⁹ showed that the presence of electronic media in children's bedrooms may reduce sleep duration and delay bedtimes. However, not all of the studies have reported similar associations between, for instance, TV viewing and shorter sleep durations.³⁰⁻³² In contrast, the fact that screen exposure may increase sleep disturbances is more recognized. Electronic media use may increase physiological and mental arousal, making it more difficult to fall asleep.³³ Computer use and TV viewing may also affect sleep architecture by decreasing slow-wave sleep, REM sleep and sleep efficiency,^{33,34} and the bright light of screens has been shown to suppress melatonin secretion, which may delay sleep onset.³⁵ What is novel, however, in the current study is the observation that sleep efficiency is not lower with the presence of only one screen in the child's bedroom. Although more studies will be needed to clarify this issue, the message in the meantime should be the same, i.e., to keep electronic screen devices out of children's bedrooms.

Newer evidence is also indicating bidirectional relationships between insufficient sleep and screen time in children, suggesting that lack of sleep and media use could be interacting problems, particularly for children from lower socio-economic households.³⁶ These are important issues to consider given that both insufficient sleep and screen time predict adverse health outcomes in childhood.^{37,38} Future research should try to understand how best to support parents and caregivers in implementing and sustaining good sleep hygiene and TV-free bedrooms for their children. Recent results from a randomized trial are promising and show that promoting household routines, particularly increasing sleep duration and reducing TV viewing, may be an effective approach to reduce BMI among low-income, racial/ethnic minority children.³⁹

A recent study has shown that having a bedroom TV was a significant predictor of weight gain beyond the effect of TV viewing time and socio-economic factors in a nationally representative sample of US children and adolescents.²² The authors suggested that the association may be the result of uncaptured effects of TV viewing, such as food advertising or of disrupted sleep patterns. With the high proportion of children watching TV in their bedrooms, the effect attributable to this risk factor among US children and adolescents was calculated to be an excess weight of 8.7 million kilograms per year.²² From a public health standpoint, it is thus important to better understand how best to support parents and caregivers in implementing and sustaining TV-free bedrooms for their children and adolescents. Furthermore, public health promotion strategies might need to adapt to the rapidly evolving media landscape to improve the success of interventions.

The strengths of this study include objectively assessed sleep and physical activity using a 24-h protocol in a population-based sample of children. Additionally, we have broadened the investigation of media use in the bedroom beyond only TV access to include other electronic screen devices such as computers and video games. However, our results need to be interpreted in light of the following limitations. First, the direction of causality cannot be determined from cross-sectional data. Second, the

media landscape for children is changing rapidly, and future studies should examine whether other types of electronic screen devices, such as smartphones or tablets, are also associated with adverse health indicators. Third, the presence of screens in children's bedrooms was reported by the parents in a questionnaire, and misclassification and/or inaccurate information is always a possibility with self-reported data. Fourth, the sampling strategy used resulted in a skewed sample towards higher socio-economic backgrounds. Therefore, the current study's cohort of children is not well suited for the integration of socio-economic status into the research questions (low inter-individual variability). Finally, the external generalizability of these findings may be mainly restricted to Canadian children from the Ottawa area.

In conclusion, the current study provides evidence that a higher number of screens in children's bedrooms is associated with higher adiposity, more total screen time and lower sleep efficiency. Furthermore, we observed that the presence of a TV in the bedroom appears to be the type of screen presence associated with higher levels of adiposity. Our findings further support the need to remove screens (especially TV) from children's bedrooms as a means to promote good sleep hygiene and prevent excess body weight in children.

REFERENCES

1. Roberts DF, Foehr UG, Rideout V. Generation M: Media in the Lives of 8-18 Year Olds. Menlo Park, CA: Kaiser Family Foundation, 2005.
2. Rideout VJ, Foehr UG, Roberts DF. Generation M2: Media in the Lives of 8- to 18-Year-Olds. Menlo Park: Kaiser Family Foundation, 2010.
3. Calamaro CJ, Mason TB, Ratcliffe SJ. Adolescents living the 24/7 lifestyle: Effects of caffeine and technology on sleep duration and daytime functioning. *Pediatrics* 2009;123:e1005-10.
4. Staiano AE, Harrington DM, Broyles ST, Gupta AK, Katzmarzyk PT. Television, adiposity, and cardiometabolic risk in children and adolescents. *Am J Prev Med* 2013;44:40-47.
5. Adachi-Mejia AM, Longacre MR, Gibson JJ, Beach ML, Titus-Ernstoff LT, Dalton MA. Children with a TV in their bedroom at higher risk for being overweight. *Int J Obes (Lond)* 2007;31:644-51.
6. Chahal H, Fung C, Kuhle S, Veugelaers PJ. Availability and night-time use of electronic entertainment and communication devices are associated with short sleep duration and obesity among Canadian children. *Pediatr Obes* 2012;8:42-51.
7. Barr-Anderson DJ, van den Berg P, Neumark-Sztainer D, Story M. Characteristics associated with older adolescents who have a television in their bedrooms. *Pediatrics* 2008;121:718-24.
8. Atkin AJ, Corder K, van Sluijs EM. Bedroom media, sedentary time and screen-time in children: A longitudinal analysis. *Int J Behav Nutr Phys Act* 2013;10:137.
9. Sisson SB, Broyles ST, Newton Jr. RL, Baker BL, Chernausk SD. TVs in the bedrooms of children: Does it impact health and behavior? *Prev Med* 2011;52:104-8.
10. Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: A review. *Sleep Med* 2010;11:735-42.
11. Owens J, Maxim R, McGuinn M, Nobile C, Msall M, Alario A. Television viewing habits and sleep disturbance in school children. *Pediatrics* 1999;104:e27-34.
12. American Academy of Pediatrics. Children, adolescents, and the media. *Pediatrics* 2013;132:958-61.
13. Katzmarzyk PT, Barreira TV, Broyles ST, Champagne CM, Chaput JP, Fogelholm M, et al. The International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE): Design and methods. *BMC Public Health* 2013;13:900.
14. Barreira TV, Staiano AE, Katzmarzyk PT. Validity assessment of a portable bioimpedance scale to estimate body fat percentage in white and African-American children and adolescents. *Pediatr Obes* 2013;8:e29-32.
15. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 2007;85:660-67.
16. Colley R, Gorber SC, Tremblay MS. Quality control and data reduction procedures for accelerometer-derived measures of physical activity. *Health Rep* 2010;21:63-69.
17. Trost SG, Loprinzi PD, Moore R, Pfeiffer KA. Comparison of accelerometer cut points for predicting activity intensity in youth. *Med Sci Sports Exerc* 2011;43:1360-68.
18. Evenson KR, Catellier DJ, Gill K, Ondrak KS, McMurray RG. Calibration of two objective measures of physical activity for children. *J Sports Sci* 2008;26:1557-65.
19. Tudor-Locke C, Barreira TV, Schuna JM Jr, Mire EF, Katzmarzyk PT. Fully automated waist-worn accelerometer algorithm for detecting children's sleep-period time separate from 24-h physical activity or sedentary behaviors. *Appl Physiol Nutr Metab* 2014;39:53-57.
20. Lubans DR, Hesketh K, Cliff DP, Barnett LM, Salmon J, Dollman J, et al. A systematic review of the validity and reliability of sedentary behaviour measures used with children and adolescents. *Obes Rev* 2011;12:781-99.
21. Mirwald RL, Baxter-Jones ADG, Bailey DA, Beunen GP. An assessment of maturity from anthropometric measurements. *Med Sci Sports Exerc* 2002;34:689-94.
22. Gilbert-Diamond D, Li Z, Adachi-Mejia AM, McClure AC, Sargent JD. Association of a television in the bedroom with increased adiposity gain in a nationally representative sample of children and adolescents. *JAMA Pediatr* 2014;168:427-34.
23. Thivel D, Tremblay MS, Chaput JP. Modern sedentary behaviors favor energy consumption in children and adolescents. *Curr Obes Rep* 2013;2:50-57.
24. Chaput JP, Klingenberg L, Astrup A, Sjodin AM. Modern sedentary activities promote overconsumption of food in our current obesogenic environment. *Obes Rev* 2011;12:e12-20.
25. Marsh S, Mhurchu CN, Jiang Y, Maddison R. Comparative effects of TV watching, recreational computer use, and sedentary video game play on spontaneous energy intake in male children: A randomised crossover trial. *Appetite* 2014;77:13-18.
26. Sisson SB, Broyles ST, Baker BL, Katzmarzyk PT. Screen time, physical activity, and overweight in U.S. youth: National survey of children's health 2003. *J Adolesc Health* 2010;47:309-11.
27. De Jong E, Visscher TL, HiraSing RA, Heymans MW, Seidell JC, Renders CM. Association between TV viewing, computer use and overweight, determinants and competing activities of screen time in 4- to 13-year-old children. *Int J Obes (Lond)* 2013;37:47-53.
28. Li S, Jin X, Wu S, Jiang F, Yan C, Shen X. The impact of media use on sleep patterns and sleep disorders among school-aged children in China. *Sleep* 2007;30:361-67.
29. Nuutinen T, Ray C, Roos E. Do computer use, TV viewing, and the presence of the media in the bedroom predict school-aged children's sleep habits in a longitudinal study? *BMC Public Health* 2013;13:684.
30. Hense S, Barba G, Pohlmann H, De Henauf S, Marild S, Molnar D, et al. Factors that influence weekday sleep duration in European children. *Sleep* 2011;34:633-39.
31. Nixon GM, Thompson JM, Han DY, Becroft DM, Clark PM, Robinson E, et al. Short sleep duration in middle childhood: Risk factors and consequences. *Sleep* 2008;31:71-78.
32. Chen M, Wang EK, Jeng Y. Adequate sleep among adolescents is positively associated with health status and health-related behaviors. *BMC Public Health* 2006;6:59.
33. Higuchi S, Motohashi Y, Liu Y, Maeda A. Effects of playing a computer game using bright display on presleep physiological variables, sleep latency, slow wave sleep and REM sleep. *J Sleep Res* 2005;14:267-73.
34. Dworak M, Schierl T, Bruns T, Struder HK. Impact of singular excessive computer game and television exposure on sleep patterns and memory performance of school-aged children. *Pediatrics* 2007;120:978-85.
35. Higuchi S, Motohashi Y, Liu Y, Ahara M, Kaneko Y. Effects of VDT tasks with a bright display at night on melatonin, core temperature, heart rate, and sleepiness. *J Appl Physiol* 2003;94:1773-76.
36. Magee CA, Lee JK, Vella SA. Bidirectional relationships between sleep duration and screen time in early childhood. *JAMA Pediatr* 2014;168:465-70.
37. Chaput JP, Tremblay A. Insufficient sleep as a contributor to weight gain: An update. *Curr Obes Rep* 2012;1:245-56.
38. Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int J Behav Nutr Phys Act* 2011;8:98.
39. Haines J, McDonald J, O'Brien A, Sherry B, Bottino CJ, Schmidt ME, et al. Healthy Habits, Happy Homes: Randomized trial to improve household routines for obesity prevention among preschool-aged children. *JAMA Pediatr* 2013;167:1072-79.

Received: March 13, 2014

Accepted: June 19, 2014

RÉSUMÉ

OBJECTIF : Examiner si le nombre et le type d'écrans électroniques disponibles dans la chambre à coucher des enfants ont un lien avec leur adiposité, leur pratique d'activités physiques et leur sommeil.

MÉTHODES : Une étude transversale a été réalisée auprès de 502 enfants âgés entre 9 et 11 ans provenant de la région d'Ottawa (Ontario). La présence (oui/non) d'un téléviseur, d'un ordinateur ou d'un jeu vidéo dans la chambre à coucher de l'enfant a été rapportée par les parents. Le pourcentage de graisse corporelle a été mesuré par impédance bioélectrique. Un accéléromètre a été porté sur une période de sept jours afin d'évaluer l'activité physique d'intensité moyenne à élevée, le temps sédentaire total, la durée ainsi que la qualité du sommeil.

RÉSULTATS : Après ajustement statistique pour l'âge, le sexe, l'ethnicité, le revenu familial annuel et le niveau d'éducation parental, les enfants qui avaient 2 ou 3 écrans dans leur chambre à coucher avaient un pourcentage de gras significativement plus élevé que les enfants n'ayant aucun écran dans leur chambre à coucher. Alors que les enfants ayant 2 à 3 écrans dans leur chambre à coucher s'adonnaient à plus de temps écran total que ceux n'ayant pas d'écran, le temps sédentaire total et l'activité physique d'intensité moyenne à élevée n'étaient pas différentes entre les deux groupes. La durée du sommeil n'était pas reliée au nombre d'écrans dans la chambre à coucher alors que la qualité du sommeil était significativement moins bonne chez les enfants ayant au moins 2 écrans dans leur chambre à coucher. Finalement, les enfants ayant seulement un téléviseur dans leur chambre à coucher avaient une adiposité significativement plus élevée en comparaison à ceux qui n'avaient pas d'écrans du tout. Par contraste, la présence d'un ordinateur dans la chambre à coucher des enfants n'était pas associée avec une adiposité plus élevée.

CONCLUSIONS : Un nombre plus élevé d'écrans dans la chambre à coucher des enfants est associé à une adiposité plus importante, davantage de temps écran total et une qualité de sommeil moins bonne. Avoir un téléviseur dans la chambre à coucher des enfants semble être le type de présence d'écran associé avec les niveaux d'adiposité les plus élevés. Étant donné la popularité des écrans chez les enfants, ces résultats sont d'une importance grandissante pour la formulation de stratégies de promotion en santé publique.

MOTS CLÉS : télévision; ordinateur; jeux vidéo; adiposité; exercice; comportement sédentaire