Outdoor time, physical activity and sedentary time among young children: The 2012–2013 Canadian Health Measures Survey

Richard Larouche, PhD,¹ Didier Garriguet, MSc,² Mark S. Tremblay, PhD^{1,3}

ABSTRACT

OBJECTIVES: Previous studies have shown that children who spend more time outdoors are more active and spend less time sedentary, but these studies were limited by the use of small convenience samples. We examined the relationship between outdoor time and measures of physical activity (PA), screen time and sedentary time in a nationally-representative sample of young children.

METHODS: Parental reports of outdoor time were obtained for 594 children aged 3–6 years (47.8% girls) who participated in the 2012–2013 Canadian Health Measures Survey. Participants were asked to wear an Actical accelerometer for seven consecutive days. Outdoor time and screen time were assessed by parent reports. The relationships between outdoor time and measures of PA, screen time and sedentary time were examined with linear regression models. Adherence to PA guidelines was estimated based on a betabinomial distribution, and adherence with the screen time guidelines was assessed through logistic regression models. All analyses were stratified by age group (3–4 and 5–6 year olds) and adjusted for sex, parental education and household income.

RESULTS: Among 5–6 year olds, each additional hour spent outdoors was associated with an additional 10 minutes of moderate-to-vigorous PA (95% CI: 6–14), 27,455 more accelerometer counts/day (95% CI: 11,929–42,980) and an increased likelihood of meeting the PA guidelines (OR = 2.53; 95% CI: 1.68–3.82). No significant relationships were observed among 3–4 year olds.

CONCLUSION: Outdoor time has a large effect on PA among 5–6 year olds at a population level. Future studies should examine the correlates of outdoor time to inform novel PA promotion interventions.

KEY WORDS: Motor activity; child; television; surveys and questionnaires

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

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Physical activity (PA) is one of the key health behaviours that contribute to reduced mortality and morbidity worldwide.¹ Even in children aged less than 5 years, higher PA levels are associated with a more favourable body composition, greater motor skill development, and improved psychosocial health.² Conversely, sedentary behaviour (particularly TV viewing) is associated with increased adiposity and less favourable psychosocial and cognitive development.³ Collectively, this body of evidence underscores the need to promote PA and reduce screen time among young children.

The Canadian PA and sedentary behaviour guidelines recommend that children less than 5 years old accumulate at least 180 minutes of daily PA of any intensity and spend less than 1 hour per day on screen time.^{4,5} Corresponding guidelines for children 5–17 years of age recommend at least 60 minutes of daily moderate-to-vigorous physical activity (MVPA) and no more than 2 hours of daily recreational screen time.^{6,7} Nationally-representative data from the 2009–2013 Canadian Health Measures Surveys (CHMS) indicated that 73% of 3–4 year olds met the PA guidelines, but only 22% met the screen time recommendation.⁸ Compliance with the PA guidelines was much lower in 5 year olds (30%), although 76% met the screen time guideline.⁸ Therefore, insufficient PA and excessive screen time among young children represent important public health issues.

One potential strategy for increasing PA and reducing sedentary time (SED) is to encourage children to spend more time outdoors. All eligible studies in a recent systematic review observed that children aged 3–12 years who spend more time outdoors accumulate more daily MVPA and engage in less SED.⁹ Many other authors have emphasized the important role of unstructured play for children's physical, emotional, social and cognitive well-being.^{10–12} However, most studies to date have been conducted in relatively small convenience samples;⁹ therefore the generalizability of their findings is unclear.

The primary objectives of our study were to describe outdoor time in a nationally-representative sample of Canadian children aged 3–6 years attending school or daycare, and to assess the

Author Affiliations

1. Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON
2. Health Analysis Division, Statistics Canada, Ottawa, ON
3. Department of Pediatrics, University of Ottawa, Ottawa, ON

Correspondence: Richard Larouche, PhD, Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute, 401 Smyth Road, Room R242, Ottawa, ON K1H 8L1, Tel: 613-737-7600, ext. 4191, E-mail: rlarouche@cheo.on.ca

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relationships between outdoor time and objectively-measured PA, screen time and SED. Our secondary objective was to examine the relationship between outdoor time and the likelihood of meeting the Canadian PA and sedentary behaviour guidelines. We hypothesized that children spending more time outdoors would be more active and less sedentary.

METHODS

Setting and participants

The CHMS is an ongoing Statistics Canada survey that collects nationally-representative data on Canadians aged 3–79 years through a household interview and direct physical measures at a mobile examination centre (MEC).^{13–15} The CHMS is representative of approximately 96% of Canadians. Residents of Reserves, institutions, some remote regions, and full-time Canadian Forces employees are excluded. Cycle 3 of the CHMS was the first to include questions on children's outdoor time. Data were collected from January 2012 to December 2013 in 16 sites located in 5 regions (Atlantic, Quebec, Ontario, Prairies and British Columbia). The MEC stayed at each site for 5 to 7 weeks, and data were collected from approximately 350 respondents per site.

Ethical approval was obtained from Health Canada's Research Ethics Board.¹³ Informed consent was obtained from a parent (or guardian) and written assent was obtained from all participating children. Of the selected households, 74.1% agreed to participate. Among the recruited households, the parents of 90.7% of eligible children aged 3–6 years completed the questionnaire, and 75.8% of these children participated in the MEC component. Therefore, the overall response rate was 50.9%. Of these participants, 75.9% provided valid accelerometer data, as defined in the data treatment section. Survey weights were created by Statistics Canada to adjust for non-response biases. Because children who stayed at home with a parent or caregiver during the day ($n = 104$ for 3–4 year olds and $n = 35$ for 5–6 year olds) were asked different questions related to outdoor time, they were excluded from our analyses. The current analyses are based on data from 594 participants (47.8% female).

Procedures

As part of the household interview, parents were asked to report where their child spent their time during the day in the past month using the following options (multiple responses were permitted): 1) daycare centre; 2) home-based daycare; 3) nursery school or preschool; 4) school (including kindergarten); 5) stay at home with a parent, guardian or caregiver; 6) receive any other type of childcare (e.g., attend day camp). For weekdays, parents were asked to report outdoor time for four segments of the day: before school, at daycare/school, after school, and after dinner. For each segment, the following instructional stem was used: *"During the past month, on an average school day, how much time did your child usually spend outside [...]?"* Response options were: 1 (none); 2 (1 to less than 15 minutes); 3 (15 to less than 30 minutes); 4 (30 minutes to less than 1 hour); 5 (1 to less than 2 hours); 6 (≥ 2 hours). When parents reported more than one location, outdoor time at daycare/school was averaged across locations because the proportion of time spent at a given location was not available. Outdoor time on weekends was assessed with a single item and with the same scale. Screen

time was assessed with two items: *"On average, about how many hours a day does he/she [your child] watch TV or videos or play video games? On average, about how many hours a day does he/she spend on a computer (working, playing games, e-mailing, chatting, surfing the internet, etc.)?"* For both questions, response options were: doesn't, <1 hour/day, 1 to less than 3 hours/day, 3 to less than 5 hours/day, 5 to less than 7 hours/day, 7 or more hours/day.

Following completion of the MEC visit, participants were asked to wear an Actical accelerometer (Phillips – Respironics, Oregon, USA) over their right hip on an elasticized belt for 7 consecutive days. The Actical accelerometer has been validated for measuring PA in children and youth.¹⁶ Accelerometers were initialized to start collecting data at midnight following the MEC visit. Data were then downloaded, and the monitor was checked to determine if it still adhered to the manufacturer's calibration specifications.¹⁷ To more accurately measure the intermittent activity of younger children, accelerometer data were collected in 15-second epochs for 3–5 year olds.¹⁸ Due to limited memory capacity when set at a 15-second epoch, the Actical can only record 5.6 days of data. Therefore, only the first 5 days were used in analyses. As with older participants in the CHMS, 6 year olds were asked to wear the accelerometer for 7 consecutive days and data were collected in 60-second epochs.

Data treatment

Outdoor time in hours/day was estimated following a four-step process.¹⁹ First, the midpoint for each response option was used to provide a unique value for outdoor time in each segment of the day. Specifically, the midpoint values were: none = 0 minutes; 1 to less than 15 minutes = 7.5 minutes; 15 to less than 30 minutes = 22.5 minutes; 30 minutes to less than 1 hour = 45 minutes; 1 to less than 2 hours = 90 minutes; ≥ 2 hours = 150 minutes. Second, outdoor time on weekdays was calculated by adding the values for the four segments of the day (e.g., before school, at school, after school, and after dinner). Third, overall outdoor time was calculated with the following formula: Weekly outdoor time = $(5 \times \text{outdoor time on weekdays}) + (2 \times \text{outdoor time on weekend days})$. This provided a measure of outdoor time in minutes/week. Fourth, to obtain a measure in hours/day, the result of the equation was divided by the constant 420 (i.e., 60 minutes $\times$ 7 days). Screen time questions were treated as per Colley et al.,²⁰ by summing the midpoints of the categories for both questions (i.e., 0, 0.5, 1.5, 3.5, 5.5 and 7 hours for the respective categories). Using this approach, compliance to the screen time guidelines was operationally defined as ≤ 1 hour/day of screen time for 3–4 year olds and ≤ 2 hours/day for 5–6 year olds.

To be included in analyses, 3–4 year olds had to provide at least 3 valid days of accelerometry data (with at least 5 hours of wear time),^{21,22} irrespective of the number of weekdays and weekend days. Wear time was determined by subtracting non-wear time (defined as ≥ 240 intervals of 15 seconds of zero counts with allowance for 30 seconds of counts between 0 and 25) from 24 hours.²² Because PA and SED guidelines are the same for 5 and 6 year olds, correction equations were used to convert the data from the 5 year olds into 60-second epochs,¹⁸ as shown in Table 1. These equations were used given the high correlations between 15-second and 60-second epochs (all $R^2 \geq 0.83$). For 5–6 year olds, a valid day was defined as ≥ 10 hours of wear time and participants

Table 1. Regression equations for associations between 60- and 15-second epoch data for physical activity and sedentary time outcome variables

Physical activity variable	Regression equation (x = 60-second epoch, y = 15-second epoch)	R^2
MVPA (minutes per day)	$x = (y - 15.76)/0.78$	0.85
Light PA (minutes per day)	$x = (y - 6.67)/0.72$	0.85
SED (minutes per day)	$x = (y - 67.20)/1.03$	0.83
Total counts per day	$x = (y - 17,229)/0.91$	0.87

Note: MVPA = moderate-to-vigorous physical activity; PA = physical activity; SED = sedentary time. Equations were derived from linear regression models. Source: Colley et al.¹⁸

providing at least 4 valid days were included in analyses.¹⁷ Wear time was determined by subtracting non-wear time (≥ 60 minutes of zero counts with allowance for 2 minutes of counts between 0 and 100) from 24 hours.¹⁷ The cut-points used for determining PA intensity were: SED (25 counts per 15-second epoch and 100 counts per 60-second epoch) and MVPA (288 counts per 15-second epoch and 1,150 counts per 60-second epoch).^{16,23} Any values between these cut-points were categorized as light PA.

Statistical analyses

A series of independent sample *t*-tests were performed to compare outcomes of interest between included and excluded participants. Multivariable linear regression analyses controlling for sex, parent-reported household income and parental education assessed the relationship between reported outdoor time and accelerometry measures (counts/day, light PA, MVPA, SED, and screen time). All models were stratified by age group. Control variables were chosen given previous research suggesting that age, sex, household income and parental education may be important correlates of PA.²⁴ Binomial logistic regression analyses examined the effect of each additional hour/day of outdoor time on the likelihood of meeting the screen time guidelines. To examine adherence to the PA guidelines, linear regression models assuming a beta-binomial distribution were used.²⁵ Under the betabinomial distribution, the probability of meeting the PA guidelines on a given day is randomly distributed as $\text{beta}(\alpha, \beta)$ where the parameters α and β are estimated by maximum likelihood. This approach provides a more accurate estimate of adherence to the PA guidelines than the traditional binomial distribution that assumes that 50% of valid days are active, especially in the case of preschoolers for whom the empirical data show that over 90% of days are physically active.²⁵ All analyses were performed using the Statistical Analysis System version 9.3 (Cary, NC) using survey weights. Statistics Canada created a specific set of survey weights for the participants that provided valid accelerometry data which we used in all our analyses using accelerometry variables. To account for the complex survey design, we estimated 95% confidence intervals using the bootstrap technique,²⁶ and degrees of freedom were set to 11. Bonferroni adjustments were used given the multiple comparisons, and adjusted alpha values are shown below the tables.

RESULTS

Compared to children who provided valid accelerometer data, those who did not were younger and had higher BMI. Participants who were excluded because they stayed at home during the day were younger than those attending school or daycare (3.2 vs. 4.7 years). No other differences were found between included and excluded participants.

Descriptive characteristics of the sample stratified by age group are shown in Table 2. On average, participants spent approximately 2 hours/day outside and about half of this time occurred during daycare/school hours. Participants accumulated about 2 hours/day of screen time. Overall, 72.9% of 3–4 year olds met the guideline of 180 minutes of PA/day and 28.6% met the guideline of ≤ 1 hour/day of screen time. Among 5–6 year olds, 22.1% met the PA guideline of 60 minutes of daily MVPA and 81.0% met the guideline of ≤ 2 hours/day of screen time.

Among 3–4 year olds, outdoor time was not associated with accelerometry measures or parent-reported screen time (Table 3). However, 3–4 year olds whose parents did not attend college accumulated 21 more minutes of light PA than those whose parents attended university (95% CI: 7–35). For each additional hour spent outside, 5–6 year olds accumulated 10 additional minutes of MVPA (95% CI: 6–14) and 27,455 additional accelerometer counts (95% CI: 11,929–42,980) per day (Table 4). Compared to their female counterparts, boys aged 5–6 years accumulated 22 more minutes of MVPA (95% CI: 9–35) and 89,909 more accelerometer counts (95% CI: 31,923–147,894) per day.

Relationships between outdoor time and the likelihood of meeting the PA and screen time guidelines for both age groups are shown in Table 5. Again, no relationships were found for 3–4 year olds. However, among 5–6 year olds, each additional hour of outdoor time increased the odds of meeting the PA guidelines (OR = 2.53; 95% CI= 1.68–3.82), and those whose family earned $< \$40,000$ were less likely to meet the PA guidelines (OR = 0.42; 95% CI: 0.21–0.85).

DISCUSSION

Consistent with our hypothesis, we observed that outdoor time was associated with substantially higher MVPA, total PA and increased odds of adhering to the PA guidelines among 5–6 year olds. The increment in PA associated with a one-hour increase in outdoor time is meaningful and represents one sixth of the minimal amount of daily MVPA recommended.⁶ However, we observed no relationships between outdoor time and PA in 3–4 year olds, and outdoor time was not associated with sedentary time or the odds of adhering to screen time guidelines for any age group. Nevertheless, given the low adherence to PA guidelines among 5–6 year olds and the substantial contribution of outdoor time to PA, the results of our study are important from a public health perspective.

To our knowledge, this is the first nationally-representative study to examine the relationships between outdoor time and measures of PA, screen time and sedentary time in children of this age. In a previous investigation among 7–14 year olds, each additional hour spent outdoors was associated with 7.0 more minutes of daily MVPA and 762 more steps/day.¹⁹ Our findings are also in

Table 2. Selected characteristics of children who attended school in the past month, by age group, household population aged 3 to 6 years, Canada, 2012–2013

Characteristic	3–4 year olds (n = 293)		5–6 year olds (n = 301)		Total (n = 594)	
	Estimate*	95% CI	Estimate	95% CI	Estimate	95% CI
Age (years)	3.6	3.6; 3.7	5.6	5.5; 5.6	4.7	4.5; 4.8
Sex (% boys)	53.1	42.6; 53.5	51.4	40.2; 62.7	52.2	45.8; 58.5
Parental education (%)						
Less than college	11.4 [†]	7.1; 15.7	10.0 [†]	3.5; 16.6	10.7 [†]	6.4; 14.9
College	35.6 [†]	22.0; 49.3	32.6	20.7; 44.5	34.0	22.7; 45.3
University	51.4	35.0; 67.9	54.3	40.0; 68.6	53.0	39.1; 66.9
Household income (%)						
<\$40,000	21.7 [†]	13.7; 29.8	24.4 [†]	9.6; 39.3	23.2 [†]	13.9; 32.5
\$40,000 to \$79,999	28.7	18.2; 39.1	28.5 [†]	13.1; 44.0	28.6 [†]	16.1; 41.1
≥\$80,000	49.6	35.8; 63.5	47.0	34.2; 59.8	48.2	37.7; 58.8
Outdoor time						
Total (hours/day)	2.2	1.8; 2.6	1.9	1.4; 2.4	2.0	1.5; 2.5
Before school or daycare (minutes/day)	6.2 [†]	3.6; 5.7	8.5 [†]	4.1; 12.8	7.4	5.6; 9.2
At school or daycare (minutes/day)	68.5	53.9; 83.1	51.7	40.5; 62.9	59.3	46.9; 71.6
After school or daycare (minutes/day)	35.0	27.3; 42.8	41.7	27.4; 55.9	38.7	29.0; 48.3
After dinner (minutes/day)	24.1 [†]	9.8; 38.5	14.6 [†]	4.3; 25.0	18.9 [†]	6.8; 31.0
On a non-school/daycare day (minutes/day)	121.6	107.7; 135.4	105.8	81.2; 130.3	112.9	93.8; 132.0
Daily screen time (hours/day)	1.9	1.6; 2.2	2.0	1.6; 2.5	2.0	1.7; 2.3
Measured PA and SED	n = 204		n = 235		n = 439	
SED (minutes/day)	456	443; 469	398	383; 413	423	414; 432
Light PA (minutes/day)	214	198; 230	294	285; 303	259	252; 267
MVPA (minutes/day)	71	67; 75	72	63; 81	71	65; 77
Accelerometer counts/day	260,328	239,638; 281,019	332,204	302,383; 362,026	301,164	279,947; 322,380
Meeting the PA guidelines (%)						
180 minutes of total physical activity	72.9	66.1; 79.7	N/A	N/A	N/A	N/A
60 minutes of MVPA	N/A	N/A	22.1	11.7; 32.5	N/A	N/A
Screen time guidelines	28.6	20.6; 36.6	81.0	71.5; 90.6	57.4	49.7; 65.1

Note: PA = physical activity; MVPA = moderate-to-vigorous physical activity; SED = sedentary time. N/A indicates that some guidelines do not apply to a particular age group.
 * Estimates are reported as mean or proportion.

[†] Indicate a coefficient of variation between 16.6% and 33.3% – these estimates should be interpreted with caution.

Table 3. Relationship between outdoor time and measures of physical activity and sedentary time in 3–4 year olds

Variable	Sedentary time (minutes/day)		Light PA (minutes/day)		MVPA (minutes/day)		Accelerometer counts/day		Screen time (hours/day)	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Intercept	427	390; 465	192	147; 237	65	49; 81	238,790	172,893; 304,687	2.0	1.3; 2.6
Sex										
Boys	21	–14; 55	–4	–24; 16	2	–8; 12	–5985	–59,676; 47,705	0.3	–0.2; 0.8
Girls (reference)										
Parental education										
Less than college	5	–55; 66	21	7; 35	8	–2; 17	3859	–27,560; 35,279	0.3	–0.5; 1.0
College	5	–34; 44	17	–20; 55	–3	–12; 7	–4187	–51,218; 42,845	0.5	–0.1; 1.1
University (reference)										
Household income										
<\$40,000	23	–28; 74	–23	–54; 8	–2	–12; 8	–28,056	–75,928; 19,816	0.3	–0.6; 1.1
\$40,000 to \$79,999	15	–23; 52	–23	–58; 12	–8	–18; 3	–29,362	–81,285; 22,561	0.2	–0.3; 0.6
≥\$80,000 (reference)										
Outdoor time (hours/day)	4	–13; 21	12	–2; 26	3	–3; 9	17,212	–7559; 41,982	–0.2	–0.5; 0.1

Note: Results of the multivariable linear regression analyses are reported as unstandardized regression coefficients (B) with 95% confidence intervals. **Bolding** indicates statistical significance ($p < 0.01$ after Bonferroni adjustment).

agreement with a recent systematic review that concluded that children who spend more time outdoors are more active overall,⁹ and with a recent position statement on active outdoor play.¹² Consistent with previous research, we found that boys 5–6 years of age were more active than their female counterparts and that low family income was associated with reduced odds of meeting PA guidelines.²⁴ However, these associations were not observed in younger children.

In contrast, we found no relationships between outdoor time and measures of SED or screen time in both 3–4 and 5–6 year olds.

These results are inconsistent with previous studies indicating that outdoor time was associated with less SED.^{9,19} For example, among 7–14 year olds who participated in the 2012–2013 CHMS, each additional hour spent outside was associated with 13 fewer minutes of SED/day.¹⁹ We also found no relationship between outdoor time and PA among 3–4 year olds. Potential explanations for these non-significant findings include: 1) spending time outdoors may not be sufficient in itself to reduce the large amount of time that children spend being sedentary; 2) children may engage in a substantial amount of sedentary activities while

Table 4. Relationship between outdoor time and measures of physical activity and sedentary time in 5–6 year olds

Variable	Sedentary time (minutes/day)		Light PA (minutes/day)		MVPA (minutes/day)		Accelerometer counts/day		Screen time (hours/day)	
	B	95% CI	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Intercept	395	338; 452	293	262; 324	52	40; 63	263,736	207,877; 319,595	2.2	0.3; 4.1
Sex										
Boys	12	–27; 51	17	–23; 57	22	9; 35	89,909	31,923; 147,894	–0.1	–1.2; 0.9
Girls (reference)										
Parental education										
Less than college	19	–57; 95	–6	–48; 36	–10	–31; 11	–38,641	–112,726; 35,444	0.5	–0.4; 1.4
College	–16	–42; 10	20	–6; 46	–2	–14; 11	–1110	–57,954; 55,734	0.3	–0.3; 1.0
University (reference)										
Household income										
<\$40,000	14	–41; 69	–1	–20; 18	–14	–23; –4	–44,231	–87,886; –576	0.1	–0.4; 0.5
\$40,000 to \$79,999	21	–18; 60	–6	–24; 12	–14	–30; 2	–44,855	–99,997; 10,287	–0.2	–0.8; 0.4
≥\$80,000 (reference)										
Outdoor time (hours/day)	–5	–21; 12	–6	–19; 6	10	6; 14	27,455	11,929; 42,980	–0.1	–0.7; 0.4

Note: Results of the multivariable linear regression analyses are reported as unstandardized regression coefficients (B) with 95% confidence intervals. **Bolding** indicates statistical significance ($p < 0.01$ after Bonferroni adjustment).

Table 5. Relationship between outdoor time and the likelihood of meeting the physical activity and screen time guidelines among 3–6 year olds

Variable	3–4 year olds				5–6 year olds			
	Screen time guidelines		Physical activity guidelines		Screen time guidelines		Physical activity guidelines	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Intercept	0.79	0.28; 2.20	1.97	0.51; 7.61	3.43	0.16; 72.45	0.01	0.00; 0.03
Sex								
Boys	0.66	0.28; 1.58	0.99	0.42; 2.34	1.03	0.15; 7.26	5.21	1.22; 22.30
Girls (reference)								
Parental education								
Less than college	0.37	0.09; 1.58	2.56	0.85; 7.73	0.30	0.05; 1.71	0.60	0.08; 4.77
College	0.45	0.13; 1.57	1.26	0.54; 2.91	0.49	0.14; 1.71	1.18	0.41; 3.40
University (reference)								
Household income								
<\$40,000	0.78	0.18; 3.29	0.48	0.12; 1.84	1.36	0.53; 3.48	0.42	0.21; 0.85
\$40,000 to \$79,999	0.94	0.41; 2.14	0.58	0.20; 1.66	2.59	0.93; 7.20	0.22	0.04; 1.05
≥\$80,000 (reference)								
Outdoor time (hours/day)	0.98	0.63; 1.54	1.34	0.88; 2.05	1.16	0.48; 2.80	2.53	1.68; 3.82

Note: Results of the binomial logistic regression models are reported as odds ratios (OR) with 95% confidence intervals. **Bolding** indicates statistical significance ($p < 0.025$ after Bonferroni adjustment).

outdoors; and 3) some outdoor settings may be more conducive to PA than others.

In this regard, it is worth noting that the CHMS did not include questions about the specific activities in which children engaged while outdoors. In a large survey of US children and youth, the most common outdoor activities reported included some sedentary activities such as “playing or simply hanging out”, “using electronic media outdoors”, and “reading or studying while sitting outdoors”.²⁷ Younger children may also spend more time being carried in a stroller than older children. In addition, other studies suggest that some outdoor locations may be more conducive to MVPA than others.²⁸ For example, using a combination of accelerometers, global positioning systems and geographic information systems, Wheeler et al.²⁸ observed that children – especially boys – were more active when in greenspaces than when in other outdoor or indoor locations. Therefore, future studies should collect additional information about the type and location of children’s outdoor activities.

Limitations and strengths

The main limitation of the current study is the cross-sectional design, which precludes causal inferences. Parent-reported outdoor time and screen time are subject to recall and social desirability biases. The response options for the outdoor time questions may have yielded a ceiling effect, particularly for weekend days. The reliability and validity of the outdoor time questions are unknown and should be assessed in future studies. Nevertheless, inaccuracies in reported outdoor time should bias the results toward the null hypothesis. The fact that the reference period for the outdoor time questions differed from the accelerometry measurement period, plus the limitation of accelerometers in capturing PA during activities such as cycling and swimming, could also have biased our results toward the null hypothesis. In addition, different epoch lengths were used to collect accelerometry data across age groups. To minimize this limitation, we used conversion equations that showed high

coefficients of determination.¹⁸ When multiple locations were reported by parents, we averaged outdoor time at daycare/school between locations because data on the percentage of time spent at a given arrangement were not available. The current data do not allow for comparison of measures of outdoor time, PA and SED among different locations. Differences between participants who provided valid accelerometer data and those who did not were mitigated by the use of survey weights adjusted for non-response bias. Finally, given the travel costs associated with the MEC, the CHMS was not designed to examine seasonality issues. Seasonality may act as a confounder because children tend to be less active in the winter²⁹ and likely spend less time outdoors during this season. Thus, future studies should control for season.

To our knowledge, this is the first nationally-representative investigation of the relationship between outdoor time and measures of PA, SED and screen time in 3–6 year-old children. The objective measures of PA and SED minimized the social desirability and recall biases associated with PA questionnaires.³⁰ Finally, the use of a betabinomial distribution provides a more robust estimate of adherence to PA guidelines.²⁴

CONCLUSION

We found that in a nationally representative sample of young children, 5–6 year olds who spent more time outdoors accumulated more MVPA and accelerometer counts/day, and were substantially more likely to meet the Canadian PA guidelines. In a context where the majority of Canadian children are insufficiently active, these findings are significant for public health. Parents, caregivers and educators should be encouraged to provide opportunities for young children to spend more time outdoors. Future longitudinal studies should examine the correlates of outdoor time among young children to inform interventions aiming to increase outdoor time. Additional information about the type of activities that children engage in while outside, and about the locations where children are most active, would be useful to guide future PA promotion interventions.

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RÉSUMÉ

OBJECTIFS : Des études précédentes ont montré que les enfants qui passent plus de temps dehors sont plus actifs et consacrent moins de temps aux activités sédentaires, mais ces études sont limitées par l'utilisation d'échantillons de convenance. Nous avons examiné les relations entre le temps passé dehors et des mesures de l'activité physique (AP), du temps d'écran et du temps sédentaire auprès d'un échantillon pancanadien de jeunes enfants.

MÉTHODES : Les parents de 594 enfants de 3 à 6 ans (47,8 % filles) ayant participé à l'Enquête canadienne sur les mesures de la santé ont rapporté le temps passé dehors et le temps d'écran de leur enfant. Les participants ont été invités à porter un accéléromètre Actical durant sept jours consécutifs. Les relations entre le temps passé dehors et les mesures de l'AP, du temps d'écran et du temps sédentaire ont été examinées avec des modèles de régression linéaires. L'adhésion aux directives sur l'AP a été estimée à l'aide d'une loi bêta-binomiale et l'adhésion aux directives sur le temps d'écran a été évaluée avec des modèles de régression logistique. Les modèles ont été

stratifiés selon le groupe d'âge (3–4 ans et 5–6 ans) et ajustés selon le sexe, le niveau d'éducation parentale et le revenu du ménage.

RÉSULTATS : Chez les 5–6 ans, chaque heure additionnelle passée dehors était associée à 10 minutes supplémentaires d'AP d'intensité moyenne à élevée (IC 95 % : 6–14), à 27 455 comptes de mouvements supplémentaires (IC 95 % : 11 929–42 980) et à une plus grande probabilité d'adhésion aux directives sur l'AP (RC = 2,53; IC 95 % : 1,68–3,82). Aucune relation significative n'a été observée chez les 3–4 ans.

CONCLUSION : Le temps passé dehors est fortement associé à l'AP chez les jeunes de 5–6 ans au niveau populationnel. Des travaux futurs devraient évaluer les corrélats du temps passé dehors afin de développer des interventions innovatrices pour promouvoir l'AP.

MOTS CLÉS : activité motrice; enfant; télévision; enquêtes et questionnaires