

Joyce Obeid<sup>1</sup>, Stephen Noorduyn<sup>2</sup>, Jan Willem Gorter<sup>2</sup>, and Brian W. Timmons<sup>1</sup> on behalf of the Stay-FIT Study Group  
<sup>1</sup>Child Health & Exercise Medicine Program, <sup>2</sup>CanChild Centre for Childhood Disability Research, McMaster University

## BACKGROUND

- Cerebral palsy (CP) is a group of neurologic conditions characterized by poor voluntary muscle control and spasticity resulting abnormal movement and posture. These impairments are known to affect the child's capacity to perform activities of daily living, and will also limit engagement in physical activity<sup>1,7</sup>.
- Children with CP are thought to be more sedentary than their typically developing peers<sup>1,5,7</sup>.
- Sedentary behaviour, independent of physical activity, has been linked with cardiovascular and metabolic risk factors in both children and adults<sup>3,4,6</sup>.
- Patterns of sedentary behaviour may be just as important as the amount of sedentary time since shorter sedentary "bouts" have been beneficially associated with metabolic risk factors<sup>3,4</sup>.
- Sedentary behaviour in CP may play an important role in mediating risk for chronic disease; however, this variable has not yet been objectively quantified in youth with CP.

## OBJECTIVE

To examine sedentary behaviour in a sample of children with CP compared with typically developing youth.

## METHODS

- Sixteen youth with CP and sixteen typically developing youth matched for age, gender, and season of assessment participated. Participant characteristics are provided in Table 1.

Table 1. Participant Characteristics

	CP	Control
<b>N (Males)</b>	16 (14)	16 (14)
<b>Age (yrs)</b>	13.1 ± 2.3	13.0 ± 2.5
<b>GMFCS Level</b>	I = 8; II = 5; III = 3	N/A

\*Age is presented as mean ± SD. GMFCS = Gross Motor Function Classification System

- Sedentary behaviour and physical activity were measured using accelerometers set to record in 3-sec sampling intervals.
- Participants were instructed to wear the device over the right hip during all waking hours for 7 consecutive days, except when engaging in water activities.

## METHODS, con't

- Total monitoring time, total active and sedentary time, as well as the frequency and duration of continuous bouts of sedentary behaviour and breaks in sedentary time were determined based on cut-points validated in youth with and without CP<sup>2</sup>.
- Sedentary behaviour was defined as activity counts of 0-5 counts/3-sec<sup>2</sup>.
- Breaks in sedentary behaviour were defined as any interruption in sedentary time in which the activity count was ≥ 6 counts/3-sec<sup>2</sup>.

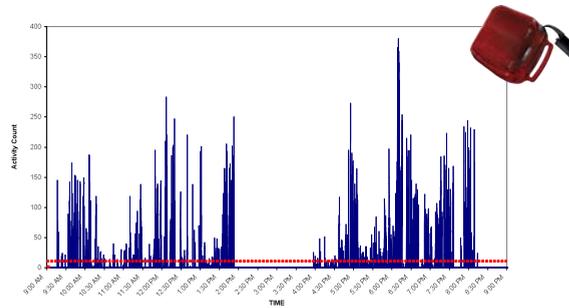


Figure 1. A typical daily accelerometer output. The ActiGraph accelerometer (top right) is fixed onto a belt that is worn over the hip and is used to objectively measure physical activity and sedentary behaviour. The accelerometer records activity intensity by measuring body movements and converts acceleration into 'activity counts'. Counts below the red dashed line represent sedentary behaviour.

## RESULTS

Table 2. Average daily activity and sedentary behaviour. Active and sedentary time are displayed as minutes per day, and minutes per hour of monitoring time. Sedentary behaviour is further broken down into the number of sedentary bouts, and breaks from sedentary behaviour. Data are presented as means ± SD, \*significance ≤ 0.05.

		CP	Control	p value
<b>Monitoring Time</b>	min/d	721.9 ± 83.4	771.9 ± 61.7	0.06
<b>Physical Activity</b>	min/d	152.4 ± 61.2	203.0 ± 45.8	0.01*
	min/hr	12.7 ± 5.0	15.9 ± 3.9	0.05*
<b>Sedentary Behaviour</b>	min/d	569.5 ± 89.0	568.9 ± 81.2	0.98
	min/hr	47.3 ± 5.0	44.1 ± 3.9	0.05*
	# bouts	1466 ± 489	1881 ± 524	0.02*
	# breaks	1649 ± 481	2126 ± 406	<0.01*

## RESULTS, con't

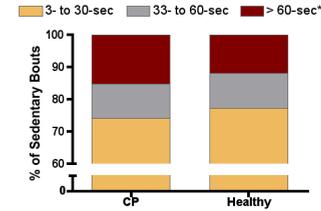
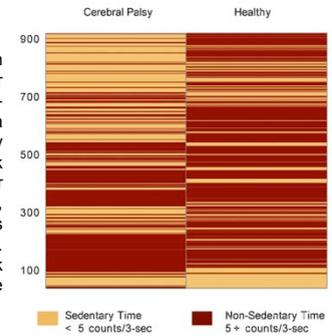


Figure 2. Breakdown of average daily sedentary bouts by duration. Longer sedentary bouts were seen in youth with CP (\*, p < 0.05).

Figure 3. Bouts of sedentary activity in a child with CP and a matched control over the course of 1 monitoring day. Each 3-sec interval is represented by either a yellow line, to indicate sedentary behaviour, or a red line to indicate a break from sedentary time. When matched for total monitoring and sedentary time, children with CP engaged in longer bouts of sedentary behaviour (yellow, p<0.05). Conversely, typically developing youth took more frequent breaks from sedentary time (red lines, p<0.05).



## CONCLUSIONS

- To our knowledge, this is the first study to objectively assess sedentary behaviour in children and adolescents with CP. The results of the present study suggest that while total sedentary time is similar in CP and healthy controls, differences exist in the manner in which it is accumulated.
- Sedentary behaviour in youth with CP is characterized by longer bouts of sedentary time with less frequent breaks when compared with their typically developing peers.
- Given that children with CP are at an increased risk of developing a number of secondary health complications including obesity, type II diabetes and cardiovascular disease<sup>7</sup>, future work should aim to examine the relationship between sedentary behaviour and health outcomes in this population.

## REFERENCES

1. Claessens, A., Gorter, J., Stewart, D., Verschuren, O., Galuppi, B., & Shinnimé, L. 2011. Becoming and staying physically active in adolescents with cerebral palsy: Protocol of a qualitative study of facilitators and barriers to physical activity. BMC Pediatrics, 11, 1-11.
2. Thompson, S., Colver, C., Gill, N., O'Brien, K., & Moloney, R. 2008. Calibration of two objective measures of physical activity for children. Journal of Sports Sciences, 26(14), 1557-1565.
3. Hsieh, S., Colver, C., Gill, N., O'Brien, K., & Moloney, R. 2008. Breaks in sedentary time: Beneficial associations with metabolic risk. Diabetes Care, 31(5), 861-866.
4. Hailey, C., Matthews, C., Durkin, D., Wilkins, E. A. H., & Owen, N. 2011. Sedentary time and cardio-metabolic biomarkers in US adults. NCHES 2003/06. European Heart Journal.
5. Shewhan, S., Holbrook, E., Fuller, D., & Morgan, D. 2015. Influence of age on step activity patterns in children with cerebral palsy and typically developing children. Archives of Physical Medicine and Rehabilitation, 96(12), 1891-1896.
6. Tremblay, R. E., & Wilson, J. D. 2003. Inactivity in the Canadian childhood obesity epidemic: related to physical inactivity? International Journal of Obesity, 27(9), 1050-1055.
7. Tremblay, M., Colley, R., Saunders, T., Hailey, C., & Owen, N. 2010. Physical activity and health implications of a sedentary lifestyle. Applied Physiology, Nutrition, and Metabolism, 38(6), 725-740.
8. van Brassen, M., van der Nat, J., Holbrook, E., Helleis, P. J. M., & Takken, T. 2011. The unmet approach to exercise in chronic childhood conditions: The decade in review. Pediatric Physical Therapy, 23(1), 2-14.

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