

# Daily physical activity in young children and their parents: A descriptive study

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M Cantell, SG Crawford, D Dewey. Daily physical activity in young children and their parents: A descriptive study. *Paediatr Child Health* 2012;17(3):20-24.

**BACKGROUND:** Little is known about physical activity (PA) in young children and about the relationship between their PA and that of their parents.

**OBJECTIVE:** The main purpose of the present study (*Y-Be-Active*) was to examine the daily PA levels of young children and their parents, and to explore the relationship between children's and parents' PA.

**METHOD:** Fifty-four children (mean age 4.3 years) and their parents (54 mothers, mean age 35.8 years; 50 fathers, mean age 38.2 years) wore accelerometers for three weekdays and two weekend days. Parents also completed questionnaires on family sociodemographics and PA habits.

**RESULTS:** Children spent most of their time in light PA. Almost all children attained 30 min of daily moderate-to-vigorous PA (MVPA), and most boys and girls attained 60 min of daily MVPA on weekdays. Only 60% of fathers and approximately one-half of mothers attained 30 min of daily MVPA on weekdays and weekend days. Children's and fathers' PA were correlated on weekends. Few parents (20% to 30%) participated regularly in organised PA with their child. Fathers' involvement in PA with their children was associated with higher MVPA in children.

**CONCLUSIONS:** Many young children and parents did not meet current Canadian recommendations for daily PA. Parental involvement in PA with their young children, particularly the involvement of fathers, appeared to promote higher levels of MVPA in young children.

**Key Words:** *Parents; Physical activity; Young children*

Physical activity (PA) is an important part of healthy living for children and their parents (1-3), and inactivity has been identified as a contributing factor to the increase in overweight children and childhood obesity (4). Relatively little is known, however, about the activity levels of young children (2,5-9), and most studies have focused on activity levels of children when they are in organized care (5,6,9). Few studies have investigated PA in children cared for at home (8), and even fewer studies have investigated the relationship between the PA levels of young children and their parents.

Research on PA in preschool-aged children faces a major challenge because there are no evidence-based guidelines (10). The National Association for Sport and Physical Education (NASPE) in the United States has released PA guidelines for young children attending preschool that recommend that children should engage in at least 120 min of PA per day, with half the time spent in structured settings and the other half in unstructured settings (11).

## L'activité physique quotidienne chez les jeunes enfants et leurs parents : une étude descriptive

**HISTORIQUE :** On ne sait pas grand-chose de l'activité physique (AP) chez les jeunes enfants et de la relation entre leur AP et celle de leurs parents.

**OBJECTIF :** Le principal objectif de la présente étude (*Y-Be-Active*) consistait à examiner le taux d'AP quotidienne des jeunes enfants et de leurs parents, ainsi qu'à explorer la relation entre l'AP des enfants et celle des parents.

**MÉTHODOLOGIE :** Cinquante-quatre enfants (âge moyen de 4,3 ans) et leurs parents (54 mères : âge moyen de 35,8 ans; 50 pères : âge moyen de 38,2 ans) ont porté des accéléromètres pendant trois jours de semaine et deux jours de fin de semaine. Les parents ont également rempli des questionnaires sur les caractéristiques sociodémographiques et les habitudes en matière d'AP de leur famille.

**RÉSULTATS :** Les enfants passaient la plupart de leur temps en AP légère. Presque tous les enfants parvenaient à 30 minutes d'activité physique d'intensité modérée à vigoureuse (APMV) quotidienne, et la plupart des garçons et des filles faisaient 60 minutes d'APMV quotidienne les jours de semaine. Seulement 60 % des pères et environ la moitié des mères faisaient 30 minutes d'APMV quotidienne la semaine et la fin de semaine. L'AP des enfants et des pères était corrélée la fin de semaine. Peu de parents (20 % à 30 %) participaient régulièrement à des AP organisées avec leur enfant. La participation des pères à l'AP avec leurs enfants s'associait à une APMV plus élevée chez les enfants.

**CONCLUSIONS :** De nombreux jeunes enfants et leurs parents ne respectaient pas les recommandations canadiennes actuelles en matière d'AP quotidienne. La participation des parents à l'AP avec leurs jeunes enfants, notamment celle des pères, semblait promouvoir de plus forts taux d'APMV chez les jeunes enfants.

These guidelines, however, are not based on research evidence and do not include any statement regarding PA intensity. The Public Health Agency of Canada (12) has recommended that children five to 11 years of age should accumulate at least 60 min of moderate-to-vigorous intensity PA (MVPA) daily. Whether these guidelines are appropriate for children younger than five years of age is unknown. If guidelines are to be developed and disseminated for promoting increased PA among young children, they must be based on research that has examined the amount and intensity of the PA that young children engage in in different settings (ie, organized child care, home).

Data from the 2007 to 2009 Canadian Health Measures Survey (CHMS) reported that only 14% of the boys and 7% of the girls six to 10 years of age accumulated 60 min of MVPA at least six days a week (13). Thus, the PA levels of elementary school-aged Canadian children are low, with most of their waking hours spent in sedentary activities. Colley et al (14) reported that 85% of

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Accepted for publication on June 18, 2011

Canadian adults were not active enough to meet Canada's new PA recommendations of more than 150 min/week of MVPA accumulated in bouts of more than 10 min. They also found that men were more active than women and that MVPA declined with increasing age and adiposity. It has been suggested that parents' PA levels could influence their children's PA. Few studies have examined this in a systematic manner in families with young children (15,16). However, Zecevic et al (17) reported that preschool-aged children receiving greater parental support for PA were more than six times more likely to be highly active than inactive. Parental interest in PA and parental efforts to be active (ie, role modelling) have also been found to be important in promoting PA in children (18). The main purpose of the present study, Y-Be-Active, was to examine the daily PA levels of young children and their parents, and to explore the relationship between children's and parents' PA.

## METHODS

### Subjects

The study was approved by the Conjoint Health Research Ethics Board of the University of Calgary (Calgary, Alberta). Fifty-four families with children three to six years of age were recruited using posters placed in local child care centres and community health care centres. Families interested in participating contacted the researchers directly. Mothers and fathers provided informed consent for their participation and their child's participation. Families met the following two criteria: a healthy three- to six-year-old child with no physical/mental disability that would interfere with PA participation and a two-parent family with both parents residing in the home. In families with more than one child participating, one child was randomly selected for the current study.

Y-Be-Active was a longitudinal research study conducted over three years. In addition to issues addressed by the present study, it also investigated: the consistency among different methods of assessing PA in young children; the relationship between PA and health factors in young children and their parents; and the stability of MVPA in young children and their parents over a one-year period.

### Assessment of sociodemographics and PA

Parents completed questionnaires on family sociodemographics and PA habits (Table 1). Socioeconomic status (SES) was measured using the Blishen index (19). For each family, the occupation of the parent with the highest SES was used as that indicator of SES. For PA habits, each parent was asked how often they participated in general PA with their child (eg, going for walks, playing outdoors, skating), and how often they participated in organized PA with their child (eg, swim class, gym class). Possible responses were: "more than once a day"; "once a day"; "5-6 times a week"; "3-4 times a week"; "1-2 times a week"; and "less than once a week".

Accelerometers were used to measure PA (Actigraph model AM7164, Actigraph, USA). This instrument has been successfully used with young children (6,7,20,21). The sampling interval of the accelerometers was set at 1 min, so that the intervals for parents and children were equivalent. Although the use of a 1 min interval is regarded by some investigators to be problematic with young children (22,23), there is currently no gold standard. Empirical evidence suggests that differences in sampling intervals is a relatively minor source of error in estimating PA, with the main consequence of using 1 min epochs in young children being a slight misclassification of some vigorous activity as MVPA (24). Accelerometer data were collected for children (n=54), for a mean ( $\pm$ SD) of 3.3 $\pm$ 0.61 weekdays and 1.7 $\pm$ 0.51 weekend days; for mothers (n=50), for an average of 3.2 $\pm$ 0.61 weekdays and 1.7 $\pm$ 0.49

weekend days; and for fathers (n=39), for an average of 3.2 $\pm$ 0.68 weekdays and 1.7 $\pm$ 0.55 weekend days. The children wore the accelerometers on average for 11.8 $\pm$ 1.3 hr/weekday and 10.6 $\pm$ 2.4 hr/weekend day; mothers wore them 14.2 $\pm$ 1.8 hr/weekday and 12.7 $\pm$ 2.4 hr/weekend day; and fathers wore them 15.6 $\pm$ 4.4 hr/weekday and 13.1 $\pm$ 2.4 hr/weekend day. Fathers who only provided questionnaire data did not differ on any variables from those who provided questionnaire and accelerometer data.

### Physical measurements

**Height and weight:** Children's and parents' height and weight were measured in the privacy of their home. Height was measured without shoes (to the nearest 0.1 cm) using a portable stadiometer (Seca Inc, USA). Weight was measured in light clothing without shoes (to the nearest 0.1 kg) with a high precision digital scale (Seca Inc, USA). These measures were taken three times and the mean of the two closest measurements was recorded.

**Body mass index:** The body mass index (BMI) (weight [kg])/height [ $m^2$ ] for age and sex (25) was used to classify children as overweight (>95th percentile), at risk of overweight ( $\geq$ 85th to <95th percentile), healthy ( $\geq$ 5th to <95th percentile) or underweight (<5th percentile). In adults, the cut-offs were: obese (BMIs  $\geq$ 30), overweight (BMIs 25 to 29.9), normal (BMIs 18.5 to 24.9) and underweight (BMIs <18.5) (26).

### Statistical analyses

Accelerometer data files were examined for sustained periods of zero activity. Data with >10 min of only zero counts were eliminated. Child-specific cut-points were used to categorize children's PA into time spent in light activity (<1680 bouts of movement/min) and MVPA ( $\geq$ 1680 bouts of movement/min) (27). These child-specific cut-points were developed using 15 s intervals and multiplied by four to approximate 1 min intervals. For mothers and fathers, adult-specific cut-points were used. Parents' PA levels were categorized into time spent in light activity (<1952 bouts of movement/min) and MVPA ( $\geq$ 1953 bouts of movement/min) (28). These adult cut-points were developed using 1 min intervals.

The number of minutes spent at each level of activity was divided by the total number of minutes that the accelerometer was worn to determine the percentage of time spent in light activity and MVPA, and to control for variation in the length of times that the accelerometers were worn. Student's *t*-tests were used to investigate sex and age differences in MVPA on weekdays and weekends. ANOVA was used to compare attained MVPA for children of different ages (three, four, and five to six years of age). The proportion of time spent in light activity and MVPA each day was examined. The actual number of minutes spent in MVPA was also examined to determine how many children, mothers and fathers attained 30 min, 60 min, 90 min and 120 min of daily MVPA. These specific MVPA targets span the range of daily PA guidelines that have been used in previous research (13,29) and recommended for children and adults by various organizations over the past decade (11,30). Mothers' and fathers' PA levels were correlated with their children's PA on weekdays and weekends. Multiple regression analysis was used to examine whether mothers' and fathers' involvement in PA with the child predicted higher levels of MVPA in children on weekdays and weekends. Statistical analyses were carried out using SPSS Version 15.0 (IBM Corporation, USA). The sample size enabled adequate power for medium effect sizes for the analyses to be maintained. Results significant at  $P < 0.05$  or trends toward significance at  $P < 0.10$  are discussed.

## RESULTS

A convenience sample of 54 families (54 mothers and 50 fathers) with children three to six years of age participated in this study. Most children were in full/part-time care during weekdays (Table 1). The majority of parents were well educated, and of high SES (19), which is characteristic of the study location (31). Approximately 10% of children were overweight, whereas almost 40% of mothers and more than 60% of fathers were overweight. More mothers than fathers engaged in general, unorganized PA with their children on a regular basis (ie, once a day), but few mothers and fathers participated regularly in organized PA with their child (Table 1).

### Physical activity

Student's *t*-tests revealed no differences in time spent in light activity or MVPA between children cared for at home and those in organized care. Children spent the majority of their time in light PA during weekdays and weekends. On weekdays, boys tended to attain more MVPA minutes than girls ( $t(50)=1.68$ ,  $P=0.098$ ) and on weekends they spent significantly more time in MVPA than girls ( $t(49)=2.57$ ,  $P=0.013$ ) (Table 2). Nearly all children attained 30 min of MVPA on weekdays and weekend days. No differences emerged among the three age groups in MVPA attainment on weekdays, but on weekends, there was a trend for children five to six years of age to spend more time in MVPA ( $F(2,48)=2.55$ ,  $P=0.089$ ) (Data not shown).

Most boys and girls attained 60 min of daily MVPA on weekdays, but on weekends these values dropped for boys (Table 3). As the time spent in MVPA increased from 30 min to 120 min, the proportion of children who attained this amount of MVPA decreased. A higher percentage of boys accumulated 30 min, 60 min, 90 min and 120 min of daily MVPA on weekdays and weekends than girls. The only noted exception was attainment of 30 min of MVPA on weekdays; both boys and girls attained this level of MVPA.

Parents spent the majority of their time in light activity (Table 2). On weekdays, more than 50% of mothers and fathers engaged in 30 min of daily MVPA; however, on weekends less than one-half of the mothers attained 30 min of daily MVPA (Table 3). Fewer than 20% of mothers and less than one-third of fathers attained 60 min of MVPA on weekdays. Daily MVPA was significantly correlated for mothers and fathers within each family on weekends ( $r=0.43$ ,  $P=0.009$ ), but not on weekdays.

There were no significant correlations between children's and mothers', and children's and fathers' daily MVPA on weekdays; however, children's and fathers' MVPA were significantly correlated on weekends ( $r=0.48$ ,  $P=0.002$ ). When these correlations were examined by child sex, all remained nonsignificant with one exception; daily MVPA for boys and fathers was significantly correlated on weekends ( $r=0.61$ ,  $P=0.003$ ).

Multiple regression analysis revealed that the best predictors of higher MVPA in children on weekdays were older child age ( $P=0.003$ ), the more time the mother spent in organized PA with the child ( $P=0.086$ ) and the more time the father spent in general PA with the child ( $P=0.039$ ;  $R^2=0.243$ ,  $F(3,46)=4.93$ ,  $P=0.005$ ). For weekends, the best predictors of higher MVPA for children were being male ( $P=0.013$ ), the father spending more time in general PA with the child ( $P=0.074$ ) and higher MVPA for fathers on weekend days ( $P=0.001$ ;  $R^2=0.430$ ,  $F(3,32)=8.05$ ,  $P<0.001$ ).

## DISCUSSION

The main purpose of the present study was to examine daily PA in young children and their parents, and to explore the relationship between children's and parents' PA. Consistent with previous research, the present study found that young children spend most

**TABLE 1**  
Sample characteristics

Variable	
Child's age, years, mean $\pm$ SD	4.4 $\pm$ 0.8
Boys/girls, n/n	30/24
Boys, %	55.6
Girls, %	44.4
Mother's age, years mean $\pm$ SD	35.8 $\pm$ 5.9
Father's age, years mean $\pm$ SD	38.2 $\pm$ 7.7
Boys' BMI, (kg/m <sup>2</sup> ), mean $\pm$ SD*	16.1 $\pm$ 0.9
Normal, n (%)	25 (86.2)
Overweight, n (%)	4 (13.8)
Girls' BMI, (kg/m <sup>2</sup> ), mean $\pm$ SD*	15.4 $\pm$ 1.2
Normal, n (%)	22 (91.7)
Overweight, n (%)	2 (8.4)
Mothers' BMI, (kg/m <sup>2</sup> ), mean $\pm$ SD†	25.1 $\pm$ 4.7
Normal, n (%)	33 (61.1)
Overweight, n (%)	21 (38.9)
Fathers' BMI, (kg/m <sup>2</sup> ), mean $\pm$ SD†	27.1 $\pm$ 4.1
Normal, n (%)	17 (37.8)
Overweight, n (%)	28 (62.2)
Mother's educational level, n (%)	
Up to and including high school	11 (21.2)
Technical college or university degree	41 (78.8)
Father's educational level, n (%)	
Up to and including high school	10 (20.4)
Technical college or university degree	39 (79.6)
Ethnic group, n (%)	
Caucasian	44 (84.6)
Mixed ethnic background (eg, Asian, Hispanic, African)	8 (15.4)
Blishen socioeconomic status, n (%)	
Low socioeconomic status	5 (9.6)
Middle socioeconomic status	20 (38.5)
High socioeconomic status	27 (51.9)
Children in family, n (%)	
One child	11 (21.2)
Two children	35 (67.3)
Three or more children	6 (11.5)
Child's daily physical environment, n (%)	
Children at home full time with parents weekdays	14 (25.9)
Children in organized care part time on weekdays	28 (51.9)
Children in organized care full time on weekdays	12 (22.2)
General physical activity with child, n (%)	
Mothers	
Less than once a week	3 (5.6)
1-2 times a week	13 (24.1)
3-4 times a week	14 (25.9)
5-6 times a week	4 (7.4)
Once a day or more than once a day	20 (37.0)
Fathers	
Less than once a week	8 (16.0)
1-2 times a week	21 (42.0)
3-4 times a week	10 (20.0)
5-6 times a week	3 (6.0)
Once a day or more than once a day	8 (16.0)
Organized physical activity with child, n (%)	
Mothers	
Less than once a week	36 (66.7)
1-2 times a week	16 (29.6)
3-4 times a week	2 (3.7)
Fathers	
Less than once a week	40 (80)
1-2 times a week	10 (20)

\*For children normal was defined as a body mass index (BMI)  $\geq$ 5th percentile and <85th percentile for age and sex; Overweight was defined as a BMI  $\geq$ 85th percentile (25); †For parents normal was defined as a BMI between 18.5 to 24.9; Overweight was defined as a BMI  $\geq$ 25 (26)

**TABLE 2**  
Average percentage of time spent in different levels of physical activity (PA)

Average percentage of time in different levels of PA	Boys (n=30)	Girls (n=24)	Mothers (n=50)	Fathers (n=39)
Weekdays				
Time in light activity	83.9	86.1	95.3	94.4
Time in MVPA	16.1*	13.9	4.7	5.6
Weekends				
Time in light activity	82.9	87.2	96.1	95.1
Time in MVPA	17.1†	12.8	3.9	4.9

Data presented as %. \* $P < 0.10$ ; † $P < 0.05$ ; MVPA Moderate-to-vigorous PA

**TABLE 3**  
Frequency of children and parents meeting specific levels of moderate-to-vigorous physical activity (MVPA) on weekdays and weekends

Recommended levels of MVPA	Boys (n=30)	Girls (n=24)	Mothers (n=50)	Fathers (n=39)
30 min, weekdays	30 (100)	24 (100)	29 (58)	24 (61.5)
30 min, weekends	30 (100)	22 (95.7)*	21 (42.9)	21 (56.8)
60 min, weekdays	29 (96.7)	18 (75)	9 (18)	12 (30.8)
60 min, weekends	26 (86.7)	18 (78.3)*	6 (12.2)	7 (18.9)
90 min, weekdays	25 (83.3)	12 (50)	4 (8)	6 (15.4)
90 min, weekends	17 (56.7)	5 (21.7)*	0 (0)	2 (5.4)
120 min, weekdays	11 (36.7)	5 (20.8)	1 (2)	2 (5.1)
120 min, weekends	11 (36.7)	3 (13)*	0 (0)	2 (5.4)

Data presented as n (%). \*One girl did not provide weekend data (n=23); †Two fathers did not provide weekend data (n=37)

of their awake time in low intensity PA, and boys spent more time in MVPA than girls, particularly on weekends (6-8). The PA levels of mothers and fathers of young children were low, and only 37% of mothers and 16% of fathers participated daily in general PA with their children. However, parents' participation in PA with their young children was a key factor; mothers' involvement in organized PA with their children and fathers' involvement in general PA with their children were found to predict the children's MVPA on weekdays, and fathers' involvement in general PA with their children predicted the children's MVPA on weekends.

The findings of the present study were consistent with those of the CHMS (13,14). Young children and their parents both displayed low levels of PA, but most of the young children in our study attained 60 min of MVPA on weekdays and weekends. This was substantially higher than the 14% of boys and 7% of girls six to 10 years of age who attained  $\geq 60$  min of MVPA on  $\geq 6$  days/week reported in the CHMS. This discrepancy in the proportions of children accumulating 60 min of MVPA could be due to the different ages of children participating in these two studies. Research has indicated that the percentage of children accumulating 60 min of MVPA/day declines with increasing age (13).

Previous studies examining the association between parents' and young children's PA (16,32) have not investigated weekday PA compared with weekend PA, and did not take into account the

location of the children's care. In the present study, most children were in full/part-time care outside the home during weekdays, but attained PA did not differ in terms of the location of care. The questionnaire data revealed that on weekdays parents, especially fathers, did not participate in PA with their children very often. This suggests that much of the PA that family members engaged in on weekdays took place in different environments, and this could account for the lack of association between children's and parents' PA levels. In children cared for in organized child care, the role of child care providers as promoters of PA could be a significant factor in the amount of PA that young children participate in and in the development of habitual PA (33).

Because PA in young children is dependent upon opportunities provided by parents/caregivers, one might assume that weekends would provide the greatest opportunity for parents to participate in PA with their children. Even among this highly educated group of parents, however, engagement in MVPA on weekends was limited, which is consistent with other research (34,35). Perhaps parents of children who are cared for outside of the home during the week assume that their children have attained sufficient levels of PA (36), and do not feel a need to capitalize on opportunities to increase their children's PA on weekends. Focusing on increasing parental participation in PA together with their children seems to be a key factor in promoting PA in young children. One intervention study reported success in increasing PA in preschool children and their parents by teaching parents outdoor games to play with their children (37).

The present study is one of the first to investigate relationships between PA in young children and their parents over the entire waking day. It expanded on previous reports by incorporating accelerometry for children, as well as parents, instead of relying on parental reports of children's PA (17). Another strength is that we obtained and analyzed data from mothers and fathers separately. All fathers provided questionnaire data; however, 11 did not provide accelerometer data, which could limit the generalizability of our findings. Another limitation is that parents were well-educated with relatively high income levels and children were less likely to be overweight/obese than recent estimates in Canadian preschool children (38-40).

Knowing how much PA to recommend for young children is difficult because we do not know the amount or intensity of PA young children require to optimize healthy growth and development (2). In children, significant health benefits could be attained from low intensity PA (41). Because evidence-based guidelines for preschool children do not exist, PA promotion in young children should focus on increasing the amount of PA activity at any intensity, rather than recommending attainment of arbitrary amounts of daily MVPA.

Early childhood is a critical time to instill healthy living habits to help prevent childhood (and subsequent adult) physical inactivity. The fact that parents of young children engage in relatively low levels of PA is a significant concern, because they are role models for their children. Promoting PA in families of young children in ways that fit into contemporary life should be the goal, with successful intervention efforts directly involving parents and caregivers from early childhood to support healthful practices in and outside of the home. While our results suggest that parental participation in PA, especially by fathers, is important, further research examining ways of promoting PA participation on weekdays and weekends in families with young children is warranted.

**ACKNOWLEDGEMENTS:** Y-Be-Active was supported by grants from the Alberta Children's Hospital Foundation. The Canadian

Institutes of Health Research provided salary support to Dr Deborah Dewey. We thank the families that volunteered and our invaluable research assistants Nadia Barnieh, Julie Burbidge, Carly McMorris, and Val San Juan who coordinated the data collection. We also appreciate the cooperation of the Alberta Health Services community healthcare centres in Calgary and childcare centres in the Calgary area for their assistance in recruitment and data collection. The authors have no financial relationships relevant to this article to disclose.

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