

Perception Versus Reality

Awareness of Physical Activity Levels of British Children

Kirsten Corder, PhD, Esther M. F. van Sluijs, PhD, Alison M. McMinn, PhD, Ulf Ekelund, PhD, Aedin Cassidy, PhD, Simon J. Griffin, MBBS, DM

Background: Interventions to increase children's physical activity have had limited success. One reason may be that children and their parents overestimate children's levels of physical activity, although there is a small amount of data on this topic.

Purpose: This study aims to assess awareness of physical activity levels among British school children aged 9–10 years and their parents.

Methods: Physical activity was measured using an accelerometer in a cross-sectional study of 1892 children (44% male; M age=10.3 years, SD=0.3) from 92 Norfolk schools (Sport, Physical Activity and Eating Behavior: Environmental Determinants in Young People [SPEEDY] study). Data were collected between April and July 2007 and analyzed in 2008. *Inactive* was defined as <60 minutes/day of moderate and vigorous physical activity. Agreement between physical activity perception (child- and parent-rated) and objective physical activity was assessed. Associations between biological (height, weight, fat mass index); parental (support, BMI, physical activity); and peer factors (support, objective physical activity) and child and parental physical activity awareness were studied using multinomial logistic regression.

Results: In all, 39% of girls and 18% of boys were inactive. A total of 80% of parents of inactive children wrongly thought that their child was sufficiently active. In all, 40% of inactive children overestimated their physical activity level. Compared to parents who accurately described their children as inactive, parents who overestimated were more likely to have girls ($p=0.005$), to have a child with a lower fat mass index ($p<0.001$), or to report more parental and peer support ($p=0.014$ and $p<0.001$, respectively).

Conclusions: Most parents of inactive children wrongly consider their children to be sufficiently active; parents of children with a lower fat mass index appear to assume that their children are adequately active. Increasing awareness regarding health benefits of physical activity beyond weight control might help reverse misperceptions of physical activity levels and encourage behavior change. (Am J Prev Med 2010;38(1):1–8) © 2010 American Journal of Preventive Medicine

Introduction

Inactivity is likely to be a risk factor for obesity and related metabolic disorders among young people.^{1,2} Because physical activity declines with age,^{3,4} it is important that habits are formed during childhood that will last into adulthood, including prevention of further decline in

physical activity.⁵ Recent literature reviews^{6–8} highlight the limited success of physical activity interventions for young people; however, the reasons for this lack of effectiveness are largely unknown and remain uncertain.

One previously posed explanation for the limited effectiveness of physical activity interventions is that people may lack awareness of their health behavior, such as believing themselves to be healthier than they really are.⁹ This misperception is especially common for complex behaviors such as physical activity, for which thresholds between healthy and unhealthy behaviors may be unclear.¹⁰ This may result in those who overestimate their physical activity level, seeing no need to alter their behavior as they are not aware that it is insufficient.¹⁰ People also may link specific health benefits to physical activity, for example, believing physical activity to be necessary for weight loss only,¹¹ although there is evidence that physi-

From the MRC Epidemiology Unit, Institute of Metabolic Science, Addenbrooke's Hospital (Corder, van Sluijs, McMinn, Ekelund, Griffin), Cambridge; and the School of Medicine, Health Policy and Practice, University of East Anglia (Cassidy), Norwich, United Kingdom

Address correspondence and reprint requests to: Kirsten Corder, PhD, MRC Epidemiology Unit, Institute of Metabolic Science, Box 285, Addenbrooke's Hospital, Hills Road, Cambridge, CB2 0QQ UK. E-mail: kirsten.corder@mrc-epid.cam.ac.uk

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cal activity contributes to health beyond weight control. Improving physical activity awareness may be a crucial component of interventions to increase physical activity, although few interventions take this into account.^{7,10}

Previous studies^{10–12} of physical activity awareness have all focused on adult Dutch populations, using self-reported physical activity to assess “true” activity levels. They show that 48%–61% of the inactive population overestimates their physical activity level. Those who overestimate their physical activity level tended to have a healthier lifestyle¹² and more favorable anthropometric characteristics^{11,12} than those who were aware of their low activity level. Psychosocial, personal, and behavioral factors have been found to be associated with physical activity awareness in adults,^{10–12} but no studies have investigated physical activity awareness among young people. Self-reported physical activity is prone to bias,¹³ and using an objective measure should allow a thorough assessment of the gap between perceived and true physical activity levels.

This study aimed to assess awareness of physical activity levels among British children aged 9–10 years and their parents and to investigate the associated biological and social factors. As no previous research was available, these analyses were mainly exploratory. However, based on the literature in adults, it can be hypothesized that parents of children with a more favorable body composition are more likely to overestimate their children’s activity levels.

Methods

The Sport, Physical Activity and Eating Behavior: Environmental Determinants in Young People¹⁴ (SPEEDY) study is a population-based study investigating factors associated with physical activity and dietary behavior in children aged 9–10 years attending schools in the county of Norfolk, United Kingdom (UK). Ethical approval for this study was obtained from the University of East Anglia research ethics committee.

Full details on participant recruitment and study procedures have been described elsewhere.¹⁴ At 92 participating schools, purposively sampled to achieve heterogeneity in urban and rural locations, all Year-5 children ($n=3619$) were invited to participate. Researchers went to each school to introduce the study to the children and distribute information packs for both the children and their parents; 2064 children obtained parental consent to participate and were measured (57% response rate).

Data collection took place between April and July 2007. A team of trained researchers visited schools to take physical measurements, administer two child questionnaires, fit accelerometers, and distribute a parent questionnaire and food diary to each child. Participants were asked to return the parent questionnaire, food diary, and accelerometers to school 1 week after measurements.

Physical activity was assessed using the Actigraph accelerometer (GT1M), shown to accurately assess physical activity–related energy expenditure in children during free-living conditions.^{15,16} Children were fitted with the monitor, set to record at 5-second epochs, during the measurement session and were asked to wear the monitors during waking hours, removing them while bathing, showering, and swimming. Accelerometry data were analyzed using a program available at www.mrc-epid.cam.ac.uk that enabled removing any data recorded after 11 PM and before 6 AM, periods of ≥ 10 minutes that had continuous zero-activity counts, and days with < 500 minutes of recording (the cutoff to define a valid day). Participants ($n=106$) with < 3 valid days of recording were excluded.¹⁷

Time (minutes/day) spent in moderate and vigorous physical activity (MVPA) was derived using 2000 accelerometry counts per minute (cpm) as the lower threshold of moderate-intensity activity.^{4,14} Accelerometer data were used to derive a dichotomous MVPA variable; a threshold of an average of 60 minutes of MVPA per day was used to classify children as active or inactive, according to British physical activity recommendations.^{18,19}

Child’s physical activity perception was assessed using the following question: *Compared with other boys or girls your age, would you say that you were: much more active, more active, about average, less active or much less active?* Parental perception of their child’s physical activity level was assessed using the following question: *How physically active would you say your child is?* with response categories as *very inactive, fairly inactive, neither inactive or active, fairly active, and very active*. Four physical activity awareness groups were derived using objective and perceived physical activity data for both child and parental data, as shown in Tables 1 and 2, respectively.

Height was measured to the nearest millimeter using portable height measures. Weight was measured to the nearest 0.1 kg using a nonsegmental bio-impedance scale. Previ-

Table 1. Classification of children into four physical activity awareness groups by child perception ($n=1863$)

Child physical activity perception in relation to peers	Objectively assessed physical activity	
	Active (69.1%) ^a	Inactive (30.9%) ^b
Much more active	Realistic active	Overestimator
More active	$n=651$ (34.9%)	$n=224$ (12.0%)
About average	Underestimator	Realistic inactive
Less active	$n=636$ (34.2%)	$n=352$ (18.9%)
Much less active		

^a ≥ 60 minutes/day MVPA

^b < 60 minutes/day MVPA

MVPA, moderate and vigorous physical activity

Table 2. Classification of children into four physical activity awareness groups by parental perception of child physical activity (n=1757)

Parent perception of child physical activity	Objectively assessed physical activity	
	Active (68.5%) ^a	Inactive (31.5%) ^b
Very active	Realistic active	Overestimator
Fairly active	n=1099 (62.5%)	n=444 (25.3%)
Neither inactive or active	Underestimator	Realistic inactive
Fairly inactive	n=105 (6.0%)	n=109 (6.2%)
Very inactive		

^a≥60 minutes/day MVPA^b<60 minutes/day MVPA

MVPA, moderate and vigorous physical activity

ously validated and published equations were used to calculate fat mass from the impedance value²⁰ and expressed as fat mass index (fat mass [kg]/height² [m²]) to account for height differences in body composition.²¹ Age and gender were self-reported; ethnicity was reported by both parents but was not included in the analysis because of homogeneity (96.1% white).

Data on parental and peer factors were derived from parent/guardian or child questionnaires, developed from validated questionnaires of physical activity correlates in children.^{22–28} The main caregiver self-reported his or her highest educational qualifications (in categories); car ownership (yes or no); and house ownership (rental or own it/buying it); these variables were used as measures of SES.

Physical activity levels of the mother and father were self-reported by the parents and expressed as the RUPE index,^{29,30} based on activity level at work and weekly hours spent cycling and performing other exercise over the past 12 months, coded as *inactive*, *moderately inactive*, *moderately active*, or *active*. Parental BMI was calculated from self-reported height and weight; the age of each parent was self-reported by the parents.

Parental support for activity was child-reported and calculated from six previously validated questions.^{22,23,28,31} Answers were given on a 4-point Likert-type scale ranging from *never/hardly ever* to *every day*. Peer support for physical activity was derived from three questions used previously,²² using a dichotomous “yes/no” answer category. Two summed scores were created to reflect composite variables for peer and parental support for physical activity. To reduce the influence of missing data, participants with missing responses for less than one third of the questions in a composite variable had their missing answers imputed with the most conservative answer (i.e., the one that was most likely to be negatively associated with children’s physical activity), based on previous findings in the literature.^{22–28} Partici-

pants answering less than two thirds of the questions within a composite variable were coded as “missing.” Associations between awareness group and support variables were first tested singly, but no significant differences were seen compared to composite variables; the latter are therefore used here.

Accelerometry data were used to assess peer physical activity levels; school- and gender-specific median values for average daily minutes of MVPA were derived, and then children were scored as zero if less active than the median and one if more active than the median.

Analyses were carried out using Stata/SE 10. Characteristics of those included and excluded from the analyses were compared using *t* tests or chi-square tests. Because of significant differences in physical activity awareness among schools, multilevel analysis was used. For both child and parental awareness, unadjusted associations between the four physical activity awareness groups and biological and social factors were assessed using multinomial logistic regression.

Multiple multinomial logistic regression was then used to assess the extent to which multiple factors were associated with awareness, with Realistic Inactive as the reference category. Variables that were significantly different across the four awareness groups in the unadjusted models were included in the multinomial logistic regression models and subsequently removed if they did not reach the predefined significance level of *p*<0.05. If more than one variable met these criteria, variables were removed one at a time, starting with the one with the highest *p* value.

Results

From the total sample of 2064 participants, 1868 (94.5%) had valid physical activity data for at least 3 days. Child and parental physical activity perception data were obtained from 1863 children (92% of the original sample) and 1757 parents (85% of the original sample), respectively. Descriptive data for these participants are presented in Table 3. Those excluded from the main analyses were more likely to be male (52.8% vs 43.6%, *p*=0.004), but there were no significant differences in body composition compared with participants. Those excluded were also less likely to have mothers with higher education and to live in owner-occupied or car-owning households (all *p*<0.001).

Tables 1 and 2 show the classification of children into the four physical activity awareness groups by objectively measured and child- and parent-perceived physical activity level, respectively. Fifty-four percent of children accurately reported their physical activity level (18.9% realistically inactive; 34.9% realistically active). Of the 30.9% who were inactive, 40% overestimated their physical activity level (12% of all participants; Table 1). As seen in

Table 3. Participant characteristics by child and parent physical activity awareness

	Child awareness					Parent awareness				
	Realistic active	Realistic inactive	Overestimator	Underestimator	Overall difference (n=1863)	Realistic active	Realistic inactive	Overestimator	Underestimator	Overall difference (n=1757)
n	651	352	224	636		1099	109	444	105	
Gender (% male)	55.0	23.9	31.3	48.4	<i>p</i> <0.001	52.3	34.9	23.9	46.7	<i>p</i> <0.001
Age (years)	10.3 (0.3)	10.3 (0.3)	10.3 (0.3)	10.2 (0.3)	<i>p</i> =0.014	10.23 (0.31)	10.28 (0.32)	10.27 (0.31)	10.25 (0.30)	<i>p</i> =0.520
Weight (kg)	35.3 (7.7)	38.4 (9.4)	37.1 (8.6)	36.4 (8.2)	<i>p</i> <0.001	35.8 (7.7)	41.5 (11.3)	36.8 (8.3)	38.4 (9.7)	<i>p</i> <0.001
Height (cm)	140.7 (6.7)	141.5 (6.7)	141.1 (6.4)	140.8 (6.7)	<i>p</i> =0.361	141.6 (6.8)	141.3 (6.7)	140.8 (6.6)	139.9 (6.6)	<i>p</i> =0.566
Fat mass index (kg/m ²)	5.3 (2.3)	6.7 (2.9)	6.1 (2.8)	5.8 (2.4)	<i>p</i> <0.001	5.4 (2.3)	7.8 (3.6)	6.0 (2.5)	6.5 (3.1)	<i>p</i> <0.001
SES (% no car)	6.9	3.7	2.6	4.8	<i>p</i> =0.005	4.8	2.8	2.7	9.5	<i>p</i> =0.047
MVPA (minutes)	88.5 (22.1)	47.2 (8.8)	48.0 (8.8)	83.1 (18.6)	—	85.6 (20.1)	46.5 (8.8)	48.1 (8.5)	82.5 (19.4)	—
Mother's age (years)	39.3 (5.3)	39.5 (6.1)	39.3 (5.2)	39.2 (5.6)	<i>p</i> =0.92	39.4 (5.4)	38.7 (5.6)	39.7 (5.6)	39.0 (5.2)	<i>p</i> =0.324
Father's age (years)	42.2 (6.6)	42.2 (6.8)	41.6 (6.5)	42.5 (6.8)	<i>p</i> =0.45	42.4 (6.5)	41.2 (5.9)	42.4 (6.8)	42.2 (6.9)	<i>p</i> =0.357
Mother's BMI	25.0 (5.1)	25.0 (4.9)	25.9 (5.3)	25.1 (4.8)	<i>p</i> =0.07	25.0 (5.0)	26.0 (4.7)	25.2 (5.2)	25.2 (5.4)	<i>p</i> =0.097
Father's BMI	26.4 (3.8)	26.8 (3.6)	26.9 (3.9)	26.7 (3.8)	<i>p</i> =0.19	26.5 (3.7)	26.9 (5.6)	26.9 (3.8)	26.2 (4.4)	<i>p</i> =0.480
Parental support	15.8 (4.0)	13.7 (3.5)	14.5 (3.8)	14.4 (3.7)	<i>p</i> <0.001	15.2 (3.9)	13.2 (3.8)	14.3 (3.6)	14.1 (4.0)	<i>p</i> <0.001
Mother's physical activity	2.7 (1.1)	2.6 (1.1)	2.6 (1.0)	2.7 (1.0)	<i>p</i> =0.37	2.7 (1.0)	2.6 (1.0)	2.6 (1.1)	2.6 (1.1)	<i>p</i> =0.172
Father's physical activity	3.1 (1.0)	2.9 (1.1)	3.1 (1.0)	3.1 (1.0)	<i>p</i> =0.002	3.1 (1.0)	2.8 (1.1)	3.0 (1.1)	2.9 (1.3)	<i>p</i> <0.001
Peer support	2.6 (0.8)	2.3 (1.0)	2.5 (0.8)	2.5 (0.9)	<i>p</i> <0.001	2.6 (0.82)	2.0 (1.0)	2.5 (0.9)	2.5 (0.9)	<i>p</i> <0.001
Peer physical activity (% more than median)	73.9	6.0	1.7	72.0	<i>p</i> <0.001	71.1	2.8	4.6	69.4	<i>p</i> <0.001

Note: Values are M (SD) unless otherwise specified. Unadjusted analyses, clustered at the school level. Boldface values indicate significance.
MVPA, moderate and vigorous physical activity

Table 4. Results of multinomial logistic regression of multiple factors on child and parental physical activity awareness

	Child awareness		Parental awareness	
	Overestimator	Differences	Overestimator	Differences
	OR (95% CI)		OR (95% CI)	
Gender				
Female ^a	1.0		1.0	
Male	1.29 (0.89, 1.87)		0.49 (0.30, 0.81)	Overestimator<realistic inactive ($p=0.005$)
Fat mass index (kg/m ²)	0.94 (0.88, 1.01)		0.78 (0.72, 0.84)	Overestimator<realistic inactive ($p<0.001$)
Parent support	1.05 (0.99, 1.11)		1.09 (1.02, 1.18)	Overestimator>realistic inactive ($p=0.014$)
Peer support	1.34 (1.04, 1.71)	Overestimator>realistic inactive ($p=0.02$)	1.63 (1.29, 2.06)	Overestimator>realistic inactive ($p<0.001$)
Peer physical activity				
Less ^a	1.0		1.0	
More	0.23 (0.07, 0.73)	Overestimator<realistic inactive ($p=0.01$)	2.54 (0.67, 9.65)	
<i>n</i>	202		405	

Note: Reference category; child awareness: realistic inactive ($n=325$); Reference category parental awareness: realistic inactive ($n=100$); overestimator, gender 0=female, 1=male. Boldface values indicate significance.

^aReference category; analysis clustered by school

Table 2, 69% of parents accurately perceived their child's physical activity level (62.5% realistically active, 6.2% realistically inactive). Of the 30.9% of parents whose children were inactive, 80% overestimated their child's physical activity level (24.5% of all participants).

Table 3 shows a summary of the associations between each biological and social factor and child and parental physical activity awareness. There were significant unadjusted associations between both child and parental awareness and gender, weight, fat mass index, parental support, father's physical activity, peer support, and peer physical activity. Child's age was associated only with child's awareness. Car ownership was the only measure of SES to differ across awareness groups; therefore, this was the only SES proxy variable included in the multiple analyses.

Table 4 shows results of multiple multilevel multinomial logistic regression of biological and social factors on categories of child and parental physical activity awareness. Although all four awareness groups were included in the multinomial logistic regression models, Table 4 shows results for inactive children only. The main emphasis of this study was on the differences between those who are realistic about their inactivity and those who overestimate their physical activity level. This is because

inactive children are most likely to be targeted in interventions to increase physical activity. Compared to children who were realistic about being inactive, those who overestimated their physical activity level reported higher levels of peer support for activity and were less active than their peers. Compared to parents who were realistic about their children's inactivity, parents who overestimated their children's physical activity level had children who were more likely to be girls, to have a lower fat mass index, or to report more parental and peer support.

Discussion

This study assessed physical activity awareness in a population-based sample of British children. Just under one third of children were not meeting the physical activity guidelines of 60 minutes/day of MVPA^{18,19}; 80% of parents of these children wrongly thought that their child was fairly active. Forty percent of inactive children overestimated their physical activity level. The lower the children's fat mass index, the more likely it was that parents overestimated their children's physical activity level.

The children in this study appeared to be more aware of their physical activity level than the 48% to 61% of

inactive adults who overestimated their own physical activity level in previous studies.^{10–12} One possible explanation could be the large and varied reference population that the children have at school. In addition, the question assessing child-perceived physical activity level asked the children to report their activity level in relation to their peers and not to assess their adherence to the guideline, which depends on the cut-points used to define MVPA.

Parents overestimated their children's activity levels more than adults have overestimated their own physical activity in previous studies. This overestimation could be due to many factors, including social desirability bias and being unaware of their children's physical activity when they are not with them. This latter statement is supported by discrepancies between parentally reported and objectively measured physical activity in studies³² comparing measurement methods in children.

Adjusted associations indicated that compared to parents who were realistic about their child's inactivity, parents who overestimated their children's physical activity level had children with a lower fat mass index. This result supports the hypothesis that overestimators may assume that their child is sufficiently active because of their favorable body composition.^{11,12} Children whose parents overestimated their physical activity levels reported higher levels of social support than those whose parents are realistic about their inactivity. Although these children appear to be receiving support for the activity that they are currently doing, it does not necessarily mean that this activity is at recommended levels. Parents whose children have a lower fat mass index may perceive them as sufficiently active and consequently see no need to facilitate or encourage them to increase their physical activity over their current levels.¹¹ Therefore, education regarding awareness of these low physical activity levels may be an important first step in family-based interventions to increase physical activity. Although similar associations have been reported in adults,^{10,12} it is interesting that parents apply these beliefs to their children.

Parents of girls were more likely to overestimate their children's activity level, and girls were on average less active than boys. Although parents were asked not to compare their child to other children of the same age and gender when judging their child's physical activity level, it is possible that parents did this anyway. Parents of daughters may therefore have been more likely to overestimate their child's physical activity level because of their frame of reference.

Compared to children who were realistic about their inactivity, children who were overestimators reported more peer support despite being less active than their peers. This overestimation of peer support could be due

to the dichotomous peer physical activity variable, as it is possible that children with higher levels of peer support had increased physical activity that was still less than 60 minutes/day and less than that of their school and gender-specific peers.

As the majority of parents of inactive children overestimate their child's physical activity level and therefore may be less likely to encourage their children to increase their physical activity, improving parental awareness could be an important component of physical activity promotion strategies in children. Self-monitoring and feedback using pedometers may be an effective way to promote parental awareness and children's physical activity behavior.³³ Evidence in adults suggests that personalized feedback may be a promising strategy,³⁴ but more research is needed to determine the feasibility of this approach on a large scale. Pedometers have been successfully used in large studies,^{35–37} and new technologic advances such as automated feedback may make individualized feedback possible. However, to fully explore the most effective types of feedback and their effect on health behaviors, further research studying changes in objectively measured physical activity behavior in large samples is needed.⁷ In addition, more work is needed studying physical activity awareness in other populations as well as the potential effect of low awareness on the effectiveness of interventions.

The authors are unaware of any other studies that have simultaneously assessed children's awareness of their physical activity level and parents' awareness of their child's physical activity level. This is important as parental involvement might be valuable in strategies to increase physical activity among children.⁷ A strength of this study is that objective physical activity measurement has been used with perceived physical activity data to classify awareness. The objective physical activity data should more accurately represent the true physical activity levels of these children and their peers than a questionnaire and will overcome the potential problem of correlated error from two forms of self-reported physical activity data.¹³

This was a cross-sectional study, so it is not possible to determine whether these associations are causal. In addition, the questions assessing child and parental perception of child physical activity differed; therefore, child and parental awareness groups are not directly comparable. The influences of three different indicators of SES were studied, of which only car ownership was significantly associated with physical activity awareness. The possibility that car ownership may be associated with home location must also be acknowledged. Although it would have been ideal to study other socioeconomic indicators, such as parental occupation and income, these were unavailable. There was some differential drop out in

this study, with boys and children from lower-level socioeconomic backgrounds being more likely to be excluded from analyses, limiting the generalizability of these results. The percentage of obese children (13.4% overweight, 16.7% obese) in the sample is lower than that reported for the UK,^{14,38} and the Norfolk region has a largely British, white population (96.2% as at the 2001 UK Census)³⁹ and is therefore not representative of all of Britain.

Most parents of inactive children wrongly consider their children to be sufficiently active; parents of children with a lower fat mass index appear to assume that their children must be adequately active. Increasing awareness regarding health benefits of physical activity beyond weight control might help reverse misperceptions of physical activity levels and encourage behavior change.

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