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Physical activity during school recess: a systematic review

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Abstract

Context: Interest has increased in examining the physical activity levels of young people during school recess. Identifying correlates of their recess physical activity behaviors is timely, and would inform school-based physical activity programming and intervention development. The review examined the correlates of children's and adolescent's physical activity during school recess periods. **Evidence acquisition:** Asystematicsearchofsixelectronicdatabases,referencelists,andpersonal archives identified 53 studies (47 focused on children) published between January 1990 and April 2011 that met the inclusion criteria. Data were analyzed in 2011. Correlates were categorized using the social-ecological framework. **Evidence synthesis:** Forty-four variables were identified across the four levels of the social- ecological framework, although few correlates were studied repeatedly at each level. Positive associ- ations were found of overall facility provision, unfixed equipment, and perceived encouragement with recess physical activity. Results revealed that boys were more active than girls. **Conclusions:** Providing access to school facilities, providing unfixed equipment, and identifying ways to promote encouragement for physical activity have the potential to inform strategies to increase physical activity levels during recess periods.

Keywords

activity, during, physical, school, recess, review, systematic

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Physical Activity during School Recess: A Systematic Review

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Context: There has been increased interest in examining the physical activity levels of young people during school recess periods. Identifying correlates of their physical activity behaviors is timely, and would inform school-based physical activity programming and intervention development. The aim of this narrative review was to examine the correlates of children's and adolescent's physical activity during school recess periods.

Evidence acquisition: A systematic search of six electronic databases, reference lists and personal archives identified 53 studies (47 of which focused on children) published between January 1990 and April 2011 that met the inclusion criteria. Data were analyzed in 2011. Correlates were categorized using the social-ecological framework.

Evidence synthesis: Forty-four variables were identified across the 4 levels of the social-ecological framework, though few correlates were repeatedly studied at each level of influence. Positive associations were found between overall facility provision, unfixed equipment, and perceived encouragement and recess physical activity. Results also revealed that boys were more active than girls.

Conclusions: Providing access to school facilities, providing unfixed equipment, and identifying ways to promote encouragement for physical activity have the potential to inform strategies to increase physical activity levels during recess periods.

Introduction

Physical activity is positively associated with psychological well-being, bone health and motor skill development, and negatively associated with waist circumference and clustering of cardiovascular disease risk factors.[1-4] However, as children and adolescents may not be engaging in sufficient physical activity to benefit their health,[1] the promotion of physical activity is a public health priority.[5]

Children and adolescents spend a significant proportion of their waking at school. Non-curricular time, such as school recess periods (recess and lunchtime) and after-school programs, provide opportunities for children to be physically active within the school environment.[6] Of these contexts, recess periods may provide the single greatest opportunity during the school year to impact on youth physical activity levels.[7] However, in recent years there has been a trend to reduce the frequency and duration of school recess, or remove it from the school day altogether, often due to academic pressures. Consequently, it is important that school recess is included in school-based physical activity programming and policy, and that the recess environment is conducive for youth to make physically active choices.[8] Whilst the scheduling and duration of recess periods vary between countries, schools should provide social and physical environments that facilitate enjoyable and safe physical activity engagement in this context.[9] A number of reviews have examined correlates of preschool, children's and adolescents' physical activity,[10-12] yet these have typically focused on factors associated with whole-day activity. Since physical activity is a multidimensional behavior influenced by numerous factors across several domains,[10] it is logical to also consider specific contexts in which children and adolescents are active. Few reviews have focused on the correlates of specific parts of the school day, such as school recess periods, yet synthesizing

such information could help to inform both school-based physical activity programming and intervention development aimed at increasing children's physical activity levels in this context. Furthermore, this information has the potential to inform future policy concerning recess periods and their role within the school day.

The aim of this review was to examine correlates of children's and adolescents' physical activity during school recess periods. From here on in, physical activity during school recess will be referred to as recess physical activity. For the purpose of this review, school recess was defined as the non-curriculum time allocated by schools between lessons for youth to engage in leisure activities.[13]

Methods

A systematic literature search of papers was conducted in 6 electronic databases (Pubmed, SportsDiscus, Web of Science, Proquest, Cochrane, and Scopus). Search strategies for the different databases included the following key words in three main areas: population (child, infant, youth, adolescent), school (school, primary, elementary, middle school, high school, secondary school), and recess (breaktime, break time, school recess, recess, playtime, lunchtime, free play). Only papers that had been published in peer-reviewed journals were considered for inclusion. Abstracts, expert opinion, case studies, conference proceedings and dissertations were not included. In addition to electronic searches, bibliographies of retrieved studies and authors' personal collections were also searched.

For inclusion in the review, studies were required to: a) include participants aged 5-18 years; b) have a measure of physical activity as the outcome variable; c) specifically examine physical activity during recess and/or lunchtime; d) have examined associations between

physical activity and other variables; e) be published between January 1990 and April 2011; and f) be published in peer-reviewed journals in English. School recess periods included morning recess, lunchtime, and afternoon recess. A previous review of recess physical activity levels reported that only two studies were published before 1990,[13] therefore this was used as the start date for the current review. Data were collected and analyzed in 2011. Studies that reported total daily recess (e.g. sum of morning recess and lunchtime) or investigated specific recess periods were included. Before school time and after-school programs conducted on school sites were not considered as recess periods in this review. Studies that reported findings before/after school time and during school time were included where the results were presented separately for the recess periods. Data from control groups, baseline intervention studies, and intervention studies where the correlate was reported separately as a confounding variable were included. Longitudinal studies were included if at least one measurement period was conducted during elementary school and results at this time point reported. Studies that only reported the effectiveness of recess-based interventions on physical activity levels were excluded. Studies that investigated physical activity levels during recess periods in special populations (e.g. autistic spectrum disorders, attention deficit disorders) were also included in the review, as these studies collected data from schools where children with and without particular disorders had access to the same school environment and had recess and/or lunchtime together. When comparisons were made between children with and without particular disorders and no differences were found, all data were included for review. In circumstances where differences occurred, data from the children without the disorders were considered to enable comparisons with other studies. Lastly, studies that solely investigated physical activity levels of special populations during recess periods were included but noted accordingly in the results.

Results obtained from the initial literature search were independently assessed. Potentially relevant papers were selected by screening a) the title; b) the abstract; and c) the full paper if insufficient detail was provided in the abstract. Data extraction was then undertaken using standardized forms and included: country of study, study design, sample characteristics (e.g. sample size, age, gender), the physical activity measure used and the outcome variable, recess period(s) studied, recess characteristics (e.g. duration, supervision, environment), and results. Appendix A provides an overview of the characteristics of the studies that met the inclusion criteria. Data are presented separately for children (5-12 years) and adolescents (13-18 years). Due to some variability across studies in the age that children transition from primary (elementary) and/or middle schools to secondary (high) schools, if children were aged 11-12 but the study was conducted in secondary schools, they were classed as adolescents.

Categorization of variables

For consistency and comparability with previous reviews of correlates of youth physical activity,[10-12] a social-ecological framework was used. The social-ecological model posits that multiple levels of influence interact to promote or constrain participation in physical activity.[14] Identified variables were categorized into four groups according to the social-ecological framework; individual, social, physical environment, and organizational/policy. Conceptually similar variables were combined (e.g. different facilities available for use during recess periods) to enable consistency with interpretation.

A range of measures were used to examine recess physical activity (see Appendix A). Children's physical activity was largely measured using objective measures, with accelerometry the most commonly used method (36% of all studies). Adolescents' physical activity was typically measured using subjective measures (e.g. self-report questionnaires;

71% of adolescent studies). Multiple physical activity measures were used in six children's studies and one adolescent study, respectively. When moderate (MPA) and vigorous (VPA) activity were reported separately and the associations obtained were in different directions, they were treated as separate results and noted accordingly. If the MPA and VPA results were reported in the same direction, the results were combined to form one overall result (i.e. MVPA). For studies that used two or more objective measures of physical activity, a combined result was reported when results from both of these measures were in the same direction.[10] Where differences in the direction of the association occurred between measures, the results were presented separately and noted accordingly. The same approach was adopted when studies examined school recess periods separately (e.g. morning recess and lunchtime) and reported different findings. A variety of statistical techniques were used to evaluate the associations (e.g. correlations, multilevel modeling, ANOVA). A number of studies reported univariate analyses, though some also reported multivariate analyses with adjustments for confounding variables. Where possible, the findings reported are from the fully adjusted models.

The results were coded using the procedure outlined in previous reviews where the association between an identified variable and recess physical activity was determined by the number of findings that support the direction of the association.[2,10,11] The summary column identifies the number of studies finding positive (+), negative (-) or no (0) associations between recess physical activity and the identified variable. The summary coding column indicates the percentage of findings that demonstrated a significant association between recess physical activity and the identified variable. When 0%-33% of the findings supported an association, the result was classified as no association (0). An indeterminate/inconclusive (?) classification was determined if 34%-59% of the findings supported an association, whilst

a positive (+) or negative (-) association was determined if 60%-100% of the findings supported the direction of the association (Table 1). If a variable was investigated four or more times and supported an association as positive, the result was coded ++, while negative associations were coded as -- and no associations coded as 00.

[INSERT TABLE 1 ABOUT HERE]

Results

Of the 2718 studies identified, 53 papers were included in the review (Figure 1). The majority of studies were cross-sectional (n=42), focused on children (n = 47), and reported MVPA as the outcome variable (n=26). Only one study included children and adolescents and reported the results separately.[15]. Eight studies used self-report measures to assess physical activity, with seven and five of these reporting the validity and/or reliability of the measures used, respectively. Due to the limited number of adolescent studies, data from children and adolescents are reported together to obtain the summary coding variables reported below. The majority of studies were conducted in the USA (n=16) [16-31] or the United Kingdom and Northern Ireland (n=12). [32-43] Five studies were conducted in Australia[44-48,] 4 in Norway[15,49-51], 3 in New Zealand[52-54], 2 each in Taiwan[55,56], Japan[57,58] and Portugal[59,60], 1 each in Hong Kong[61], Mexico[62], the Philippines[63], Canada[44], Belgium[64], Hungary[65], Spain[66] and France[67]. Only one study collected data across multiple countries[44]. Of the 53 studies, four studies collected data from morning recess[17,30,58,66], seven from lunchtime[23,32,57,52,53,63,67] and 12 from daily recess (i.e. no time of day reported).[16,22,24,26-28,46,49-51,61,62] The remaining 30 studies collected data across multiple recess periods (e.g. morning recess and lunchtime).

[INSERT FIGURE 1 ABOUT HERE]

Correlates of school recess physical activity

Table 2 summarizes associations between identified correlates and recess physical activity. Correlates that have been examined four or more times are reported below.

[INSERT TABLE 2 ABOUT HERE]

Individual variables

Sixteen individual variables were identified from 47 studies, with five of these being investigated four or more times. The most frequently studied variable was sex (38 studies), with boys consistently found to be significantly more active than girls. [15-18,21,23,25,28,29,31,32,34,35,37-40,42,43,45-48,51,52,54,59,66-66] No associations were found for grade level[15,18,20,23], or body mass index/central adiposity[18,30,39,40,42,54], while the evidence for differences in physical activity between children with and without special education needs[21,27,55-58] and age[17,30,33,34,35,37,39,52,54,55,59,63,67] were inconclusive.

Social variables

Associations between social variables and physical activity were examined in ten studies. Five social variables were identified, with associations between perceived encouragement, socio-economic status, supervision and physical activity investigated four or more times. A positive association was found between physical activity and perceived encouragement from friends, family and schools.[53] Higher levels of perceived encouragement were associated with higher physical activity levels.[53] There was inconclusive evidence for associations between socio-economic status[45,61,63] and adult supervision[25,38,40,46-48] and physical activity.

Physical environmental variables

Twelve physical environmental variables were identified from 16 studies, six of which were studied four or more times. The most frequently studied variables were the availability of facilities in the outdoor school grounds, and fixed equipment and markings within the school grounds. The availability of separate facilities in outdoor physical activity spaces/areas (e.g. ball areas, sports fields, green spaces) has been mainly investigated in adolescents, and no association with physical activity was found.[15,47,50] However, when overall facility provision was considered (that is, the sum of facilities available), positive associations with physical activity were identified.[15,32,50,51] Fixed equipment and markings have been investigated in children and adolescents, and the association with physical activity was inconclusive.[15,32,38,44,46,47,50] In comparison, unfixed equipment (e.g. loose equipment, balls, skipping ropes) has only been investigated in children, with positive associations found.[25,38,40,46-48] An indeterminate result was obtained for weather/seasonal differences.[34,36,38,40,46,48] No association was found between available outdoor space and physical activity.[38,46]

Organizational/policy variables

Eleven variables were identified from 19 studies, two of which had been studied four or more times. An inconclusive association was found between recess duration (which is typically determined by school policy) and physical activity.[24,37,39,45,46] Differences in physical activity levels between recess periods and physical education have primarily been investigated in children with special education needs, and the findings were inconclusive.[20,26,28,41,56,61,62]

Discussion

This review provides evidence for factors to include in a social-ecological model of recess physical activity behavior but also highlights areas where evidence is lacking. Forty-four variables were identified across the four levels of the framework, though only 36% had been investigated four or more times. Only three studies examined correlates across all levels of the social-ecological model simultaneously.[38,46,48] The majority of the variables identified were at the individual and physical environmental levels of the model, though only three consistent associations were found for sex, unfixed equipment and facility provision. Few studies examined social influences, despite recess providing an opportunity for youth to engage in social interactions with their peers relatively free of adult constraints.[68] Potentially important factors such as composition of social groups (e.g. single sex, mixed sex) have not been investigated, though this may be somewhat explained by the large number of child studies reviewed where the focus has typically been on teacher supervision and management.[25,38,40,46-48] In addition, further research should investigate correlates of children's and adolescents' recess physical activity for variables that were not frequently investigated but indicated positive associations with physical activity. Identifying recess physical activity correlates may help inform future intervention development and school programming, as although recess interventions have generated positive results, reported changes are small and often focus on short-term changes.[30,39,64]

Some limitations of included studies warrant attention. The majority of the research in this area has examined small samples, utilized cross-sectional study designs. A meta-analysis of the data may provide more information though such an analysis is difficult given the limited number of studies that report effect sizes and the lack of consistency in the correlates assessed between studies. A range of physical activity measures have been also used, which may influence the associations identified. While the majority of child studies have used

objective measures of physical activity, in particular accelerometry and direct observation, different accelerometer cut-points and observation systems may have influenced the strength of the associations observed. The majority of adolescent studies used self-report measures and while face and content validity of the measures were documented in some of the studies[15,53,54], further research using objective measures are needed to determine adolescents' recess physical activity levels.

Arguably the main weakness in the evidence to date is at the organizational/policy level, where only 2 variables have been investigated four or more times and the associations for recess duration and differences between recess periods and physical education were inconclusive. This weakness in the literature base is concerning, especially as there is an increasing trend to reduce the frequency and/or duration or recess.[69] The way in which recess is defined may explain the lack of consistent findings, as several studies included time spent eating at lunchtime and thus a substantial component of compulsory sedentary behavior.[37,40] Moreover, some studies reported total daily recess duration (i.e. morning recess and lunchtime combined)[35,60] whilst others examined the impact of individual recess periods[18,31], which may have also influenced the results.

Little research has documented the effect of written recess policies on recess provision and physical activity levels, particularly in countries where daily recess is not mandatory (e.g. the US).[70] However, mandatory recess periods may be one approach to impact on children's physical activity at the organizational/policy level.[51] Schools are encouraged to have a written school physical activity programming policy that includes recess, which may contribute to stronger policies and programs at the school level.[70] This may also encourage schools that are contemplating the removal of recess to consider the benefits of retaining recess in the school

day not only on youth social, emotional, physical and cognitive development[68,71], but also their classroom behavior and academic performance.[71] Furthermore, adopting written school physical activity programming policies may not only help promote more consistent scheduling of recess[70], but help to contribute to both children and adolescents' daily physical activity levels as a significant proportion of their recommended daily physical activity can be accumulated during this time.[72]

Higher perceived encouragement from parents, peers and the school as a whole was associated with higher self-reported physical activity levels during recess periods, particularly in adolescents.[53] It was surprising, however, that perceived parental encouragement influenced physical activity levels in the younger adolescents given the lack of involvement parents have during this period of time. This result may be somewhat explained by the measures used , as the adolescents were not specifically asked about parental encouragement for physical activity and sport during school recess.[53] Interestingly, parental encouragement may benefit physical activity levels across a range of contexts, even in those where parental involvement is minimal.

Overall facility provision (i.e. sum of facilities available) was positively associated with physical activity.[15,32,50,51] Interestingly, the provision of outdoor (e.g. sports fields, ball areas)[15] and indoor spaces (e.g. gyms)[50] during recess periods were not associated with physical activity when they were investigated as individual facilities. These facilities may be associated with physical activity during other non-curricular periods, such as before or after school, though this was not examined in this review. Increasing access to different facilities during recess and/or lunchtime at school may benefit youth physical activity though single spaces may not be effective on their own. This supports research that has demonstrated that providing access to a range of spaces and facilities may stimulate physical activity by

increasing a sense of choice and providing supportive environments that facilitate active behaviors.[37,73,74] Future research should examine whether increasing access to school facilities during recess periods increases physical activity levels in children and adolescents.

A positive association was found between unfixed equipment and recess physical activity in children. No studies examined this association in adolescents. These results contrast with previous correlates reviews that reported no or inconclusive associations between the availability of toys/equipment and overall physical activity.[10,11] It is possible that unfixed equipment may affect physical activity participation in specific contexts, rather than overall daily physical activity. In the present study, there was no clear indication as to whether unfixed equipment increased MPA, VPA or MVPA, which may be dependent on the type and number of equipment provided. For example, Zask and colleagues[48] reported that the ratio of balls to children impacted on VPA, whilst others used a dichotomous variable to identify the presence or absence of equipment and found positive associations with both MPA and VPA.[25,38,40,47] Further research is needed to determine whether specific types of equipment, or the overall availability of unfixed equipment, are associated with higher levels of physical activity. In elementary school settings, the provision of games equipment has been found to increase children's physical activity levels.[64] Examining whether the provision of unfixed equipment is a suitable strategy for increasing adolescents' recess physical activity is warranted.

This review found that boys are more physically active than girls during recess, supporting previous reviews of preschool, childhood and adolescence correlates .[10-12] Boys view recess as an opportunity to play competitive games that often dominate the available space.[75,76] In comparison, girls may view recess as an opportunity to socialize with friends.[75,77] However,

behaviors during recess have been primarily studied among children, and there are limited data concerning adolescents. There is a need to establish why adolescent males are more active than females during recess, as this will inform strategies targeted at promoting physical activity in this age group. Future research should examine the correlates of boys and girls physical activity separately. Identifying modifiable variables that differ by sex could be critical in the development of activity promotion strategies, and may help to inform evidence-based practice and policies designed to increase physical activity in primary and secondary school children.

Conclusion

In summary, there is currently a dearth of literature concerning correlates of physical activity during recess periods, particularly in adolescents. Despite the paucity of associations identified, it is recommended that schools should increase overall facility provision, provide unfixed equipment, and identify methods to increase social support, particularly by peers, to benefit children and adolescents' physical activity levels during recess.

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Figure Legend:

Figure 1**:** Flow diagram of search results published between January 1990 and April 2011

Table 1: Rules for classifying variables regarding strength of associations with recess physical activity[11]

Studies supporting association (%)	Summary code	Explanation of code
0-33	0	No association
34-59	?	Indeterminate/inconclusive association
60-100	+	Positive association
60-100	-	Negative association

When an outcome had been studied four or more times, it was coded as 00, ??, ++, or --

Table 2: Summary of reported outcomes of studies published January 1990 to April 2011

Correlate	**Found association with PA during recess**		**Found no association with PA during recess**				**Summary coding**	**Summary code**
	References	Association (+/-)	References				n/N for row (%)	Association (-/+)
Individual variables								
Behavioral								
Day-to-day variability			36				0/1 (0)	0
Physical conflict frequency	40	+					1/1 (100)	+
Sedentary activities (time)	40	-					1/1 (100)	-
Play ball games	46	+					1/1 (100)	+
Sports activities (time)	40	+					1/1 (100)	+
Biological								
Age	30, 33[b], 39, 59, 67	-	17, 34, 35, 37, 52, 55[4]				5/15 (33)	00
	33[a], 54, 55[c], 63	+						
Grade level	15	-	20, 23				1/4 (25)	00
	18	+						
BMI (overweight)	18[d], 39[b,d], 54[c]	-	18[c], 30, 39[c], 40, 42, 54[d]				3/10 (30)	00
	54[n]	+						
Body mass	67	-					1/1	+
Maturation	67	-					1/1	+
Ethnicity (Caucasian)	54	-	18				1/2 (50)	?
Fitness			20				0/1 (0)	0
Sex (male)	15, 16, 17, 18, 21[4], 23, 25, 28, 29[Step], 31, 32, 34, 35, 37, 38[b], 39, 40, 42, 43[a,b,d], 45, 46, 47[b], 48, 51, 52, 54, 59, 64, 65, 66	+	22[3], 27, 29[HR], 30, 35[b], 38[a], 43[b,c], 47[a], 49, 62, 63, 66				32/43 (74)	++
	60	-						
Special educational needs	21, 55, 56, 58[PDD]	+	20, 27, 57, 58[ADHD]				4/8 (50)	??

(no disability)								
Cognitive								
Interest in physical activity	50, 51	+					2/2 (100)	+
Enjoyment			29				0/1 (0)	0
Social								
Group size (10 or more)	40	+					1/1 (100)	+
Perceived encouragement[1]	53[d,e,i], 53[d,e,j], 53[d,g,i], 53[d,h,i]	+	53[d,g,j], 53[d,h,j]				4/6 (67)	++
SES (low)	61[3], 63[d]	-	45, 63[c]				2/4 (50)	??
Supervision[2]	25, 46 (observation, presence)	-	38, 40, 47[a,d], 48				3/8 (38)	??
Supervision[3]	47[b,d]	+						
Teacher management			46, 48				0/2 (0)	0
Physical environment								
Aesthetics			32				0/1 (0)	0
Unfixed equipment	25, 38[a], 40, 46, 47[b], 48 (ball/child ratio)[b]	+	38[b], 46 (# of balls), 47[a], 48				6/10 (60)	++
Facility Availability and Accessibility								
Outdoor physical activity areas	15 (sledding hill, soccer field[k]), 50 (green space)	+	15 (ball areas, green spaces, soccer field[l]), 47 (sports fields), 50 (ball areas, soccer fields, ski, water, woods)				3/12 (25)	00
Outdoor space	38 (space/child)[b]	+	38 (space/child[a], total space), 46 (total space)				1/4 (25)	00
Indoor physical activity spaces/areas	50 (gym)	+	50 (ice skating, swimming)				1/3 (33)	0
Fixed equipment/markings	15 (equipment[k], hopscotch[k]), 44[b], 46 (markings, shading), 47[a], 50 (equipment, obstacle course)	+	15 (boarding area, fixed equipment[l], hopscotch[l], obstacle course), 32 (design), 38 (fixed equipment, markings), 50				8/19 (42)	??

			(boarding area, climbing, fenced court yard)					
Fixed equipment/markings	47[b]	-						
Overall facility provision	15[i], 32 (sports provision), 50, 51	+	15[m], 32 (facility provision)				4/6 (67)	++
Play location (indoor)	19	-	65				1/2 (50)	?
Play surface (grass)	44, 46	+	47				2/3 (67)	+
School location (rural)	23	+					1/1 (100)	+
Seasons/temperature/ weather	38 (temp)[b], 40 (temp), 46 (raining, temp)	-	34 (season), 36 (season), 38 (temp)[a], 46 (humidity), 48 (heat stress)				4/9 (44)	??
Organizational/Policy								
Written policy	51	+					1/1 (100)	+
PA program involvement			51				0/1 (0)	0
Organized activities	51	+					1/2 (50)	?
	25	-						
Number on roll	48	-	38				1/2 (50)	?
Recess duration	39[b,c HR], 45	+	37[a], 39[a,c], 39[a,b,d]				3/7 (43)	??
	24, 39[b,c ACC], 46	-						
Class time vs. recess	22[3]	-					1/1 (100)	-
Fitness break vs. recess	29	+					1/1 (100)	+
Morning vs. Lunchtime recess	25	+					1/2 (50)	?
	48	-						
PE vs. recess	20 , 26[b, 3], 41, 61[3]	-					4/7 (57)	??
	26[a, 3], 28[o], 56, 62	+	28[p]					
Provision of PE (5x/wk - Yes)			51				0/1 (0)	0
Number of daily recess periods			34				0/1 (0)	0

Note: The summary code is an overall summary of the findings for each variable: 0 = No association; ? = Indeterminate/inconclusive association; + = Positive association; - = Negative association.

[1] Perceived encouragement includes that from friends, parents, school and teachers.

[2] Supervision from adults (e.g. lunchtime assistants) and teachers - no direct management or organization of games/activities during recess/lunch

[3] Data collected from special population only

[4] Data from children without disorders in studies that included special populations

[a] Association for MPA (moderate physical activity)

[b] Association for VPA (vigorous physical activity)

[c] Association for recess

[d] Association for lunchtime

[e] Association for friend support

f association for overall support

[g] Association for parent support

h Association for school support

[i] Association for junior high adolescents

[j] Association for senior high adolescents

[k] Association for adolescent males

[l] Association for adolescent females

[m] Association for primary school children

[n] Association for central adiposity

[o] Association for girls

[p] Association for boys

HR = heart rate; ACC = accelerometry; Step = Pedometer; ADHD = Attention-deficit/hyperactivity disorder; PDD = Pervasive developmental disorders