

The characteristics of the outdoor school environment associated with physical activity

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Abstract

The school is an important setting for physical activity. The purpose of the present study was to examine the association between physical environmental characteristics and participation in daily physical activity during school breaks. Data from 130 schools and 16 471 students (Grades 4–10) in Norway were obtained in 2004 through self-administered questionnaires to principals and students. Multilevel logistic regression models revealed that boys at secondary level with a larger number of outdoor facilities at school had 2.69 times [95% confidence interval (CI) = 1.21–5.98] and girls 2.90 times (95% CI = 1.32–6.37) higher odds of being physically active compared with students in schools with fewer facilities. Boys at secondary level with areas for hopscotch/skipping rope had 2.53 times (95% CI = 1.55–4.13), with a soccer field 1.68 times (95% CI = 1.15–2.45), with playground equipment 1.66 times (95% CI = 1.16–2.37) and with a sledding hill 1.70 times (95% CI = 1.23–2.35) higher odds to be physically active compared with students in schools without these facilities. A sledding hill was also associated with girls' physical activity participation

in secondary school (odds ratio = 1.58, 95% CI = 1.11–2.24). Outdoor facilities in secondary schools are associated with students' daily physical activity participation during school breaks. Therefore, improving the outdoor environment should be considered in physical activity promotion school programs in secondary schools.

Introduction

Large proportions of children and adolescents in western countries [1, 2] report that they do not participate in moderate to vigorous physical activity (VPA) for 60 min on most days as recommended [3] to achieve health benefits [4]. The health consequences of an inactive lifestyle together with the rising prevalence of childhood obesity from early age have become global concerns [3, 5–7]. Effective programmes are needed to increase physical activity levels and such interventions should be based on evidence of efficacy. Until recently, studies mainly examined individual correlates of physical activity, such as demographic differences and cognitive, affective and social correlates [8]. Such correlates have, however, captured a relatively small percentage of the variance of physical activity behaviour [9].

There has been growing attention given to the use of ecological models as frameworks for addressing multiple levels of influences on an individual's engagement in physical activity [10]. Levels of influence generally included are intrapersonal, interpersonal, sociocultural and the physical environment [9]. By taking into account the environmental impact on physical activity, ecological

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models distinguish themselves from earlier theories by considering a broader range of potential approaches for promoting physical activity. Identifying the factors in the physical environment that are associated with young people's physical activity can reveal promising determinants and lead to more effective intervention strategies [11]. However, so far research on environmental influences on young peoples' physical activity behaviour has been limited and revealed ambiguous results [8, 12, 13].

As nearly all children attend school, international and national policy documents have identified the school as a key setting for promoting physical activity for young people [3, 14–18]. The school arena provides several opportunities for students to be physically active, including lunch breaks and recess periods [19–21]. Recess can be defined as regularly scheduled time for unstructured physical activity and play [21]. Norwegian schools provide students in general with several recess periods daily throughout secondary school and a longer after lunch break. A recent review found that students' involvement in physical activity during such non-curricular school time can contribute to 5–40% of the recommended daily 60 min [22]. Only a small number of studies have examined the impact of characteristics of the school environment on students' activity during recess and lunch breaks. One study found that area type, size and fixed outdoor equipment, together with supervision and organized activities, explained 59% of the variance for boys' and 42% for girls' observed non-curricular physical activity [23]. However, another observational study found no associations with equipment availability, except for number of balls and VPA, and with a linear decrease in physical activity observed with school size [24]. Also, the provision of extra equipment and supervision [25], extra game equipment [26] and painting the school playgrounds [27] have demonstrated increased physical activity throughout the school day, one with effect sustained over time [28]. In addition, factors such as provision of more storage amenities, fewer facilities barriers and fewer school equipment barriers have been associated with physical activity opportunities (time) in schools [29].

Earlier studies have mostly examined one or a small number of physical environmental factors [12, 13]. The purpose of the current study was to determine the availability of a variety of outdoor characteristics at schools and the associations with students' participation in physical activity during recess time and lunch break.

Methods

School recruitment

The study was based on the cross-sectional baseline data of schools and students participating in a Norwegian nationwide project called 'Physical activity and healthy meals in school' aimed at developing feasible school models for integrating 60-min daily physical activity into school hours. Of the 300 schools that applied in spring 2004, 208 representing all counties and geographical regions in Norway met the criteria for becoming a project school and were invited to participate in the project. In one county (Nordland), all 50 schools met the criteria; half of these schools were randomly selected to take part in the evaluation study. Thus, in total 183 schools were recruited for the baseline study: 115 primary schools (Grades 1–7, age 6–12), 31 secondary schools (Grades 8–10, age 13–15) and 37 combined schools (Grades 1–10). It can be noted that in Norway, almost all students are allocated to a secondary school in the area where they live. Only a few per cent choose to attend another school.

Procedures

Data were collected from September to November 2004. A school-level questionnaire and a student questionnaire to be distributed to all students were sent to the school administration, together with information letters and a standardized description of procedures for the teachers. Information letters were sent to the parents/guardians before the survey with a notification of their right to withdraw their child from the study. Data collection procedures followed the standards for the Health Behaviour in School-aged Children (HBSC) study [30]. The school-level questionnaire was to be completed by

the principal/school leader. The student survey was carried out as an anonymous in-school survey. Schools that did not return the questionnaires within the deadline received two reminders by e-mail. The study was approved by the Privacy Ombudsman for Research, The Norwegian Social Science Data Services.

Study sample and student participation

Of the 183 schools invited to take part in the study, 130 (71%) completed the school-level questionnaire. The final school sample consisted of 80 primary, 21 secondary and 29 combined schools. The mean number of student enrollment for all grades across schools was 215 students (SD = 146). The student survey was, however, only administered to students from Grade 4 (age 8–9) through Grade 10 (age 14–15), in total 19 582 students. Of these, 16 471 (84%) students completed the questionnaire. Some schools reported that not all classes participated due to practical and organizational issues. However, such information was not systematically reported. Of the final student sample, 9613 (58%) were primary level students (Grades 4–7) and 6858 (42%) were secondary level students (Grades 8–10). Sample sizes were equally distributed across genders and ranged across grades from 2084 (Grade 10) to 2487 (Grade 5) students.

Measures

School-level questionnaire

Each principal received a 14-page questionnaire on school policies, environmental and organizational structures related to the possibilities for students to be physically active and eat healthily at school. The items were derived from a questionnaire used in a Norwegian national school survey in 2000 [31].

To assess physical school characteristics, the following item was asked: ‘What facilities exist in the indoor environment and the school surroundings available for physical activity’. The item contained a list of 11 features found or assumed to be relevant for physical activity in a Nordic school setting. A hall for gymnastics or a sports hall was available in all schools, and a swimming hall was not considered relevant for school breaks.

Therefore, the following eight outdoor facilities that were included in the study: soccer field, courts for other ball activities, areas with marks for hopscotch/skipping rope, an outdoor obstacle course, a sledding hill, areas for boarding/skating, green spaces/forest areas and playground equipment. An ‘outdoor facility index’ was computed by adding facilities and standardizing the score to the range of facilities (0–8), with a score of 1 indicating the maximum number of facilities and a score of 0 indicating the lowest number of facilities.

To assess total recess time, the following item was asked: ‘The list below presents various alternatives for the duration recess periods. How many recess periods of the following categories did students at each grade level have in the course of a regular school day?’ [Less than 10 minutes, 10–14 minutes, 15–19 minutes, 20–24 minutes, 25 minutes or more]. In Norway, it is educational policy to provide students with several daily recess periods from Grades 1 to 10 in addition to the extended recess following the lunch. However, based on known variations in the structural composition, responses were reported separately for 1–4 Grades, 5–7 Grades and 8–10 Grades. A sum score of daily recess minutes was created, with the time categories converted to the following middle scores: <10 = 7, 10–14 = 12, 15–19 = 17, 20–24 = 22 and ≥25 = 30 min.

Student questionnaire

The students received a two-page questionnaire, with three items assessing physical activity during school classes, transportation to school and during recess. The recess item was ‘How OFTEN during recess are you physically active in a way that makes you out of breath and/or sweat?’ [Every recess, two recesses or more per day, less than two recesses per day, not every day but still every week, not every week, never]. The wording of the item refers to engagement in activities generally thought of as VPA [32]. However, children characteristically involve in alternating moderate to vigorous activity with small rest periods [32]. The physical activity quantified by this item should consequently not be interpreted only as vigorous activity, but

participation in typical non-organized physical activities. The item has been used in the Norwegian part of the HBSC studies [33], and in a test-retest study of students aged 13 and 15 years, the intra-class correlation coefficient score was 0.68, indicating moderate stability [34].

Prior to the Norwegian HBSC study data collections, also comprehensive qualitative pilot studies have been conducted for both primary and secondary schools to ensure psychometric quality and to verify item comprehension, clarity face validity and ease of completion.

Data analysis

Using SPSS for Windows v. 13.0, the student sample was split by gender, and separate analyses were conducted for students at primary school (Grades 4–7) and secondary school (Grades 8–10) levels. The response categories of the item assessing participation in physical activity during recess were converted to dichotomous variables, with the first three responses categorized as being ‘daily physically active in recess time’. Pearson’s correlation was used to test for total recess time as a possible confounder. The correlation between number of facilities and total recess time was not significant (Grades 5–7; $r = -0.017$ and Grades 8–10; $r = 0.049$, NS). Therefore, the association between physical activity time and number of facilities could not be explained by total recess time. The chi-square test with Yates’ correction for continuity was used to examine gender and grade differences in physical activity participation. A multilevel logistic regression analysis with random effects for schools was conducted using the xtlogit command in STATA 9.0 SE. In separate analyses for primary and secondary school-level students, the regression was calculated for physical activity against each of the outdoor facilities.

Results

Participation in physical activity

Overall, 73% of the boys and 57% of the girls at the primary school level reported daily participation in

physical activity during recess. For students at the secondary school level, the prevalence was 38 and 21%, respectively. The participation in physical activity during recess for each grade is presented in Table I. For all grades, significantly more boys than girls were engaged in physical activity. The participation reached a peak in Grade 6 for both genders. A significant reduction in physical activity from the previous grade was observed in the higher grades, starting from Grade 7 for girls and Grade 8 for boys.

Recess time

The mean sum score for daily recess time was 52.0 (± 15.6) min for Grades 1–4, while for Grades 5–7 it was 57.8 (± 12.7) and for Grades 8–10 it was 57.8 (± 11.1).

Facilities for physical activity

The most frequently available outdoor facilities for students across schools were areas for hopscotch/skipping rope, soccer fields and courts for other ball games (Table II). It can be seen that the proportion of students having each of the included facilities available was highest among primary school-level students.

Considerable variations were observed in the total number of outdoor facilities that students were offered. While 65% of the students at primary level had six or more facilities available, only 20% of the students at secondary level were offered this number. Among students at secondary level, 47% had three or fewer facilities available.

Table I. Prevalence (%) of boys and girls being daily physically active during recess by grade

Gender	Grade						
	4	5	6	7	8	9	10
Boys	72 ^a	71 ^a	76 ^{ab}	73 ^a	46 ^{ab}	39 ^{ab}	28 ^{ab}
Girls	58	59	60	54 ^b	28 ^b	21 ^b	13 ^b

^a $P < 0.05$, Yates chi-square test indicating significant differences between genders.

^b $P < 0.05$, Yates chi-square test indicating significant difference from previous grade.

Associations between the characteristics of school environment and participation in physical activity

Table III shows the bivariate associations between daily physical activity during recess and the avail-

Table II. Proportion of students (%) having each of the specific facilities available according to school grade level

Facilities	Primary level students	Secondary level students	Total
Areas for hopscotch/skipping rope	100	76	90
Soccer field	93	81	88
Areas for other ball games	90	77	85
Green spaces/forest areas	73	63	69
Playground equipment	90	21	61
Sledding hill	72	30	55
Areas for boarding/skating	27	26	27
Outdoor obstacle course	31	14	24

ability of facilities and the relationship between physical activity and the outdoor facility index. Higher odds for recess activity are observed for boys at secondary level in schools with soccer field, playground equipment, sledding hill and area for hopscotch/skipping available, compared with those without each of these facilities. Access to a sledding hill was also a predictor for daily recess activity for secondary level girls. It can be seen that students at the secondary level with a larger number of outdoor facilities available had almost three times higher odds to be daily active during recess compared with students with fewer facilities. No associations were observed for students at primary school level.

Discussion

In the present study, schools scheduled on average almost 1 hour daily for recess time, which make this context to a promising complementary setting for physical activity promotion. So far, few studies

Table III. ORs and 95% CIs from multilevel logistic regression models predicting daily physical activity participation during recess—primary and secondary school level

Variables		Primary level students (Grades 4–7)		Secondary level students (Grades 8–10)	
		OR	95% CI	OR	95% CI
Soccer field	Boys	1.01	0.71–1.44	1.68*	1.15–2.45
	Girls	0.78	0.49–1.2	0.98	0.64–1.52
Areas for other ball games	Boys	1.22	0.34–4.33	1.06	0.79–1.43
	Girls	1.19	0.82–1.72	1.49	0.88–2.53
Areas for hopscotch/skipping rope	Boys	1.19	0.88–1.60	2.53*	1.55–4.13
	Girls	0.39	0.09–1.69	1.60	0.97–2.66
Playground equipment	Boys	1.20	0.88–1.63	1.66*	1.16–2.37
	Girls	1.33	0.91–1.96	1.39	0.95–2.04
Outdoor obstacle course	Boys	1.07	0.88–1.30	1.11	0.60–2.08
	Girls	1.16	0.91–1.47	1.44	0.93–2.25
Sledding hill	Boys	1.10	0.90–1.35	1.70*	1.23–2.35
	Girls	1.09	0.84–1.42	1.58*	1.11–2.24
Green spaces/forest areas	Boys	1.08	0.87–1.34	0.95	0.73–1.25
	Girls	1.26	0.96–1.65	1.22	0.84–1.79
Areas for boarding/skating	Boys	1.06	0.86–1.32	0.89	0.64–1.23
	Girls	1.03	0.79–1.35	0.99	0.67–1.45
Outdoor facility index (0–1) ^a	Boys	1.43	0.86–0.40	2.69*	1.21–5.98
	Girls	1.57	0.82–2.99	2.90*	1.32–6.37

OR, odds ratio.

^aSummarized and standardized score, with 1 indicating the maximum and 0 lowest number of facilities. **P* < 0.05.

have examined how the physical school environment can influence participation in physical activity during recess periods. The present study demonstrates that secondary level students with larger number of outdoor facilities available had almost three times higher odds to participate in daily physical activity during recess compared with students with fewer facilities. In addition, four of eight characteristics (soccer fields, areas for hopscotch/skipping rope, playground equipment and sledding hill) were significant predictors for daily physical activity for boys and one (sledding hill) for girls. The findings correspond to previous research suggesting that improvements of the physical school environment can increase physical activity participation in recess and lunch time [23, 25–27, 35] and give support to the World Health Organization guidelines recommending that appropriate facilities and equipment can promote physical activity in schools [3].

No significant relationships were found for students at the primary school level, which could be due to several factors. Younger children are thought to have a stronger biological drive to be physically active [36]. In the study, the overall participation in recess physical activity for primary school children was high, resulting in less variance. There was in addition less variation in available facilities across primary school. Along with the probability of more inaccurate reporting among primary school students, these factors may have suppressed associations. It can also be that children's activity is not as specific in primary school and that they consider the environment as an opportunity to be active regardless of the facilities available. For both genders, the peak in physical activity participation was observed in Grade 6, followed by a significant reduction for each grade level starting from Grade 7 for girls and Grade 8 for boys. However, the biggest change was observed from Grade 7 to Grade 8 for both genders. This period represents the transition to secondary school. In the study, secondary level students had considerably less facilities available, which could explain part of the reduced participation at secondary grade level. Lack of motivating school environments has been reported as one of the main reasons

why adolescents are less physically active during school time than desired [37].

At every grade level, a higher percentage of boys compared with girls were daily physically active during recess, in line with several other studies [22, 26, 38, 39]. Differences in physical activity have been linked to gender role patterns. Girls seem to be more interested in using recess time to socialize with others and less interested in vigorous sport activities compared with boys [40–42]. Sport activities are often related to competition and achievement, these elements have been reported as reasons for not participating in physical activity in school among girls [43]. In the present study, soccer fields and hopscotch/skipping rope areas, the most common facilities across schools, were only associated with recess activity for boys. The latter characteristics could be an indicator of having additional asphalt fields that can be used for ball activities. These findings are in accordance with several observational studies reporting that school fields predominantly have been used by boys for soccer and football during breaks, with girls remaining passive and not claim their share of the activity settings [39, 41]. Thus, although areas and facilities are physically available for all students, not all girls may perceive these as accessible or enjoyable as boys. Despite the finding that schools were a frequent neighbourhood resource for physical activity uptake, two American studies found no association between number of schools in the neighbourhood and weekend physical activity among sixth-grade girls [44] or total physical activity among 12th-grade girls [45]. These findings support the assumption that school grounds and the available facilities may not be attractive for girls' physical activity interests. To increase their physical activity levels, girls have suggested more equal opportunities and more choices of activities in school and programmes, including activities such as dancing and gymnastics [37, 43]. Interestingly, soccer is one of the most popular organized sport activities in after-school hours among Norwegian girls [46], which demonstrates that physical activity preferences may vary across settings. Nevertheless, the present study demonstrated that the likelihood for

girls to be active increased significantly with higher accumulated numbers of facilities. This could be related to less competition for existing spaces or facilities.

As acknowledged by ecological models [9], several context-specific factors should be taken into account when addressing a complex behaviour like physical activity. Especially among young people, physical activity should to a large extent be regarded as a social activity [47]. The influences of school specific psychosocial factors have so far received little attention. However, in a recent study of urban 9- and 15-year-old Norwegian students, general enjoyment of physical activity, enjoyment of Physical Education, support from peers and support from teachers were all predictors of informal games play in school, but the associations were strongly moderated by age [48]. Interestingly, perceived physical competence was negatively related to physical activity in recess and after-school hours. The author suggests that a less explicit focus on physical skills and abilities makes this context viable for less competent students [48]. More in-depth research that simultaneously addresses the impact of individual level factors, sociocultural factors and a wide range of environmental factors, and the interaction between them, is required to get a better understanding of the pathway to physical activity participation in this setting.

A limitation of the study was the use of self-report assessment of physical activity and the lack of psychometric information on the use of the recess physical activity item for children under the age of 13. It is recognized that the sporadic nature of children's physical activity and their cognitive functioning reduces children's ability to accurately recall intensity, frequency and duration, and only moderate correlations have been found between self-reports and more objective measurements [49, 50]. In the present study, the physical activity item referred to a specific setting and level of intensity that could have increased the accuracy in reporting. The dichotomizing of the physical activity responses may also have increased the numbers of students correctly categorized. Other individual level data known to be associated with physical activity such

as indicators of socio-economic status (SES) was not collected and could not be controlled for. However, a study of a representative sample of Norwegian school children found no differences in recess physical activity across SES family status [51]. The subjective assessment of the characteristics of the school environment could also have reduced the accuracy of the data, as it is not clear if the principals interpreted each area in the same way. Direct observation of the available facilities could have increased the quality of the data and identified if the characteristics were used for purposes other than the activity they were designed or labelled for. In this study, it was, however, not feasible.

Conclusions and implications

Low rates of daily recess physical activity together with few facilities available for students in secondary schools demonstrates a great potential for improvements. It is thus encouraging that the availability of outdoor facilities in secondary schools was found to be associated with students' engagement in physical activity during recess. Since environmental changes can influence the whole student population, with new groups continuously being exposed to the environment, effects of such improvements can be multiplied. Involving the students in the identification of attractive settings seems like a promising approach to promote recess physical activity.

The findings support an ecological approach to the promotion of physical activity and should encourage researchers and practitioners to apply a multilevel framework that includes a focus on the physical environment, when developing policies and interventions in schools. Studies using more objective methods to assess physical activity and to identify modifiable school facilitators are warranted to more accurately assess associations. A step further would also be to include more factors on different levels like social, psychological and cognitive factors as well as more organizational school environmental factors.

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Conflict of interest statement

None declared.

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