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Promoting public playgrounds usage and children's physical activity with sports activities: A quasi-experimental study

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ABSTRACT

This study aimed to evaluate the children's usage and their physical activity levels at playgrounds with (N = 4) and without (N = 4) organized sports activities, following a quasi-experimental study design. Direct observations were used to assess the playground usage and estimate the playground users' age category, sex, and physical activity intensity level. The results indicated that playgrounds with sports activities were associated with 53% more users at the time of the activities. However, this increase was only seen in boys. Furthermore, playgrounds with sport activities were not associated with different physical activity levels in children as compared to children on regular playgrounds.

1. Introduction

Sufficient physical activity, such as active transport, leisure-time exercise, sports and playing, is essential for developing and maintaining physical, mental and social health (Ekelund et al., 2019; World Health Organization, 2019). Particularly for children, meeting the physical activity guidelines (World Health Organization, 2019) is important as it is associated with numerous health benefits such as higher cardiorespiratory fitness (Janssen and LeBlanc, 2010; Poitras et al., 2016), higher muscular strength (Morrow et al., 2013), higher motor competence (Dapp et al., 2021), less body fatness (Janssen and LeBlanc, 2010), and less depressive symptoms (Biddle and Asare, 2011). Also, physical activity behaviors in childhood are associated with physical activity behaviors in adolescence and adulthood (Batista et al., 2019). This altogether makes regularly active children less prone to developing chronic diseases in the long term. Hence, the promotion of physical activity in children is an important objective (World Health Organization, 2019).

Over the past two decades, the ecological model of active living was a foundational framework for promoting physical activity behaviors. This model highlights the need for multilevel interventions targeting individuals and their social, physical, and policy environment (Sallis et al., 2006). Meanwhile, a growing body of literature has strengthened the ecological rationale for physical activity promotion. For example, the

literature indicated that physical activity stimulating parents (social environment), school physical activity policy (policy environment), and the proximity of public playgrounds and parks (physical environment) are positively associated with physical activity behaviors in children (van et al., 2022; Sterdt et al., 2014).

Given that a substantial portion of children's physical activity involves playing outside (Remmers et al., 2019), the living environment of children must facilitate easy access to public playgrounds. Besides its proximity, the usage of playgrounds is influenced by physical factors such as the number of play structures, a zonal design, small equipment availability, and markings, all of which have positive relations with playground usage in children (Dalene et al., 2016; Cohen et al., 2020; Reimers and Knapp, 2017; Gustat et al., 2020). Less is known about the social factors influencing playground usage of children, but findings suggest that the provision of supervision and organizing events or activities at playgrounds may be related to its usage during after-school hours on weekdays and weekends (Boonzajer Flaes et al., 2016).

In alignment with the ecological rationale, Dutch municipalities increasingly promote public playground usage by organizing sports activities for children. These activities are usually facilitated by a neighbourhood sports coach, which ensures high accessibility and a physically and socially safe environment for physical activity of local children. However, the efficacy of this approach in increasing playground usage and physical activity levels in children, and potential

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gender differences, remain unexplored. Increasing insight into this would be beneficial for informing municipal policy development regarding sports and physical activity in public spaces. Therefore, this study aimed to evaluate the children’s usage and physical activity intensity at playgrounds with organized sports activities as compared to playgrounds without organized activities. It was hypothesized that playgrounds with organized sports activities attract more children and that children at those playgrounds are also more active.

2. Materials and methods

2.1. Study design

In this quasi-experimental study, we evaluated usage and children’s physical activity levels on four playgrounds with organized sports activities and four matched control playgrounds in Almere, the Netherlands. We collected data between April 2023 and June 2023 using direct observations. Informed consent was not required in this study because only anonymous data was obtained. This study’s data acquisition procedures were approved by The Medical Ethics Committee of the VU University Medical Centre (#2022.0086).

2.2. Playgrounds

At the time of this study, a local sports provider organized school playgrounds sports (SPS) on four school playgrounds. These playgrounds were included in the study and matched to a control playground in an adjacent neighbourhood based on playground characteristics (i.e., size, amenities). The distance between the paired playgrounds was between 550 and 1.300 m. All neighbourhood characteristics were derived from CBS statline (CBS, 2022). Playground characteristics were inventoried during a site visit before the observations. See Table 1 for the neighbourhood and playgrounds characteristics.

The SPS activities were provided once a week in the afternoon and consisted of 1-h group sports activities like soccer, flag football, and

other types of games and were facilitated by a professional sports neighbourhood coach. During the study, all SPS activities were delivered by the same female sports neighbourhood coach. Communication about the activities was done by a municipality website, local newspapers and magazines, and the sports providers’ social media. Also, the sports neighbourhood coach visited local schools to promote the SPS activities. Participation in the sports activities was free of charge and preferably with a subscription, but all children aged 6–12 years at the playground at the time of the activity were allowed to participate. Children already playing at the playground at the start of the activity were invited to join the activity.

2.3. Observations

We used the System for Observing Play and Recreation in Communities (SOPARC) protocol (McKenzie et al., 2006) to assess playground usage and estimate the playground users’ age category, sex, and physical activity intensity level. The SOPARC protocol is the most common protocol used in previous research to assess usage of parks and open spaces and estimate the users’ physical activity levels (Evenson et al., 2016). It has been validated and shown to have excellent agreement for the number of observed people and their sex and age category, and fair to good agreement for the physical activity levels, whereas the lowest agreement was found for vigorous PA (Marquet et al., 2019; Agaronov et al., 2018). Hence, to increase the reliability of our data we decided to adjust the observation protocol by combining the moderate and vigorous activity levels into one category (MVPA) (Agaronov et al., 2018).

The playgrounds were divided into smaller target areas following the SOPARC protocol. We performed the observations simultaneously on both the SPS playground and the control playground. We made sure that a sports activity was organized at the SPS playground. On these playgrounds, five consecutive scans were conducted every 10 min at the pre-determined target areas on four different days. This is considered a sufficient amount of observations to provide a robust estimation of

Table 1
Playground and their surrounding neighbourhood characteristics.

	SPS (N = 4)				Control (N = 4)			
	1	2	3	4	1	2	3	4
<i>Neighbourhood</i>								
No. inhabitants	4395	3985	7095	5795	4005	5265	5975	5025
% children (0-14y)	17.2	18.9	23.1	19.1	16.7	16.7	18.7	17.7
No. households	1930	1720	2620	2165	1665	2350	2380	2015
% households with children	39.6	41.6	51.9	54.5	45.9	40.0	48.3	49.6
<i>Playground</i>								
Target area's (No.)	7	7	7	6	6	6	7	4
Size (Ha)	0.93	0.36	0.18	0.14	0.17	0.25	0.30	0.27
Type play feature (Y/N)								
Balance beam	Y	Y	N	N	Y	N	N	Y
Basket	N	N	Y	Y	Y	Y	Y	Y
Benches/picnic table	Y	Y	N	Y	N	N	N	Y
Climber	Y	Y	Y	Y	Y	Y	Y	Y
Free play area	Y	Y	Y	Y	Y	Y	Y	Y
Markings	Y	Y	N	Y	Y	Y	Y	Y
Multi-sports field	Y	Y	Y	Y	Y	Y	Y	Y
Play panel	N	N	N	N	N	Y	N	N
Playhouse	N	Y	N	Y	Y	Y	N	N
Sandpit	N	Y	N	N	N	Y	N	N
Slide	Y	Y	Y	Y	N	Y	N	Y
Swing	Y	N	Y	N	N	Y	Y	Y
Spinner	N	N	N	Y	N	N	N	N
Table tennis/football	Y	N	Y	Y	Y	Y	Y	Y
Tumble bars	N	N	N	N	N	Y	Y	Y
Volleyball field	N	N	Y	N	N	N	N	N

SPS, school playgrounds sports; N, sample size; y, year; No., number; Ha, hectare; Y, yes; N, no.

playground usage (Cohen et al., 2011). Two trained research assistants collected the data. Their training comprised of online tutorials on the SOPARC protocol, and by conducting a practice observation session. Per the SOPARC protocol, observations were only conducted when weather conditions allowed normal playground use.

2.4. Data analysis and statistics

The outcome measures were the number of children on the playground and their physical activity levels (sedentary/MVPA). The independent variable was playground type (control/SPS). The proportion of children in MVPA was calculated, per scan, by dividing the total number of observed children by the number of children in MVPA. This was also calculated for boys and girls separately. The differences in the physical activity levels (%MVPA) between boys and girls were analyzed using independent samples t-tests. To analyze the association between playground type and the outcome variables Generalized Estimating Equation analyses were conducted, considering the clustering of the data within two levels; the playground and the day of measurements. After checking the distribution of the data, different models were compared, using the quasi-likelihood under the independence model criterion, to select the best-performing models. For analysis of the association between playground type and the number of observed children, we used a negative binomial regression model to account for the overdispersion of the data. We used a linear regression model to analyze the association between playground type and the proportion of children in MVPA, expressed by an Incidence Rate Ratio (IRR). No neighbourhood or playground variables were included in the models as covariates, because this reduced model performance. In all analyses, an exchangeable working matrix was used. P-values and confidence intervals (CI) were considered to assess the results' significance. All statistical analyses were conducted using IBM SPSS version 29 (SPSS Inc.).

3. Results

More children were, on average, observed at SPS playgrounds ($M = 20.3$, $SD = 7.6$) compared to the control playgrounds ($M = 13.3$, $SD = 14.1$) (Table 2). Usage of the SPS playgrounds was higher than the control playgrounds but this difference was not significant ($IRR = 1.528$, 95% CI: 0.971–2.405, $p = 0.067$). Significantly more boys were observed at SPS playgrounds ($IRR = 1.914$, 95% CI: 1.243–2.947, $p = 0.003$). For girls, usage of the playgrounds was similar ($IRR = 1.068$, 95% CI: 0.616–1.853, $p = 0.815$) (Table 3).

On average 43.6% ($SD = 21.9$) of the children were physically active at the playgrounds (Table 2). Boys were significantly more active than girls at the playgrounds in general ($p = 0.008$) and at the SPS playgrounds ($p = 0.015$) in particular. The proportion of boys and girls in MVPA was similar at the control playgrounds ($p = 0.148$). The proportion of MVPA was not significantly different between the SPS and control playgrounds for all the children ($p = 0.714$), boys ($p = 0.936$) and girls ($p = 0.882$) (Table 3).

Table 2
Playground users and their PA level per playground type.

	All playgrounds (N = 8)		SPS (N = 4)		Control (N = 4)	
	Mean	SD	Mean	SD	Mean	SD
<i>Playground users (No.)</i>						
Children	16,81	11,82	20,33	7,64	13,30	14,08
Boys	10,54	7,41	13,85	5,59	7,24	7,57
Girls	6,27	5,71	6,48	3,99	6,06	7,04
<i>MVPA (%)</i>						
Children	43,63	21,87	42,66	14,10	44,75	28,41
Boys	45,54	24,31	45,32	17,76	45,80	30,41
Girls	37,25	26,73	36,90	24,42	37,75	29,89

N, sample size; SPS, school playground sports; SD, standard deviation; No., number.

4. Discussion

In this study, we sought to evaluate children's usage and physical activity levels at playgrounds with organized sports activities as compared to matched regular playgrounds. The main findings are that the SPS playgrounds are associated with a factor 1.53 (i.e. 53%) higher playground usage. However, this difference was attributable to a factor 1.91 (i.e. 91%) increase in observed boys at the SPS playgrounds. Despite that boys were, in general, more active than girls, the observed children's physical activity levels were similar on the playgrounds with and without the SPS activities.

Previous studies on playgrounds often focused on the physical features. The literature indicated that factors such as innovative design (Cohen et al., 2023), size (Talarowski et al., 2019), and the number of play structures (Cohen et al., 2020; Reimers and Knapp, 2017; Gustat et al., 2023; Colabianchi et al., 2011) are associated with playground usage. The literature also indicated that children themselves prefer large adventurous playgrounds with interesting play equipment and areas, such as climbable objects, sports courts and playable natural elements (e.g. trees, rocks) (Veitch et al., 2020, 2021). Despite the fact that studies that evaluated the effect of organized sports activities on playground usage are very scarce, the literature suggests that organizing activities is associated with increased usage of public playgrounds (Boonzajer Flaes et al., 2016) and parks (Cohen et al., 2010, 2012). Our study adds that the provision of SPS, as a social-environmental approach, is associated with substantially higher playground usage by boys. This is a promising result because SPS is a flexible and relatively easy-to-implement intervention strategy. Nevertheless, the question of whether this contributes to increasing physical activity overall in children remains and may be relevant to investigate in the future.

Gender differences in outdoor play are well established within the literature (Cohen et al., 2020; Evenson et al., 2016; Helleman et al., 2023; Joseph and Maddock, 2016), indicating that boys, compared to girls, use playgrounds more and engage in more MVPA. SPS seems to reinforce these gender differences. This may be due to the type of activity, as SPS was oriented towards group and sports activities, such as soccer, flag football and other games. Typically, such competitive activities are more boy-oriented and, as literature shows, girls may feel unwanted, incompetent or chased away at such activities alongside boys (Slater and Tiggemann, 2011). Girls are generally more attracted to free play and individual activities (Eime et al., 2010; Liu et al., 2013). Despite that, in our study, all SPS activities were delivered by a female neighbourhood sports coach, we still observed primarily boys at the playgrounds. Hence, the coach's gender may not be a major factor in attracting girls. This suggests that it may be unlikely to assume that the provision of sports activities on playgrounds will reach genders equally, as observed in our study. Considering such gender differences in the delivery of playground activities by providing appropriate activities for girls and the use of role models, is deemed essential.

Numerous studies have explored the influence of playground design on the physical activity levels of children. A review study by Pfladderer et al. (2022) indicated that playground interventions successfully increasing the physical activity levels in children included the addition of marking, zonal design, and adding small equipment or novel structures (Pfladderer et al., 2022). Our study adds that, despite that more children were present at SPS playgrounds, the children's physical activity levels appeared to be similar at SPS playgrounds and regular playgrounds. These results correspond with the findings from Tortella et al. (2019) (Tortella et al., 2019). They observed, with accelerometers, similar physical activity levels in children during free play and organized sessions on a playground. Organizing sports activities may, therefore, not be successful in increasing children's physical activity levels on public playgrounds. This also indicates that children are very well able to play actively by themselves. Sports activities may therefore be better suited for contributing to other relevant factors of outdoor play, such as the duration of play, social play, skill development, and

Table 3
Results from the GEE analysis.

	B	SE	95% CI for B		p	IRR	95% CI for IRR	
			Lower	Upper			Lower	Upper
<i>Playground users</i>								
Children	0,424	0,231	-0,029	0,878	0,067	1,528	0,971	2,405
Boys	0,649	0,220	0,217	1,081	0,003^a	1,914	1,243	2,947
Girls	0,066	0,281	-0,485	0,617	0,815	1,068	0,616	1,853
<i>MVPA</i>								
Children	-2,094	5,710	-13,285	9,097	0,714			
Boys	-0,480	5,987	-12,215	11,254	0,936			
Girls	-0,845	5,686	-11,989	10,299	0,882			

B, unstandardized regression coefficient; SE, standard error; CI, confidence interval; IRR, incidence rate ratio; MVPA, moderate to vigorous physical activity.

^a Significant at $p < .01$.

enjoyment. However, how organized sports activities impact those factors has yet to be established.

Although this study provided valuable insight, this study also had some limitations that should be kept in mind when interpreting the results of this study. First, given the natural experimental study design, we could not control the allocation, content and promotion of SPS nor for potential novelty effects. Therefore, caution is advised in projecting our results to a broader implementation of sports activities on public playgrounds. Second, despite that our study collected sufficient data on the usage of individual playgrounds (Evenson et al., 2016), the low number of playgrounds in this study limited the possibility of controlling the analysis for neighbourhood characteristics. This could be relevant because it can be assumed that neighbourhoods with higher proportions of child inhabitants are associated with more children playing in playgrounds. To control the analysis for those factors, a higher number of playgrounds is needed. Therefore, we can not estimate to what extent our results are related to neighbourhood characteristics. Besides, all playgrounds were located in an urban area which limits translation of the results to other areas. Third, playground usage changes across the seasons (Roemmich and Johnson, 2014). As we collected data between April and June it remains to be determined how our results depend on seasonality. Fourth, the influence of organized sports activities may differ for younger and older children, which may be relevant to evaluate in future studies. Finally, given that the observations were conducted during SPS activities at the SPS playgrounds and simultaneously at control playgrounds the results from this study only relate to the time-frame of the SPS activities. We are uncertain about how these results translate to playground usage in general.

In conclusion, this study indicated that SPS playgrounds were associated with a 53% increase in playground usage at the time of the activities. However, given that this difference fully comprised of boys (91% increase) this study indicated that SPS mainly attracts boys. Furthermore, SPS playgrounds were not associated with different physical activity levels in children as compared to children on regular playgrounds. Thus, providing sports activities on public playgrounds may be a viable approach to increase public playground usage by boys. To increase playground usage by girls, a different approach is needed. Based on the results of this study, policy makers and other professionals involved in playgrounds are advised to consider organized sports activities as a strategy to 'activate' playgrounds. This may be particularly relevant in urban areas with a relatively high proportion of children or deprived neighbourhoods with limited opportunities for (safe) outdoor play. Regarding playground (re)design, local sports providers (i.e. the sports neighbourhood coaches) can be considered important stakeholders. They can provide practical insights to ensure that playgrounds are (re)designed to be suitable for organized sports or play activities. Furthermore, care is advised for tailoring the organized playground activities to the local situation and, preferably, obtain balanced participation of boys and girls.

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CRediT authorship contribution statement

S. Blienkendaal: Writing – original draft, Methodology, Formal analysis, Conceptualization. **J. Nauta:** Writing – review & editing.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability

Data will be made available on request.

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