



## Original research

# PACE: A group randomised controlled trial to increase children's break-time playground physical activity



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## ABSTRACT

**Objectives:** To assess the effect of a school playground intervention on the physical activity levels of primary/elementary aged children.

**Design:** Two-arm parallel group randomized controlled trial.

**Methods:** In 2011, children aged 4–13 years from thirteen primary/elementary schools (in Illawarra, New South Wales, Australia) were invited to participate in the study. School recruitment was based on existing policies, equipment and willingness to participate. Participating schools were randomly allocated to the intervention or control using the 'hat and draw' method. The intervention was delivered over four months. Intervention schools introduced policy changes and portable equipment to break-time after baseline measures were collected. The primary outcome was the proportion of break-time spent in Moderate to Vigorous Physical Activity (MVPA) assessed by the System for Observing Playground Activity in Youth (SOPLAY). The analysis involved linear mixed models adjusting for the clustering effect of schools. The study is registered with the Australian New Zealand Clinical Trials Registry (ACTRN12614001128684).

**Results:** Four schools (two intervention and two control) met the inclusion criteria (1582 children: 790 males; 267 controls, total of 792 females; 248 controls). Students from the intervention schools had a greater increase at follow-up in the proportion of break-time in MVPA; (adjusted difference = 12.5 percentage points, 95% CI [−13.0%, 38.0%];  $P=0.17$ ;  $r=0.6$ ) compared to the controls. MVPA at recess significantly increased (adjusted difference = 18.0 percentage points, 95% CI [6.9%, 29.1%];  $P=0.02$ ; effect size = 0.7). There were no significant increases in MVPA when examining overall break times. Results were greater for girls compared to boys.

**Conclusions:** Making environmental and policy changes are promising strategies for promoting health-enhancing physical activity during school break-time.

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## 1. Introduction

Due to established health benefits,<sup>1</sup> international recommendations specify that children should accumulate 60 min of physical activity daily.<sup>2</sup> However, children spend large portions of their day being sedentary,<sup>3</sup> with sedentary past-times in the home environment further jeopardizing children's physical activity levels.<sup>4</sup> The prevalence of sufficient physical activity in children is low in many countries, and research suggests interventions should target

various levels of influence including the home, school and community settings.<sup>5</sup>

The school environment is ideal for the promotion of physical activity as it is a medium that reaches the majority of the population in most countries.<sup>6</sup> Pressures to meet curricular targets can limit class time opportunities for physical activity however school break-times have the potential to contribute up to 40% of children's recommended daily physical activity, making it an ideal setting for physical activity promotion.<sup>7</sup>

Evidence suggests an association between children's school break time physical activity, the introduction of portable equipment (e.g. balls, ropes, hoops), and the potential for policy to influence children's school break time physical activity levels.<sup>7–9</sup>

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However few interventions have investigated the effect of environmental and policy interventions on children's school playground physical activity levels.<sup>8</sup> Some school break time policies, such as 'no hat no play' (The term 'no hat no play' refers to a policy in most Australian primary/elementary schools where children are required to wear a hat at school during break times for sun protection and if they forget their hat they are required to sit for the length of the break-time as punishment) and compulsory break-time sitting periods, may negatively influence children's break time physical activity. This study assessed the effect of an intervention which modified the physical school playground environment and implemented policy changes in order to increase break-time physical activity levels among primary/elementary school children.

## 2. Methods

The reporting of this study is according to the CONSORT guidelines.<sup>10</sup> It is registered with the Australian New Zealand Clinical Trials Registry (ACTRN12614001128684). It was funded by a University Faculty grant. The study was a cluster randomized trial, using a nested cohort design called Physical Activity Children and the Environment (PACE). Thirteen Catholic primary/elementary schools within the Illawarra region of New South Wales, Australia were approached to participate in the study. The study was limited to a maximum of four schools due to funding. There were no changes to the study methods after trial commencement. Permission to conduct the study was gained through the Wollongong Catholic Education office and from principals at each school. The study received ethical approval from the Human Ethics Research Committee (HE11/124).

Schools were recruited based on existing policies, equipment and their willingness to be involved in the study (including to be randomized). This was established during the first contact with the school principal. To be involved in the study children at the schools had limited access to portable equipment, restricted access to larger playground areas, compulsory break sitting time and a 'no hat no play' policy. Recruitment of the schools occurred in June 2011. Passive consent was gained from the students at all four schools to assess observational playground physical activity data.<sup>11</sup> Data were collected within each school setting. The intervention schools implemented a multi-component intervention: involving physical and policy changes to the school playground environment to promote break time physical activity. The intervention duration was 4 months. Baseline data were collected to accommodate school schedules at the end of Term 2 during the week commencing the 10th of June 2011 and 22nd of July 2011 at the start of Term 3. Follow-up data were collected in November 2011.

The first author recruited the schools and liaised with each school principal. A school staff member was nominated as a liaison for the research staff and assisted the implementation of the intervention. The first author developed the randomisation sequence, following baseline measurements. Schools were randomized to either the intervention or control group by having an independent person draw folded pieces of paper with the schools codes on them from a hat. The research assistants were blinded but the environmental changes in the school meant they may have been aware of allocation. For ethical reasons and to minimize bias results from compensatory rivalry and resentful demoralization, the PACE intervention was offered to the control schools at the completion of post-intervention assessment (i.e., wait-list control) (supplementary Fig. 1).

The intervention schools received identical sets of mixed portable equipment (valued at \$800 AUD), including: 10 soccer balls, 10 rugby balls, 10 basketballs, 20 large rubber balls, 80 small bouncy balls, 35 skipping ropes, 45 hoops, two cricket sets and 18

catch cups (cup on a stick, with a long string and ball attached). It was supplied to them after baseline data collection and wait-listed to the control schools after follow up data collection. Schools decided how the equipment was distributed. One school allowed children to take equipment from a classroom tub prior to exiting for the break, the other made equipment available via access to equipment bins freely available in the playground during the break.

Intervention schools were encouraged to participate in the following policy changes after baseline data was collected: a maximum 5 min sitting period at recess and 10 min at lunch, a minimum 5 min extension of each break period, a revision of each schools policies to encourage maximum access to sporting fields during break times and the introduction of a 'no hat, play in the shade' policy (as an alternative to 'no hat, no play'). All of the schools in the study had large outdoor undercover play areas designed for weather protection.

The fidelity of the intervention was monitored between baseline and follow-up data collection. A total of six process evaluations were conducted (at both the intervention and control schools) monitoring: the use of portable equipment, whether students had free access to the equipment, whether teachers were organising games at break-times and whether break time policy changes were being implemented.

The primary outcome for the study was the proportion of time spent in MVPA (Moderate to Vigorous Physical Activity). Physical activity and area contextual characteristics (accessibility, usability, supervision, organized activities and equipment) were assessed via direct observation of school playgrounds using the validated System for Observing Play and Leisure Activity in Youth instrument (SOPLAY).<sup>11</sup> SOPLAY is an objective momentary time sampling observational instrument, where observers scan a predetermined area of the school playground to determine the physical activity level of the children and to record playground characteristics.<sup>12</sup> The playground was assessed, measured and segmented prior to the commencement of the scanning process. Observers agreed upon the size, area and boundaries of each area and recorded them on a school map. Each observer carried and referred to a copy of the segmented map during the break period. Two observers separately rotated around the school playground area moving to a new section every 10 min. The observers continuously scanned each area (from left to right) alternating between males and females until the break time was finished or until they moved to another section of the playground. The physical activity levels of the children are coded during each scan as either sedentary (e.g. lying down, sitting, or standing), walking or vigorous.<sup>13</sup> MVPA was determined by summing the walking and vigorous categories.<sup>11</sup> Student activity was recorded at a rate of approximately one child per second.<sup>13</sup> Scanning took place on three school weekdays.

Six observers were trained to use SOPLAY during an all-day training session at one school in the Illawarra region. To assess the reliability of the observer's use of the SOPLAY instrument at the end of the training session, spearman correlation coefficients were calculated against the gold standard video. There were significant correlations between the observers scans and the gold standard ranging from  $r = 0.83$  to  $r = 0.97$ ,  $p < 0.001$ . Inter-rater reliability was assessed at baseline and follow-up (in the school environment) using Spearman's correlations coefficients. There were significant correlations between the observers  $r = 0.77$  and  $r = 0.97$ ,  $p < 0.001$ .

At the end of the study an anonymous teacher evaluation and reply paid envelope was placed in each teacher's school internal mail box at the schools involved in the study. Teachers were asked to rank their responses using a five point Likert scale (1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree). The teachers were asked if they felt the research was conducted in a manner that was mindful of school activities and routines. Teachers were also asked if they believed that the following changes to policy

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