



Features of the UK childcare environment and associations with preschooler's in-care physical activity

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ABSTRACT

Objective. Features of the childcare environment may influence children's in-care physical activity (PA). We assessed the association between UK preschool care-provider, environmental and policy factors and 3–4-year-olds' average daily in-care sedentary behaviour (SED) and PA.

Methods. In 2013, we used accelerometers to measure the in-care SED/PA of 201 3–4-year-old children (51% female) in 30 preschools in Cambridgeshire, UK, (average wear time: (mean \pm SD) 4.2 \pm 1.3 week-days). We assessed the childcare environment using the Environment and Policy Assessment and Observation tool; demographic and carer information was taken from questionnaires. We used three-level mixed-effects regression analyses (adjusted for sex, in-care time and travel mode to care) to determine the association between childcare factors and children's in-care average daily minutes/hour spent SED, in light PA (LPA) and in moderate-to-vigorous PA (MVPA).

Results. Children spent 5.6 \pm 2.5 h in care per day on average; clustering of PA within preschools was limited (ICCs: 0.003–0.05). Fully adjusted models showed that active opportunities were positively associated with children's in-care SED. No associations with in-care LPA and MVPA were observed.

Conclusion. Few care-provider, environmental and policy factors were associated with children's in-care activity. UK childcare policies advocating child-driven play, moving freely indoors and outdoors, may be more conducive to individual children's PA.

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Background

As the time children spend in out-of-home care increases, the childcare environment is likely to exert a greater influence on young children's activity (Ward et al., 2010). Guidelines for under-5s recommend 180 min of total activity daily (Department of Health, 2011; Tremblay et al., 2012), including light (LPA; e.g. crawling, walking) and moderate-to-vigorous physical activity (MVPA; e.g. running, jumping). Yet low levels of MVPA (Tucker, 2008) in combination with high levels of sedentary behaviour appear common during the childcare day (Reilly, 2010).

Much of the evidence regarding levels of preschool-aged children's activity in childcare comes from the USA and mainland Europe (Troost

et al., 2010) (where 'preschool' is defined as 2.5/3–5/6 years depending on country (The World Bank, 2013)). Positive associations with preschool-aged children's physical activity have been reported for fixed (e.g. climbing frames) and portable (e.g. wheeled) toys, the presence of natural elements (e.g. vegetation), and staff education, training and behaviour in the playground (Troost et al., 2010). In contrast, qualitative work suggests that factors including parental concerns about child safety and emphasis on educational outcomes (Copeland et al., 2012) may result in greater sedentary behaviour. The childcare day in the United States (US), and to a lesser extent in mainland Europe (Raustrop et al., 2012; Cardon and De Bourdeaudhuij, 2008), tends to include structured periods of learning and recess. In the United Kingdom (UK), settings operate a free-flow policy where regardless of weather conditions children self-select activities, both inside and out, for the majority of the day. Understanding how these contextual differences and elements in the UK childcare environment influence preschoolers' physical activity may be beneficial to inform research and practitioners internationally.

This study therefore sought to determine whether elements in the interpersonal, environmental and policy domains are associated with UK 3–4-year-old children's sedentary behaviour and physical activity when in childcare.

Abbreviations: PA, Physical activity; SED, Sedentary; LPA, Light physical activity; MVPA, Moderate-to-vigorous physical activity; ICC, Intra-class correlation co-efficient; SPACE, Studying Physical Activity in preschool-aged Children and their Environment Study; IMD, Index of Multiple Deprivation; EPAO, Environment Policy Assessment and Observation; Ofsted, Office for Standards in Education.

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Table 1
Characteristics of participating settings by type.

	All settings (n = 30)	Nursery ^a (n = 15)	Preschool ^b (n = 15)
<i>Interpersonal</i>			
Children enrolled at setting ^c (mean (SD))	72 (52)	95 (58)	46 (28)
3–4 year-olds enrolled at setting (mean (SD))	44 (30)	49 (33)	38 (25)
Class composition (n (%))			
2–4 year olds	13 (43)	6 (40)	4 (27)
3–4 year olds	17 (57)	9 (60)	11 (73)
% Non-white children (mean (SD))	11.2 (13.6)	15.0 (17.7)	7.4 (6.6)
Government funded places (mean (SD))	33 (24)	27 (15)	37 (30)
Children per staff member ^d (mean (SD))	3.2 (7.1)	3.2 (9.0)	3.2 (5.6)
Preschool Staff (all mean (SD))			
Age in years	38.9 (8.5)	34.9 (7.9)	43.6 (6.7)
Years at setting	6.3 (3.4)	6.6 (3.7)	6.2 (3.3)
Years in childcare	9.7 (5.3)	8.9 (3.3)	10.8 (6.8)
<i>Environmental</i>			
Number of hours observed ^{**} (mean (SD))	7.1 (2.4)	9.1 (1.0)	5.1 (1.5)
Fixed equipment ^e (mean (SD))	4.8 (1.7)	5.0 (1.7)	4.6 (1.7)
Portable equipment ^e (mean (SD))	6.1 (1.5)	6.2 (1.6)	6.1 (1.5)
Reported time spent in GMP (n (%))			
0–60 min	4 (13)	2 (13)	2 (13)
61–120 min	8 (27)	2 (13)	6 (40)
121–180 min	7 (23)	3 (20)	4 (27)
>180 min	11 (37)	8 (53)	3 (20)

GMP: Gross Motor Play; a: Nursery: offers full day care (~7 am–6 pm) for children <1 year up to 4 years 11 months, usually privately run; b: offers sessional care (~9 am–12noon and/or 12noon–3 pm) for children between 2 years 9 months and 4 years 11 months old, usually state-run; c: Number of children enrolled at setting includes all children who attend on weekly basis, regardless of age and study eligibility; d: Calculated as a ratio: number of children in room /number of staff in room; e: refers to the average number of pieces of fixed/ portable play equipment visible at setting. Significant difference by setting type: * $p < 0.05$; ** $p < 0.005$.

Methods

Study design and recruitment

Data were from the “Studying Physical Activity in preschool-aged Children and their Environment (SPACE) Study” (Hesketh et al., 2015). Both preschool (state-run education) and nursery (privately-run care) ‘settings’ were purposively recruited to enable comparison, as they are (usually) differentially funded, operate in different built environments and vary in the care provided (see Table 1). Recruitment and data collection took place in January–July 2013. Detailed information about setting and child recruitment has been published elsewhere (Hesketh et al., 2015). Briefly, 88 settings in Cambridgeshire were approached to participate; 30 (34%) setting managers provided written consent. Within settings, preschool-aged children were eligible to participate (n = 602) if they: were 3–4-years-old; would be present on the designated measurement day; were free from physical disability; and attended the setting for at least 9 h per week. Parents/guardians provided written consent; children provided verbal assent prior to measurement. A minimum of 5 participating children per setting was required to ensure sufficient analytical power. The University of Cambridge Psychology Ethics Committee provided ethical approval for the study (Pre.2012.68).

Data collection

At settings, we fitted children with an Actiheart activity monitor (Cambridge Neurotechnology Ltd, UK), a combined lightweight heart-rate monitor and accelerometer, previously validated in preschool-aged children (Adolph et al., 2012). The unit was secured to the chest, and set to record at 15-second epochs. Written instructions were sent home to the parents, together with a previously validated questionnaire (McMinn et al., 2009) designed to assess potential correlates of physical

activity. We encouraged children to wear the monitor continuously for <7 days, including during water-based activity and sleep.

Outcome variables

Counts data from Actiheart monitors were downloaded and processed using STATA 13/SE. Childcare attendance during the measurement week was reported by parents using a specially designed open-ended question (Hesketh et al., 2015). To reflect when children were most likely to be active and/or in care, we restricted data to between 7 am and 6 pm (maximum 660 min). Although children would plausibly be awake outside these hours, they were not, according to parental report, in care. We removed data periods of >100 min of zero-activity counts (Collings et al., 2013), and days with <600 min of recording (Beets et al., 2011) (average in-care days: (mean \pm SD) 4.2 \pm 1.3 days). We applied a previously validated conversion factor (Ridgway et al., 2011), and used validated cut points (Pate et al., 2006) to classify children’s activity as sedentary (SED: <38 Actigraph counts per 15 s); LPA (>38–420); and MVPA (>421) (Pate et al., 2006). Each child’s activity and location data were matched in 15-minute segments (Hesketh et al., 2015). Only ‘in care’ segments were used in the present analyses; outcome measures were expressed as average daily minutes per hour spent SED, in LPA and MVPA.

Exposure measures

A trained researcher assessed the setting environment using the validated Environment Policy Assessment and Observation (EPAO) tool (Ward et al., 2008). Responses to questions across 8 physical activity sub-domains from the EPAO were scored from 0 to 2 and totalled within a given domain to a possible maximum of 20 points, yielding 8 physical activity subscale scores (Bower et al., 2008). An overall physical activity environment score (possible range 0–160, higher score indicates more supportive environment) was also calculated for each setting (‘EPAO score’).

Additional exposure variables were chosen based on prior evidence (Troost et al., 2010). The average time staff had spent at the setting and as a childcare provider was taken from the questionnaire completed by each carer and used to calculate averages for each setting. Setting managers reported daily minutes children spent in gross motor play (in categories: <60 min; 61–120 min; 121–180 min, >180 min), and five rules relating to outside play: in light rain, heavy rain, snow, wet conditions and high UV/sun (allowed always; in special clothing; never). Each setting’s Office for Standards in Education (Ofsted) rating (satisfactory, good/outstanding), given following independent external review by trained inspectors, was obtained from the Ofsted website (<https://www.gov.uk/government/organisations/ofsted>).

Statistical analyses

All children with >2 valid week-days of accelerometry data were included in analyses (n = 201), and a pre-defined significance level of $p < 0.05$ was used for all analyses. Descriptive statistics were calculated and compared by setting type using t-tests for normal, Mann–U Whitney for non-normal or χ (Department of Health, 2011) tests for categorical data.

Three-level hierarchical linear regression models were fitted, assessing the associations between childcare-related factors and children’s daily average minutes per hour of in-care SED, LPA and MVPA (Level 1: in-care activity; Level 2: child; Level 3: setting). Univariable regression models were first conducted to assess the association between each exposure variable and children’s activity. All variables significantly associated in univariable models were subsequently entered into a multivariable regression model. Variables were removed from the adjusted model if they did not meet the pre-defined significance level. All analyses were adjusted for sex, daily hours spent in care and parent-reported travel mode to childcare.

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