

Developing evidence-based design

Environmental interventions for healthy development of young children in the outdoors

Nilda G. Cosco

The sedentary lifestyle problem

It is well established that behavioural patterns such as food intake, physical activity and sedentary lifestyles have a strong impact on childhood obesity (Davison and Birch, 2002). This chapter is a summary of the background for a study of childcare outdoor play environments conducted by the author as a research contribution to the emerging field of design for active living for young children. The study is based on the positive association between physical activity and weight in children (Sallis *et al.*, 2000), the premise that the childcare centre is the highest predictor of physical activity of children 3–5 years old (Finn *et al.*, 2002) and the notion that the childcare outdoors is the strongest correlate of physical activity of preschool children (Baranowski *et al.*, 2000; Sallis *et al.*, 1993).

Most young children learn about the surrounding world by physically interacting with it. For them, life is movement and sensory stimulation (Piaget, 1952). The neural pathways of the brain are developed through movement, revealing a clear interdependence between physical activity, language acquisition and academic performance (Hannaford, 1995). Play is the motivating force that produces physical activity (Pellegrini *et al.*, 1998) and social interactions with other children and adults (Frost *et al.*, 2001; Moore and Wong, 1997). Despite these assumptions about children's natural drive to stay active, the health of even the youngest is currently affected by sedentary lifestyles. Recent research in young Scottish children by Reilly *et al.* (2004) shows that 3-year-old boys spend a median of 76% of their time in sedentary behaviour and girls up to 81%. The proportion reduces slightly with age. Time spent in sedentary behaviours for 5-year-old boys shows a median of 73%. For girls the median is 78% (Reilly *et al.*, 2004). This lack of physical activity, combined with poor nutrition, is producing a profoundly negative effect on children's physical health, especially in developed countries. In the United States, more than 10% of children two to five years old are overweight and more than 20% of children of the same age are at risk of being overweight (Ogden *et al.*, 2002). The average rate of child obesity in Europe is 25%, with highest percentages in Spain (30%) and Italy (36%) (IOTF, 2005). In the United Kingdom, 16% of children aged two to fifteen are obese according to the Health Survey for England (2002).

These figures imply serious health problems, especially for low-income children (Mei *et al.*, 1998), and suggest the need for urgent interventions if children are to avoid a compromised quality of life at an early age. The added cost associated with such dramatic decline in health is also an issue.

Daily life environments for many young children

According to the National Survey of America's Families, in 1999 almost three-quarters (73%) of US children under five with employed parents were in a childcare arrangement other than care by a parent (Capizzano *et al.*, 2000; Sonenstein *et al.*, 2002). This percentage represents approximately 8.7 million children from which 42% (3.6 million children) spend most of their waking hours in centre-based and family childcare services (28% and 14% respectively).

In effect, in the last two decades, childcare centres in developed countries have become the most crucial environment outside the home for young children. Despite this fact, researchers and governmental agencies have been slow to consider childcare centres (highly regulated institutions) as gateways for environmental interventions aimed at obesity prevention early in life.

For many years, even the most influential health reports avoided reference to young children. The *US Surgeon General's Report on Physical Activity and Health At-a-Glance Summary* (1996: 1) 'brings together, for the first time, what has been learned about physical activity and health from decades of research'. The publication includes vital information about a new view of physical activity and its benefits, a call for moderate exercise in daily life, precautions for a healthy start at different stages of life and special messages and guidance for different population groups. Remarkably, children under 12 years of age are not mentioned.

Just recently, on 23 April 2003, in a speech to the National Head Start Health Institute, Washington, DC, Vice Admiral Richard H. Carmona (then US Surgeon General) called childhood obesity 'the most serious health problem in America today'. Such forthright concern should make the topic a US national priority with an implied call for action for educators,

health professionals and licensing consultants to produce the appropriate institutional changes to address this health crisis.

The built environment and children's active living

In 2004, the US National Institute of Health (NIH) acknowledged the impact of the built environment on sedentary lifestyles in the Strategic Plan for NIH Obesity Research entitled *Preventing and Treating Obesity through Behavioral and Environmental Approaches to Modify Lifestyle* (USDHHS/NIH, 2004: 27). The plan includes short-term goals related to children's environments such as to 'assess children's environments . . . to determine barriers to increasing physical activity' (28); to 'Identify . . . environmental and behavioural factors to obesity . . . prevention . . . and assess . . . environments such as . . . childcare . . . for specific barriers to increasing physical activity' (29).

The severity of the problem has also encouraged regional initiatives in Europe, where approximately 14 million children are already overweight or obese. On 15 March 2005 the European Commission launched the EU Platform for Action on Diet, Physical Activity and Health (EU 2005). A broad spectrum of government, industry and community representatives are part of the initiative (consumer organizations, food industry and health NGOs, among others). Special emphasis is given to programmes for children since this age group shows the highest obesity rise in the region and it is proven that overweight children will become overweight or obese adults.

Targeting and improving children's outdoor environments to support greater amounts of physical activity might be a substantial contribution to the success of these plans. Whole body movement not only influences physical health but general child development, since movement also stimulates brain development (Hannaford, 1995). Moreover, research has confirmed that contact with (and even views of) green environments support attention functioning (Faber Taylor *et al.*, 2001).

It is known that the layout of the site, the number of play settings and the amount and type of vegetation affect children's behaviour (Fjørtoft, 2001; Moore, 1974; Moore and Wong, 1997). The richer the environment, the more engaging for children's play (Grahn *et al.*, 1997). Systematic observations of children's



9.1 Preschool area tricycle path. BHFS Child Development Center. Research Triangle Park, NC, USA.

interactions with diverse environments confirm these findings. For example, a curvy, 1.5m (5ft) wide pathway can afford children's movement around a circuit of diverse play settings (flower and vegetable gardens, vegetated arbours, circle of rocks, sand play area and others), providing adequate space for continuous roaming and the use of tricycles and carts (Figure 9.1). The level of activity of a play area is mostly due to the additive effect of the layout of the site and its attributes (objects, plants, other children and events) on children's behaviours (Cosco, 2006).

When engaged in self-guided exploration, children stay physically active, performing novel movements and challenging their own developing skills. For example, a group of preschoolers was observed trying to reach a Hyacinth Bean pod (the 'violet thing') that was hanging high up on a bean teepee (vine-covered metal armature in the shape of a teepee). In this 20-minute episode of activity, six 3-to-5-year-old children (four boys and two girls) were actively engaged without adult intervention in trying to jump up and harvest the intriguing, purple pod. The environment was sufficiently rich and stimulating to support their extended explorations (Figure 9.2).



9.2 Bean teepee planted with a mix of Hyacinth Beans and gourds. Preschool area, BHFS Child Development Center, Research Triangle Park, NC, USA.

The concept of affordance

A key to understanding the implications of the built environment and children's active living is the concept of affordance (Gibson and Pick, 2000). The concept is valuable for describing environments from a behavioural perspective (i.e. from the point of view of children's outdoor play). In this manner, an object in the play area will be considered *climb-able* if it

is possible to climb on it, *slide-able* if it allows sliding, or *swing-able* if one can swing on it. The approach considers the individual and the environment as an interactive system.

Children learn about the environment and themselves by picking up environmental information and by performing developmental activities such as climbing, balancing, catching, clinging, crawling, hanging, hopping, jumping, leapfrogging, rocking, rolling, running, skipping, sliding, spinning, walking and so on. However, the environment must be designed to afford these activities. Over time, the daily use of environmental affordances guides future behavioural responses and, as children develop, they learn about the growing scale of their bodies and their emerging specialized skills by using the potential environmental affordances that appear in front of them. The progressive learning and realization of affordances is supported by further environmental exploration that results in

sustained activity as perception and action become intimately connected.

The concept of affordance can be utilized, therefore, for discovering and analysing the characteristics of behaviour settings from a young child's point of view (Heft, 1988, 2001). For instance, evergreen plants and grasses automatically add 'pickable' affordances to the environment throughout the year that support rich sequences of play. In an attempt to examine how these interactions work, two preschoolers (a boy and a girl) were observed on a late autumn afternoon carefully picking leaves and collecting them on top of a pail full of sand. They moved in and out of tall grasses around the periphery of the play area, harvesting the 'reachable' leaves and running back and forth to the sand area. They were 'cooking' a birthday party cake. Other girls joined the group activity. When the 'cake' was ready, all walked in a procession-like manner to a picnic table



9.3 Collecting leaves for a 'birthday cake'. The Enrichment Center, BHFS. Research Triangle Park, NC, USA.



9.4 One more leaf for the 'birthday cake'. The Enrichment Center, BHFS, Research Triangle Park, NC, USA.

for the 'birthday party'. This active, cooperative and harmonious group activity would not have occurred without the combined affordances of elements such as pickable grass leaves, pails, sand, picnic table and the story line created by children's imagination (Figures 9.3, 9.4 and 9.5).

Environments full of novel information and rich affordances should be considered as a developmental need to accompany children's growth and the extension of physical capacities (Gibson and Pick, 2000). However, what children perceive is not the abstraction of colour, sound or texture but the *layout* of the space, the *objects* in the layout and the *events* that occur in that particular layout in relation to the existing objects (Gibson and Pick, 2000).

The *layout* contains the surfaces to walk on, the walls or plants that surround subjects, the overhangs that wrap them up spatially and communicate a sense that the body is a volume. The layout of the site helps children to situate themselves in the place that contains *objects* (animate and inanimate) such as people, animals, plants and elements to climb on, sit on, swing on and so on.

According to Gibson and Pick (2000: 24) *events* are 'the movement and actions that occur, some performed by ourselves and some external to us. They implicate objects and provide the dynamics of all scenes in the layout'.

Children learn about their surroundings by performing movements and actions (*events*), they learn how to orientate themselves using fixed elements such as landmarks, and can increase their territorial exploration with the confidence that they will not be lost. The process involves children's active engagement and supports the emergence of new actions that contribute to expanding environmental experiences. For instance, preschool children are fascinated by wheeled toys. They start by learning to use tricycles, coordinating the move-

ment of their legs, pressing hard on the pedals, and aiming at their destination guided by their arms and hands. Not long after the process starts, they master the movements and can perform other tasks as they drive their wheeled toys. At this stage, they not only ride tricycles but also carry other children with them, along with toys and play materials.

Playing in diverse environments potentially establishes active behaviours in young children and fondness for the outdoors as a preventative measure against sedentary lifestyles in later years.

Physical activity play

Outdoor play is associated with physical activity (Sallis et al., 1993) and higher energy expenditure rates (Pellegrini et al., 1998). Recent articles and governmental websites show that free play has been re-discovered as a critical activity that provides the necessary amount of daily exercise for young children (Dowda et al., 2004; USDA, Nutrition Newsletter). Negating playtime for young children may bring serious health and developmental consequences (Dowda et al., 2004), although children will spontaneously compensate for the lack of play activity when social and physical environments allow for it (Pellegrini and Smith, 1998).

Recently, the report of a panel of experts representing the fields of public health, epidemiology, exercise science, behaviour and medicine was released, containing a review of the current knowledge about physical activity and proposed priorities for research in early childhood (Fulton et al., 2001). The panel acknowledged the importance of play as the main source of physical activity in children two to five years of age, characterized by short bursts of energy such as rough-and-tumble play



9.5 'Birthday cake' on picnic table. The Enrichment Center, BHFS. Research Triangle Park, NC, USA.

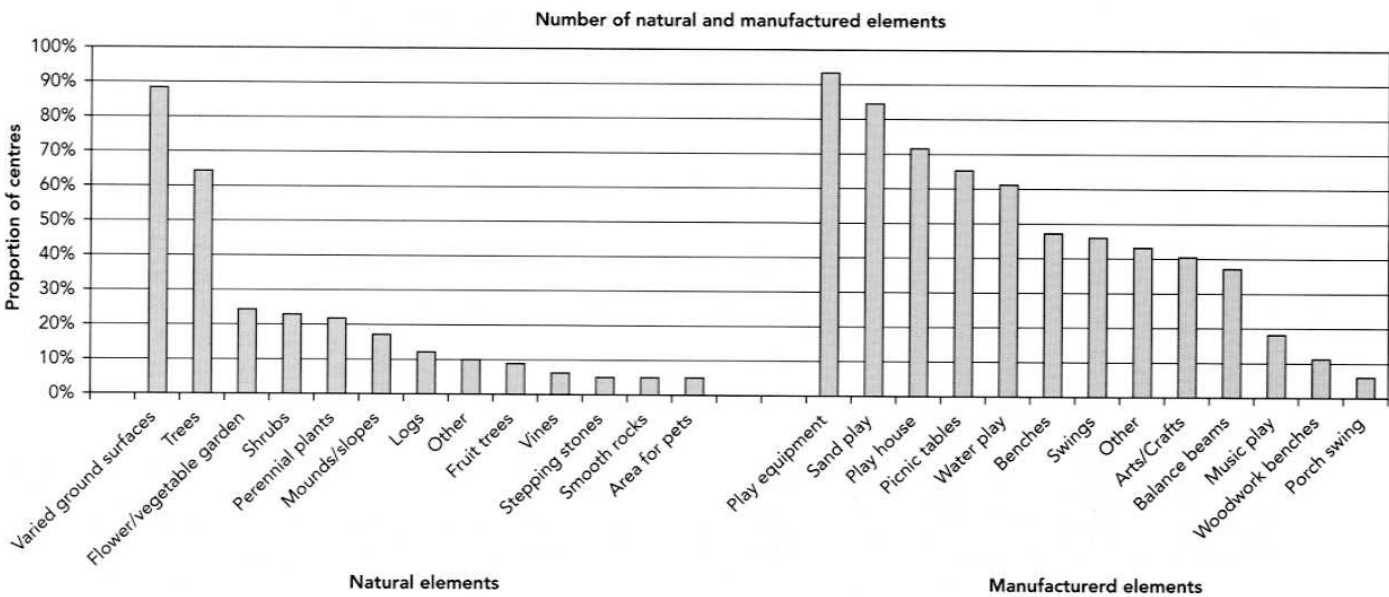
(Pellegrini et al., 1998) and group games. The panel highlighted the need for developing reliable physical activity measures for young children and for identifying potential environmental factors including quality of day care (Fulton et al., 2001).

Conditions of outdoor play environments in childcare centres

As a contribution to the baseline knowledge of outdoor environments for young children, the report *Childhood Outdoors*:

A Baseline Survey of Environmental Conditions of Outdoor Areas in North Carolina Childcare Centers (Cosco and Moore, in press) was recently completed. Approximately 10% of licensed childcare centres in the State of North Carolina, USA were surveyed (n=326). Results show that the large majority of licensed childcare centres offer minimum accommodations for active play beyond basic sand play areas and climbing structures.

Limited environmental diversity reflected in the number of natural or manufactured elements present describes the condition of most outdoor play areas in North Carolina (a



9.6 Types of natural and manufactured elements present in outdoor play areas. *Childhood Outdoors: Baseline Survey of Environmental Conditions of Outdoor Areas in NC Childcare Centers* (Cosco and Moore, in press).

state considered a leader in childcare standards in the United States). A high percentage of centres provide a single piece of play equipment and few natural elements (Figure 9.6). Shade is seldom provided, even though there is a great concern about the negative health consequences of exposure to the sun. Trees, pergolas and vine-covered arbours are inexpensive shade elements that could be provided but are rarely present.

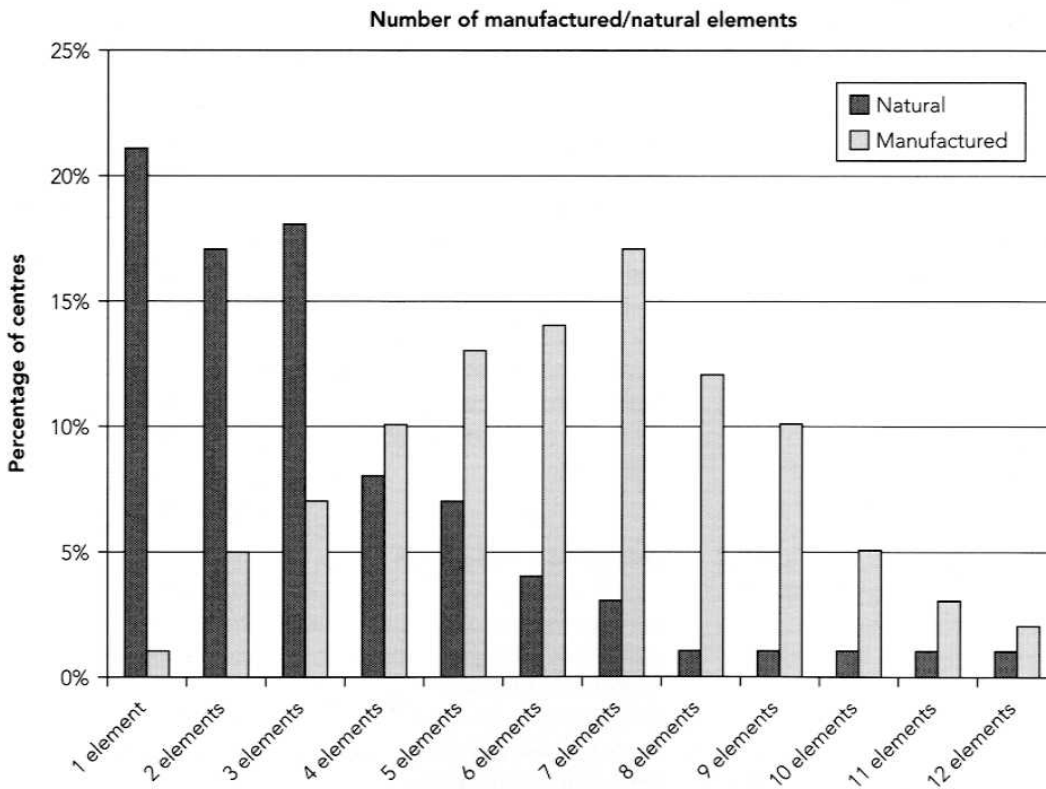
While the majority of centres have an average of seven manufactured play elements (play equipment, sandbox, play house, picnic tables, water play, benches, swings, easels) the average number of natural elements present is just three (mainly grass, mulch and occasional trees) (Figure 9.7). Lack of diversity is a major reason why outdoor play areas are not attractive.

They are boring and uncomfortable for children as well as for teachers.

The desire for improvement is strong among childcare providers. Respondents to the survey emphasized the need for training and professional help to enhance their outdoor play areas.

Balancing play value and safety regulations

Survey respondents also showed concern about the impact of new health and safety regulations on the quality of the children’s outdoor experience. There is a perception among



9.7 Number of manufactured and natural elements present in outdoor play areas. *Childhood Outdoors: Baseline Survey of Environmental Conditions of Outdoor Areas in NC Childcare Centers* (Cosco and Moore, in press).

educators and designers that playgrounds in general, and childcare play areas in particular, have turned into unchallenging, un-engaging spaces in the last 20 years. Such environments do not support children's daily requirements for physical activity, and therefore, healthy development. The US Consumer Product Safety Commission CPSC guidelines (*CPSC Guidelines*, 1997) are a significant factor influencing the characteristics of childcare play areas and, unintentionally, have adversely affected their play value. Outdoor play should provide children with the necessary, reasonable risk-taking opportunities that support healthy growth and learning (Frost *et al.*, 2001). Environments that support children's free explorations, expansive movements, and interactions with other children and adults, offer higher play value. The inclusion of childcare facilities within the scope of the *CPSC Guidelines*, attached to the notion of places of 'public use', was presumably intended to address issues of quality of provision, but is a questionable idea. 'Public use' implies a place 'accessible to all members of the community' (Webster's International Dictionary). This is not the case with childcare centres, where children are enrolled in programmes and access is highly controlled. Moreover, during operating hours, close supervision, indoors and outdoors, is provided by trained, professional staff.

Additionally, the way in which the *CPSC Guidelines* are sometimes interpreted and imposed on childcare facilities in the United States has had a clear impact on the layout of childcare outdoor play areas and their patterns of use. For example, the indispensable safety surface under play structures (usually mulch or sand) is often expanded unnecessarily to adjacent areas, transforming them into giant sandpits or mulched areas where it is difficult to run and where wheelchairs or wheeled toys cannot be used. A further issue is the way safety regulations are often enforced by local inspectors without balancing playground safety with the need for high play value.

Research shows that the majority of injuries at childcare centres are minor (no intervention of a doctor is required) and that, although a high percentage occur at the playground (74%), most of them are precipitated by child-related factors (59%) such as pushing and biting (Alkon *et al.*, 1999). Similar results were found by the author in the review of incident reports (minor injuries) conducted before and after renovation of a childcare centre play yard (Cosco and Moore, unpublished). The

results showed that after the renovation – that dramatically increased the natural diversity – the number of injuries had a statistically significant decline ($p=0.5$).

However, additional research is needed to confirm these preliminary findings and identify specific physical and social factors that contribute to children's injuries in childcare centres. Lack of empirical research on where and how children get hurt is a major barrier to promoting change in safety regulations for play areas at childcare centres.

To create environments that support children's healthy development and which also comply with licensing and safety regulations requires a sensible understanding and enforcing of the rules. How to confront these two apparently contradictory needs is a current dilemma and suggests the need for policy challenge (Pate *et al.*, 2004). The opinions of educators, parents, owners, safety consultants and designers are divided. Some have chosen to comply with all regulations in the name of safety and have created static, 'equipment-based' play areas surrounded by a sea of wood chips or sand. Others have decided to bypass the safety guidelines (which apply only to anchored equipment) and have created 'garden-like' play areas with minimum or no equipment. Still others have decided to leave selected pieces of equipment and to add trees, shrubs and naturalistic play settings. Surprisingly, the decision-making process is often driven by external constraints (budget, licensing and space limitations) rather than educational or children's health requirements. In any case, there are insufficient research studies to support more rational choices about the quality of children's outdoor environments and their implications for healthy development. This lack of evidence produces a narrow discourse on the topics of safety, environmental diversity and play value.

Need for research

Current research supports the assumption that the childcare centre is an emerging opportunity for successful environmental interventions to counteract the sedentary lifestyles of young children since the childcare centre is the highest predictor of physical activity of children three to five years old (Finn *et al.*, 2002). The fact that preschool physical activity tracks throughout

childhood and has a protective effect against early adolescence adiposity (Moore *et al.*, 2003), confirms the hypothesis that the preschool years offer the best opportunity to establish active lifestyles.

More specifically, studies have established that being outdoors is the strongest correlate of physical activity of preschool children (Baranowski *et al.*, 2000; Sallis *et al.*, 1993) and that diverse natural environments support attentional functioning, gross motor development, children's health and richer play behaviour (Sääkslahti *et al.*, 2004; Faber Taylor *et al.*, 2001; Grahn *et al.*, 1997). As a result, researchers now have the opportunity of embarking on the development of studies to uncover the associations between children's physical activity and specific spatial or design attributes with the objective of supporting designers and educators to promote change.

Although the focus of attention to date has been on children regardless of their BMI (Body Mass Index), special consideration should be given to those already overweight (Moore *et al.*, 1995). They might be at increased risk of further weight gains because of low levels of physical activity during the preschool day (Trost *et al.*, 2003) and because they are less inclined to test their physical abilities. A key research topic to address this need (on both sides of the Atlantic) is the study of play setting preferences by overweight children and the description of appealing settings and specific features that might afford sustained or greater amounts of physical activity. A further important focus is low income and ethnic minority children (especially African-American and Hispanic in the USA) and girls, who are more likely to be at risk of being overweight or obese (Mei *et al.*, 1998). Studies that address the use of play areas by these specific populations are urgently needed.

Opportunities for change

Provision of active living environments for young children appears obvious, but there is a need to build a knowledge base through environmental design research to guide policy makers, licensing agencies, designers and teachers. Evidence-based licensing requirements will help emphasize the need to spend time outdoors and reinforce the importance of creating environments that are diverse enough to motivate children and

teachers to use them for longer periods of time every day. Empirical evidence could also help lobbying efforts to increase budget allocations for developing outdoor settings to promote physical activity.

The search for evidence-based, site-specific recommendations is currently pursued by governmental health organizations in an effort to counteract the sedentary lifestyle trend and to support the work of planners and designers (DHHS). The places where children spend time daily are a highlighted priority.

In sum, studies that bring knowledge concerning the dynamics of active children's environments will support the creation of new standards of practice. The evaluation of outdoor play areas from the perspective of children's daily physical activity will follow as a natural spin-off and necessary complement to the new standards. For this reason, specific instruments should be developed to measure preschool activity and play area characteristics based on objective research findings.

The *Preschool Outdoor Environments Measurement Scale – POEMS* (DeBord *et al.*, 2005) is an example of a scale intended to measure the overall outdoor quality of preschool play areas and could provide an impetus to develop instruments focused on active lifestyles outdoors. There is no doubt that childcare centres are potential agents of change that could be activated by designing spaces and programmes that support healthy development. Appropriate space design and childcare licensing policies and accreditation regulations can become viable instruments to produce environmental change and, therefore, support healthy behavioural changes in the daily lives of millions of children.

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