



Time spent outdoors during preschool: Links with children's cognitive and behavioral development



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ABSTRACT

This study examined the concurrent and long-term relations between the amount of time children attending daycare spend outdoors and their cognitive and behavioral development during preschool and first grade. We applied a multi-informant design using cognitive testing and ratings from parents and teachers to follow 562 Norwegian preschoolers (298 girls; mean age at first assessment = 52.45 months, $SD = 15.96$) over a period of four years. Children's attention skills were tested with the digit span test while teachers rated their behavior. Growth curve analyses showed a positive relation between outdoor hours and children's digit span scores, and an inverse relation between outdoor hours and inattention-hyperactivity symptoms, controlling for a host of possible confounds. Results indicate that outdoor time in preschool may support children's development of attention skills and protect against inattention-hyperactivity symptoms.

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1. Introduction

In Western countries, the proportion of mothers returning to the labor market shortly after having a child has grown over the past decade. Several indicators suggest that this growth has not yet peaked (Bell, Donkin, & Marmot, 2013; Hegewisch & Gornick, 2011). Consequently, the effects of daycare on children's health and development has received much attention (Burger, 2010; Vermeer & van IJzendoorn, 2006). Daycare centers' pedagogical approaches have become increasingly diverse, and, today, a number of daycares offer outdoor activities and play-based learning approaches. For example, daycare centers differ in the quantity of outdoor activities offered (Copeland, Khoury, & Kalkwarf, 2016; Ministry of Education and Research, 2006). In Scandinavia, daycare centers increasingly offer high quantities of outdoor time; some centers offer up to 9 h of daily outdoor time, irrespective of weather and season (Borge, Nordhagen, & Lie, 2003). Given the increased diversity in the use of outdoor activities and pedagogical approaches in early childcare, there is a need to know whether such

various approaches promote children's cognitive and behavioral development.

Some literature indicates that exposure to outdoor environments may be beneficial for children's health and cognitive development (Chawla & Nasar, 2015; Gill, 2014). Thus, one might expect developmental differences between children attending daycare centers offering the recommended minimum of 1 h outdoor time per day and those attending centers that offer 7–9 h per day. Such differences in development may be visible in the short term or the long term once the children start attending formal school. Moreover, the relation between outdoor time and children's development may be linear, but curvilinear or threshold links are also possible. For example, a specific number of outdoor hours may be enough for a beneficial effect, or there may be a dose-response relationship. It is also possible that the relation between outdoor time and cognitive-behavioral development is explained by other qualities particular to the daycare centers, such as ideology and type, or that it is confounded with socio-economic status (Geoffroy et al., 2007). Thus, a longitudinal perspective and a continuous approach to outdoor time need to be adopted while controlling for a host of confounding factors to isolate the effect of outdoor time on children's development and determine the nature of this association. These are the goals of the present study, which is set in

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Norway, a leading country with respect to the use of outdoor time in daycare centers (Borge et al., 2003).

1.1. A historical-philosophical perspective

In Scandinavia, it is considered to be common sense that the outdoor environment promotes health and prevents mental and somatic problems (Borge et al., 2003). This idea is inspired from philosophers, such as Thoreau and Muir, who established a fascination for the wilderness and laid the roots for later environmentalists (Naess, 1984). In line with this concept, Froebelian kindergartens were established in Germany, the United Kingdom and the United States of America during the 19th century. The concept of “kindergarten” meant a garden for - not of - children. Froebel believed that placing children literally in the garden would engage them to play and act out in the real world, which was deemed to be good for intellectual development (Bruce, 2012). Similarly, Rousseau advocated child-rearing principles of “back to nature”, sending children to the woods, and Dewey created an educational approach based on school gardens where children might discover mathematics from seeds and gardens (Chung & Walsh, 2000). Of course, these philosophical ideas remain only ideas if not backed up by empirical evidence.

In Norway, daycare centers usually offer between 1 and 9 h of daily outdoor time. In accordance with government guidelines, daycare centers are often placed in spots that secure good weather conditions and that are rich in vegetation (Ministry of Education and Research, 2006). The intention is to stimulate play, shield from noise and traffic, and promote an appealing context. The daycare centers are encouraged to provide children with climbing structures, large sandboxes, hard surfaces (asphalt and concrete), and a place to hose off the children before going back indoors. Children may play with mud and sand in the rain, and need solid rain-proof clothing and warm shoes. In winter time, slopes and hills enable skiing and tobogganing (a simple sled used on snow by the children to ride downhill). Some daycare centers have access to an outdoor environment that is large, without fences, and distant from the buildings. Often, the buildings are old-fashioned cabins or turf huts. In Scandinavia, specific shelters (*lavvu*) in the shape of a tepee have an open fire, benches with reindeer skins to keep the children warm, and a place to store bags and food. In sum, the outdoor environment is rich in fresh air and provides experiences of seasonal changes, physical activity and allows for noisy activities requiring lots of space.

1.2. Daycare environments and children's development

Studies show that the daycare centers' structural environments may be associated with the quality of care that is provided (NICHD Early Child Care Research Network, 2000) and children's cognitive development (Peisner-Feinberg et al., 2001). For example, child-adult ratio, group size, and caregiver's education level and involvement with the children are factors associated with the quality of care that is provided (NICHD Early Child Care Research Network, 2000). Further, the quality of daycare has been associated with children's cognitive development and attention skills (NICHD Early Child Care Research Network, 1998; Wylie, Hodgen, & Thompson, 2003). The effects of daycare on children's development also tend to be moderated by child and family characteristics, such as child's gender and family harmony (Bekkhus, Rutter, Maughan, & Borge, 2011; Côté, Borge, Geoffroy, Rutter, & Tremblay, 2008), parents' socioeconomic status (Geoffroy et al., 2007), and child temperament (De Schipper, Tavecchio, Van Ijzendoorn, & Van Zeijl, 2004). There are also a number of empirical studies showing short-term gains from exposure to environments similar to those offered

in outdoor daycare centers (Chawla & Nasar, 2015; Gill, 2014). For example, in a large cross-sectional study, Kuo and Faber Taylor (2004) found that children diagnosed with ADHD showed lower levels of parent-reported inattention and hyperactivity symptoms following after-school activities in green outdoor settings than following activities in built outdoor or indoor settings. However, to our knowledge, no previous large-scale studies have investigated whether the quantity of time spent outdoors during daycare is associated with children's development in the short and long run.

Attention restoration theory gives credence to a possible positive link between exposure to outdoor environments and children's cognitive and behavioral functioning (R. Kaplan & Kaplan, 1989). Attention restoration theory suggests that natural elements found outdoors help focus attention. Nature may bolster children's attention and self-regulatory skills by allowing neural inhibitory mechanisms to rest and recover from use (Berman, Jonides, & Kaplan, 2008). For example, the indoor noise level of daycare centers is sometimes comparable to highway noise, with potentially adverse effects on child well-being (Werner, Linting, Vermeer, & Van Ijzendoorn, 2015). Outdoor time may be beneficial because the outdoor environment allows for restoration of attentional resources that have been depleted by noise and other distractions. Of note, although attention restoration theory largely explains short-term effects of exposure to nature, working memory has been described as a bottleneck for cognitive functioning (Vogel & Machizawa, 2004). Short-term benefits of outdoor time on attention may thus translate into long-term benefits by allowing children to engage in advanced learning activities (i.e. readiness to learn) (Fitzpatrick & Pagani, 2012). For example, children might engage in longer and more focused sequences of play, and they might be able to perform more complex tasks, as their attention skills are enhanced (Ruff & Lawson, 1990). Accordingly, children spending a lot of time outdoors during their preschool years may develop more self-regulatory and cognitive skills than their counterparts who are confined to indoor daycare. As a consequence, they could also become better prepared for formal school.

However, the opposite is also possible, in that indoor environments may encourage the use of effortful attention, which is beneficial for cognitive development. In line with a strength model of self-regulation (Baumeister, Vohs, & Tice, 2007), children's attention skills might mature faster in environments that require high levels of effortful attention, because of continued practice in dealing with conflicts and distractions. Also, the indoor daycare environment resembles the formal school and workplace environments where the children will spend many years. At least in the long-term, outdoor time may therefore have iatrogenic effects on attentional development if the demand for effortful attention in the outdoor environment is too low. Children spending a lot of time outdoors during preschool might thus miss out on effortful attention practice and therefore become less prepared for school.

So far, a few studies on this topic provide support for a positive link between exposure to natural environments and children's attention skills (Dadvand et al., 2015; Kuo & Faber Taylor, 2004; Mårtensson et al., 2009; Taylor, Kuo, & Sullivan, 2002; Wells & Evans, 2003). For example, a recent study that followed urban school children for one year, found that the level of vegetation surrounding homes, schools and commuting routes, as measured by satellite photos, were associated with improved working memory and a reduction in inattentiveness in 7–10 year old children (Dadvand et al., 2015). Also, Wells and Evans (2003) found that high amounts of vegetation near the homes of children mitigated the association between life stress and children's psychological distress and self-worth. In fact, Mårtensson et al. (2009) found that preschool children playing in green outdoor environments were rated by teachers as showing less inattentive behavior.

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