

# Effects of Child Care Policy and Environment on Physical Activity

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## ABSTRACT

TROST, S. G., D. S. WARD, and M. SENSO. Effects of Child Care Policy and Environment on Physical Activity. *Med. Sci. Sports Exerc.*, Vol. 42, No. 3, pp. 520–525, 2010. Child care centers differ systematically with respect to the quality and quantity of physical activity they provide, suggesting that center-level policies and practices, as well as the center's physical environment, are important influences on children's physical activity behavior. **Purpose:** To summarize and critically evaluate the extant peer-reviewed literature on the influence of child care policy and environment on physical activity in preschool-aged children. **Methods:** A computer database search identified seven relevant studies that were categorized into three broad areas: cross-sectional studies investigating the impact of selected center-level policies and practices on moderate-to-vigorous physical activity (MVPA), studies correlating specific attributes of the outdoor play environment with the level and intensity of MVPA, and studies in which a specific center-level policy or environmental attribute was experimentally manipulated and evaluated for changes in MVPA. **Results:** Staff education and training, as well as staff behavior on the playground, seem to be salient influences on MVPA in preschoolers. Lower playground density (less children per square meter) and the presence of vegetation and open play areas also seem to be positive influences on MVPA. However, not all studies found these attributes to be significant. The availability and quality of portable play equipment, not the amount or type of fixed play equipment, significantly influenced MVPA levels. **Conclusions:** Emerging evidence suggests that several policy and environmental factors contribute to the marked between-center variability in physical activity and sedentary behavior. Intervention studies targeting these factors are thus warranted. **Key Words:** PRESCHOOL, EXERCISE, MOTOR DEVELOPMENT, CHILDREN, PHYSICAL ACTIVITY PROMOTION

Descriptive studies measuring physical activity in preschool children have consistently observed substantial between-center variability in physical activity behavior (8,12,13). Indeed, in one study, it was estimated that center or school independently accounted for 31% of the variance in preschooler's moderate-to-vigorous physical activity behavior (MVPA) (13). That child care centers differ systematically with respect to the quality and quantity of physical activity they provide, strongly suggests that center-level policies and practices, as well as the center's built environment, are important influences on children's physical activity behavior. The challenge for researchers and practitioners wishing to promote physical activity and prevent obesity in preschool children is to identify which policies and what types of environments best promote regular physical activity in child care settings.

The purpose of this review was to summarize and critically evaluate the extant peer-reviewed literature on the influence of policy and environment on physical activity in preschool-aged children. Studies investigating the impact of selected center-level policies and practices will first be examined. This will be followed by an overview of studies correlating specific attributes of the outdoor play environment with the level and intensity of physical activity performed in this setting. Next, studies in which a specific center-level policy or environmental attribute is experimentally manipulated and evaluated for changes in physical activity behavior will be described. We will conclude with a discussion of current limitations and future research directions.

For the purposes of this review, the term "child care" or "preschool" refers to center-based care for preschool-aged children. It includes the care provided by privately owned and operated early childhood education centers, centers operated by churches and other places of worship, as well as Head Start facilities. Although significant percentages of preschool-aged children receive care from friends, relatives, and family child care homes (10), the influence of physical activity policy and environment in these settings has not been studied extensively and will not be discussed in this article. A physical activity "policy" is defined as any written statement, plan, or course of action that describes the center's expectations or goals related to physical activity

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Submitted for publication December 2008.

Accepted for publication March 2009.

0195-9131/10/4203-0520/0

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DOI: 10.1249/MSS.0b013e3181cea3ef

and sedentary behavior and the practices deemed acceptable to achieve these goals. A physical activity “practice” is an activity or action undertaken by a center on a consistent basis that may or not be linked to a formal policy. The term “environment” refers to attributes of the center’s built environment (i.e., constructed or natural outdoor play areas); in some studies, the presence or absence of teachers and teacher behavior (i.e., prompts) are considered elements of the built environment but might also be considered part of the social environment created by center practices. It is acknowledged that, under an ecological framework, policy and environment are closely related and that the policies adopted by center directors directly influence the child care environment and *vice versa*.

## THE INFLUENCE OF CENTER POLICIES AND PRACTICES

To date, two studies have investigated the influence of policy on preschool children’s physical activity behavior. These are summarized in Table 1. Both contrasted the activity levels of children attending preschools with and without policies considered conducive to promoting physical activity.

Dowda et al. (7) conducted structured interviews with administrators from nine randomly selected preschools in Columbia, SC. Each center had an enrollment of 60 or more children between 3 and 5 yr and more than 60% of the children were African American. The interview elicited information on some center policies and practices, including the educational credentials and training of center staff, policies regarding the use of television and computers, time allocated to free play and amount of outdoor time, frequency of field trips, class size, and formal and informal partnerships with community-based physical activity providers. In addition, the Early Childhood Environment Rating Scale Revised (ECERS-R) was performed in one classroom from each center. Scores on the ECERS-R were used as a quantitative indicator of overall preschool quality.

At each center, participation in sedentary behavior and MVPA was measured using the Observation System for Recording Activity in Children – Preschool (OSRAC-P) (5). The investigators also used the OSRAC-P to code the physical location of children, allowing them to quantify sedentary behavior and MVPA during the entire preschool day and during playground time. For each policy area addressed

in the interview, preschools were classified as “physical activity promoting” or “non-physical activity promoting.” The investigators then compared the activity levels of both groups. Comparisons were made for total observed time and playground time only. In addition, the activity levels of children attending preschools in the top quartile for ECERS-R were compared with those in the lower three quartiles.

After controlling for age, sex, race, body mass index, and location of observation (playground vs other), children attending preschools classified as “physical activity promoting” for activity-related field trips ( $\geq 4 \text{ month}^{-1}$ ), time spent outdoors ( $\geq 90 \text{ d}^{-1}$ ), free play time ( $\geq 120 \text{ min}\cdot\text{d}^{-1}$ ), class sizes ( $\leq 17$  children), and higher scores on the ECERS-R (upper quartile) exhibited higher levels of MVPA during the preschool day than children attending preschools classified as “non-physical activity promoting” on these policy areas. However, only the difference for field trips was statistically significant in the fully adjusted analyses. For activity performed on the playground, children attending preschools in which the majority of the staff were college-educated exhibited significantly higher levels of MVPA than children attending preschools with less-educated staff. No other factors were related to playground physical activity. Notably, after adjusting for age, sex, race, body mass index, and physical location, children attending preschools with lower scores on the ECERS-R exhibited significantly more time in sedentary activity than children attending preschools of higher overall quality.

Although the results of this study provide novel information on preschool policies and practices related to physical activity, the findings are somewhat difficult to interpret. In the statistical analyses, child-level physical activity behavior served as the dependent variable, although each child was observed for 1 h for 2–3 d. Furthermore, preschools were classified as both “physical activity promoting” and “non-physical activity promoting” depending on the policy area under examination.

In a similar style of study, Bower et al. (4) administered the Environment and Policy Assessment and Observational Audit Tool (EPAO) in 20 randomly selected child care centers in North Carolina. The majority of centers participated in the Child and Adult Care Food Program, and 20% were accredited by the National Association for the Education of Young Children. The average racial/ethnic distribution for each center was 59% white, 33% African American, 4% Hispanic, and 4% other. The EPAO protocol

TABLE 1. Studies examining center policies and practices.

Study	Sample	Study Design	PA Measure	Major Findings
Dowda et al. (7)	<ul style="list-style-type: none"> <li>• 266 children</li> <li>• 9 preschools in Columbia, SC</li> <li>• African American (60%)</li> </ul>	Cross-sectional	Direct observation (OSRAC-P)	<ul style="list-style-type: none"> <li>• No. field trips and college-educated teachers were positively associated with MVPA in children</li> <li>• ECERS-R scores were inversely associated with sedentary activity</li> <li>• EPAO scores were positively associated with MVPA and mean PA levels, and inversely associated with time in sedentary behavior</li> </ul>
Bower et al. (4)	<ul style="list-style-type: none"> <li>• 20 centers across NC</li> </ul>	Cross-sectional	Direct observation (OSRAC-P)	

ECERS-R, Early Childhood Environment Rating Scale – Revised Edition; EPAO, Environment and Policy Assessment; MVPA, moderate-to-vigorous physical activity; OSRAC-P, Observational System for Recording Activity in Children – Preschool Version; PA, physical activity.

was conducted during one full day and involved compiling information from two different data sources: direct observation and document review.

After completing the EPAO protocol, each center received a score on the following eight physical activity-related policy areas: active opportunities, sedentary opportunities, portable play environment, fixed play environment, sedentary environment, staff behaviors, physical activity training and education, and physical activity policies. The sedentary opportunities and sedentary environment subscales were reverse-scored so that higher scores indicated fewer opportunities and environmental supports for sedentary behavior. In addition, a total physical activity environment score was derived for each center by aggregating scores on all eight policy areas. Physical activity while attending child care was measured via direct observation using a modification of the OSRAC-P observational system. Children at each center (four per observation period) were randomly assigned to one of eight 32-min monitoring periods and were directly observed for two nonconsecutive 4-min periods. Observations were completed during 2 d (4 × 32-min monitoring periods per day) and spanned the morning and afternoon hours. Child care centers with scores above the median for the total physical activity environment score were categorized as “high EPAO” and compared with centers scoring below the median categorized as “low EPAO.”

Child care centers classified as “high EPAO” exhibited significantly higher mean activity scores, greater percentages of time in MVPA, and lower percentages of time in sedentary activity than centers classified as “low EPAO.” These differences were independent of outdoor temperature and level of precipitation on the day of observation. In bivariate analyses, physical activity opportunities and physical activity training and education were most strongly associated with center-level physical activity level. Stepwise regression analyses revealed active opportunities, portable play environment, and fixed play environment (inverse association) to be significant predictors of time in MVPA. Active opportunities, sedentary opportunities (inverse association), and physical activity training and education were significant predictors of mean activity level. For time in sedentary behavior, physical activity opportunities (inverse association), sedentary environment, and teacher training and education (inverse association) were

significant predictors. Notably, these small sets of policies and practices explained between 40% and 60% of the variance in physical activity behavior.

The authors speculated that the counterintuitive findings obtained for sedentary opportunities and sedentary environment might be explained, in part, by the availability of funding. That is, centers with the financial resources to purchase expensive electronic media such as televisions, DVD players, and computers may also be able to spend more on portable play equipment and attract more educated teachers. Such findings highlight the limitations associated with the use of cross-sectional designs in the study of environmental influences on behavior as well as the need to control for potentially important center-level covariates such as centers’ financial resources.

## PLAYGROUND ATTRIBUTES AND THE OUTDOOR ENVIRONMENT

Two recently published studies have investigated how specific attributes of the playground or outdoor environment influence preschool children’s physical activity behavior. These studies are summarized in Table 2. The results of both studies confirm that features of the outdoor play environment do indeed influence preschooler’s physical activity, although the number of playground attributes demonstrating significant relationships is small and their explanatory power is, at best, modest.

Boldemann et al. (3) assessed the influence of the outdoor environment on young children’s physical activity level in 11 preschools in Stockholm, Sweden. Centers were scored on the following outdoor attributes: (a) total outdoor area [1 = small (<2000 m<sup>2</sup>), 2 = medium (2000–6000 m<sup>2</sup>), 3 = large (>6000 m<sup>2</sup>)], (b) trees and shrubbery and open ground (1 = little/nonexistent, 2 = less than half of the area, 3 = more than half of the area), and (c) integration of play areas with vegetation (1 = vegetation is close to buildings or scant vegetation is adjacent to play structures/areas, 2 = play structures/areas adjacent to trees and shrubbery OR open areas are located between play structures/areas, 3 = both conditions listed for a score of 2 are satisfied). Scores for these attributes were summed and divided by 3 to provide an overall outdoor environment score. Centers with a score of 2 or more were categorized as “high,” whereas centers scoring less than 2 were categorized as “low.” In

TABLE 2. Studies examining playground attributes and the outdoor environment.

Study	Sample	Study Design	PA Measure	Major Findings
Boldemann et al. (3)	<ul style="list-style-type: none"> <li>• 197 children</li> <li>• 11 preschools in Stockholm, Sweden</li> </ul>	Cross-sectional	Pedometer	<ul style="list-style-type: none"> <li>• “Outdoor environment” scores were positively associated with step counts in boys, but not in girls</li> <li>• Indoor play area had a trend toward positive association with step counts</li> </ul>
Cardon et al. (6)	<ul style="list-style-type: none"> <li>• 783 children</li> <li>• 39 preschools in Belgium</li> </ul>	Cross-sectional	Pedometer	<ul style="list-style-type: none"> <li>• Less children per square meter of play space and shorter recess periods were associated with higher PA levels</li> <li>• Hard play surfaces were associated with higher PA in boys</li> <li>• No. supervisors was inversely associated with PA in girls</li> <li>• No association was found between PA and ground markings, vegetation, or toys</li> </ul>

addition to the outdoor assessments, the amount of indoor space (m<sup>2</sup>) at each center was obtained from a government agency. The activity level of children attending these preschools was measured objectively with a pedometer during a 5-d monitoring period. To control for differences in attendance time, the pedometer data were expressed as steps per minute.

Children attending centers with “high” outdoor environment scores, indicating a greater presence of trees, shrubbery, and open play areas, exhibited significantly higher step counts than children attending centers with “low” outdoor environment scores. The difference between high and low centers was statistically significant for the whole sample (21.6 vs 17.7 steps per minute), in boys (23.0 vs 18.4 steps per minute) but not among girls (19.4 vs 16.9 steps per minute). Centers with larger indoor play areas (20.4 steps per minute) tended to have higher step counts than centers with smaller indoor play areas (18.2 steps per minute); however, none of these differences were statistically significant.

More recently, Cardon et al. (6) assessed the influence of specific playground attributes on recess physical activity behavior in 39 randomly selected preschools. Members of the research team recorded the presence or absence of the following environmental attributes: playground markings, soft ground surfaces, vegetation, varying topography, and availability of toys for at least 10% of the children. In addition, the number of soccer and basketball goals, amount of fixed playground equipment (e.g., swings, slides, climbing structures), and number of supervising teachers were recorded. All coding was verified independently via photography. To quantify physical activity, children wore an electronic pedometer for the duration of their recess period. The length of the recess was noted, and the pedometer data were expressed as steps per minute. The relationship between each of the playground attributes and physical activity level was tested using a two-level regression model in which a single school-level playground attribute explained variation in the mean step count or intercept for each preschool. Separate analyses were performed for boys and girls.

Among boys, playground density (children per square meter), recess duration, and soft ground surfaces emerged as significant inverse predictors of physical activity. Among

girls, playground density, the presence of teachers, and recess duration were significant inverse predictors of recess activity. Playground attributes commonly thought to be salient influences on activity behavior, such as the availability of fixed equipment, topography, vegetation, and playground markings, were not significantly related to physical activity level in this study. However, lack of heterogeneity with respect to playground attributes and low statistical power may have been mitigating factors. The findings suggested that child care facilities could increase physical activity during recess by adopting policies that minimize the potential for overcrowding in specific playground areas. Furthermore, the observed inverse relationship between recess duration and physical activity suggested that teachers could use recess time more effectively by providing structured activities in addition to opportunities for free play. For boys, the findings suggested that the availability of harder surfaces that are more suitable for bike riding and ball games may be an important influence on physical activity levels. For girls, the findings reinforced the need for teachers to prompt girls to be active and, whenever possible, participate in some form of activity with them.

## EXPERIMENTAL STUDIES

Studies in which one or more features of the child care environment are experimentally manipulated and evaluated for change in physical activity behavior have, perhaps, the greatest potential to inform policy in this setting. To date, three studies of this type have been published. In one study, the time allocated for outdoor recess was extended; in a second, the playground environment was modified by the addition of “activity-friendly” portable play equipment; and in the third, classroom instructional practices were modified to reduce time in sedentary behavior. The results of these studies are summarized in Table 3.

Citing studies linking time spent outdoors to higher levels of physical activity (2,11), Alhassan et al. (1) conducted a randomized controlled trial to evaluate the effects of increasing outdoor play time by 60 min·d<sup>-1</sup>. Thirty-two Latino children attending a single Head Start program in southern California wore an ActiGraph accelerometer on four consecutive days. After 2 d of monitoring to

TABLE 3. Experimental studies.

Study	Sample	Study Design	PA Measure	Major Findings
Alhassan et al. (1)	<ul style="list-style-type: none"> <li>• 32 children</li> <li>• CON (<i>n</i> = 15), INT (<i>n</i> = 18)</li> <li>• 1 Head Start program in southern CA</li> <li>• Latino</li> </ul>	Randomized control trial	Accelerometer	<ul style="list-style-type: none"> <li>• No significant difference in total counts, school day counts, or percent time spent in MVPA for CON or INT</li> </ul>
Hannon and Brown (9)	<ul style="list-style-type: none"> <li>• 64 children</li> <li>• 5 classes in 1 preschool</li> <li>• Caucasian</li> </ul>	Time series	Accelerometer	<ul style="list-style-type: none"> <li>• Significantly decreased sedentary behavior and increased LPA, MPA, and VPA</li> </ul>
Trost et al. (14)	<ul style="list-style-type: none"> <li>• 42 children</li> <li>• CON (<i>n</i> = 22), INT (<i>n</i> = 20)</li> <li>• 1 preschool in Manhattan, KS</li> </ul>	Randomized group trial	Accelerometer Direct observation (OSRAC-P)	<ul style="list-style-type: none"> <li>• Classroom MVPA was increased significantly in INT</li> <li>• Classroom VPA was significantly increased in INT during the last 2 wk</li> <li>• INT had significantly higher MVPA during outdoor play</li> </ul>

CON, control group; INT, intervention group; LPA, low physical activity; MPA, moderate physical activity; MVPA, moderate-to-vigorous physical activity; OSRAC-P, Observational System for Recording Activity in Children-Preschool Version; VPA, vigorous physical activity.

establish baseline levels of physical activity, children were randomized to one of two conditions: a recess group that received two additional 30-min periods of outdoor free time or a control group that followed their normal classroom schedule. The extended play periods were not structured in any way, and children were not given any instructions or suggestions on how to use the time.

On the two baseline monitoring days, the Head Start attendees participated in very little physical activity. On average, children spent more than 90% of their time in sedentary activities. Across the entire school day, the percentage of time spent in MVPA was 2.5% or less. Increasing outdoor play time had virtually no impact on physical activity levels while at school or during the entire day. Changes in the percentage of time spent in MVPA were, on average, less than 1%. Although the study was limited by a small sample size and a brief 2-d intervention period, the results indicated that simply increasing preschoolers' outdoor free play time without concurrent changes in physical activity programming or teacher behavior may not increase the quality or quantity of physical activity performed at preschool.

Hannon and Brown (9) tested the physical activity-enhancing effects of adding "activity-friendly" portable play equipment to a preschool playground. A single-group pre-post design was used in which physical activity during outdoor recess was objectively measured via accelerometry 5 d before and after the modification of the playground environment. The portable play equipment included easily obtainable "off-the-shelf" items such as hurdles to jump over, hoops to jump through, tunnels to crawl through, balance beams (ground level), target toss/throw sets, bean bags, and a variety of balls. The total cost of the equipment was less than \$1000; however, the authors stated that similar-functioning equipment could be improvised at a fraction of the cost. The equipment was placed in an irregular circle, and children were free to play with the equipment in any way they desired. Teachers did not provide any formal instruction related to the use of the equipment or increase the frequency with which they prompted children to be physically active.

After the introduction of the portable play equipment, children significantly decreased time spent in sedentary activities (57.1% to 41.2%) and significantly increased time spent in light- (30.6% to 34.1%), moderate- (9.8% to 17.6%), and vigorous-intensity (2.3% to 7.0%) physical activity. The results demonstrated that a simple, relatively inexpensive modification to the playground environment that requires little if any teacher/provider training can increase physical activity in preschool children. Although impressive, the study would have been strengthened if the authors had continued to monitor physical activity after removing the portable equipment (ABAB study design).

Trost et al. (14) conducted a randomized group trial to evaluate the impact of a policy change to increase classroom physical activity in 3- to 5-yr-old children

attending a half-day preschool program. Teachers from two randomly assigned classrooms were trained to integrate movement experiences ("move and learn" activities) into daily circle or group time, a classroom learning context in which children are typically expected to remain seated and relatively sedentary. The two remaining classrooms in the center served as usual-care controls. Physical activity while attending the program was measured objectively using accelerometry (ActiGraph) and direct observation (OSRAC-P). Notably, the accelerometer and PDA-based observational system were synchronized so that activity levels in specific locations and learning contexts could be readily delineated.

At the completion of the 8-wk intervention, children in the move and learn classrooms exhibited significantly higher levels of classroom MVPA than children completing their usual curriculum. Children in the intervention classrooms were 2.6 times (95% confidence interval = 2.2–3.0) more likely than children in the control classrooms to exhibit MVPA during circle time. Interestingly, although no efforts were made to change teacher behavior during outdoor play time, children in the intervention classrooms were 40% more likely to exhibit MVPA during outdoor play time than children in the control classrooms. The results demonstrated that a relatively simple change in instructional practices can result in small, but significant, increases in physical activity.

**Summary and future directions.** Although relatively few studies have examined the influence of policy and environment on physical activity behavior in child care settings, emerging evidence suggests that several key factors contribute to the marked between-center variability in physical activity and sedentary behavior.

From a policy standpoint, staff education and training, as well as staff behavior on the playground, seem to be salient influences on physical activity. Child care centers with greater levels of physical activity tend to employ teachers with higher levels of education and are more likely to provide staff with additional training in physical activity. In addition, these centers may reach out to parents with suggestions for promoting physical activity at home. The observation of an inverse association between teacher supervision and physical activity during recess serves as a reminder that teachers play an important role in physical activity promotion, and they should frequently prompt children to be active and avoid prolonged periods of conversation.

With respect to the physical environment, there is some evidence to suggest that attributes of outdoor play areas act as key influences on physical activity. Cross-sectional observational studies suggest that lower playground density (less children per square meter) and the presence of vegetation and unbroken open areas are positive influences on physical activity. However, not all studies have found these attributes to be significant influences. Interestingly, there was little evidence to support the notion that the amount or quality of fixed play equipment on-site influences physical activity behavior. On the contrary, the availability and

quality of portable play equipment emerged as key determinants of activity level. With respect to time outdoors, child care centers must continue to ensure that children have adequate outdoor play time. However, the observed inverse association between recess duration and physical activity level and the failure of extended recess periods to significantly increase physical activity suggest that multiple outdoor recess breaks may be more effective in promoting physical activity than a single prolonged outdoor play period.

The influence of policy and environment on physical activity and sedentary behavior in child care settings is a relatively new area of research. Not surprisingly then, studies published to date have been mostly cross-sectional, insufficiently powered, and, with the exception of the study by Cardon et al. (6), have used statistical methods that do not fully account for the hierarchical nature of data collected in child care settings. Consequently, it is critically important that future studies recruit sufficient numbers of

child care centers to ensure that they are adequately powered to detect small but potentially meaningful associations. Care should be taken to recruit a wide variety of child care centers, so that there is sufficient heterogeneity in policy and environmental influences to detect relationships. To advance the current knowledge base, child care centers should be studied as a collection of behavior settings that influence physical activity and sedentary behavior differentially. Investigators should explicitly identify the behavior settings within a child center that could influence physical activity behavior (i.e., paths, sandbox) and measure the characteristics of these settings that promote or encumber physical activity. Investigations of this type should use multilevel modeling techniques that take into account the hierarchical nature of data collected in child care centers (child → behavior setting → child care center).

No funding sources to disclose for this work.

The results of the present study do not constitute endorsement by the American College of Sports Medicine.

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