

## INFLUENCES OF PRESCHOOL POLICIES AND PRACTICES ON CHILDREN'S PHYSICAL ACTIVITY

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**ABSTRACT:** The objective of this study was to determine if moderate to vigorous physical activity (MVPA) of 3–5 year old preschool children varied with differences in policies/practices, and overall quality of preschools. A total of 266 children (47% males, 60% African American) from 9 preschools were observed for 1 hour on 3 different days. PA of children was observed twice per minute and scored as 1–5, with 1 for stationary/motionless and 5 for fast movement. Summary MVPA was calculated over the 3 days as percent of times observed at levels of 4 or 5, and percent of time at levels 1 or 2 as sedentary activity. A structured interview about PA policies was conducted with an administrator at each preschool and overall quality of the preschool was assessed using Early Childhood Environment Rating Scale-Revised Edition (ECERS-R). Preschools were divided into groups according to whether a specific policy/practice that would be logically hypothesized to promote PA was in place at the school. MVPA differences between groups of children was assessed using mixed ANOVA controlling for preschool. **When preschools offered more field trips, and more college educated teachers, the children participated in more MVPA.** Children who attended preschools with lower quality spent more time in sedentary activity. In conclusion, children in preschools which may have more resources and better quality appear to show both more sedentary behavior and more MVPA.

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**KEY WORDS:** observation; physical activity; sedentary behaviors; preschool quality.

### INTRODUCTION

Recent increases in the prevalence of overweight and obesity in preschool and school-age children constitute a significant and growing

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public health problem.<sup>1-4</sup> Overweight status during childhood has been associated with cardiovascular disease risk factors,<sup>5-6</sup> and overweight adolescents are at very high risk for becoming overweight adults.<sup>7</sup> One factor that may contribute to overweight and obesity in children is inadequate physical activity and/or excessive sedentary behavior.<sup>8,9</sup>

Many young children spend part of their day in a formal preschool-type setting. In 2001, about 56% of 3- to 5-year-old children were enrolled in early childhood care programs, which include day care centers, nursery schools, preschools, Head Start programs, and pre-kindergarten programs.<sup>10</sup> However, very little research has focused on physical activity and the determinants of physical activity of children in the preschool setting. A recent Centers for Disease Control and Prevention workshop on physical activity and sedentary behavior in 2- to 5 year-old children identified determinants of physical activity behavior as an important research topic for this age group.<sup>11</sup> In particular, it identified the need for research on the effects of environment on physical activity behavior, and noted that quality of care is an important environmental factor that may affect the physical activity level of preschool children.

Many factors are known to affect the quality of service provided in preschool-type settings. Foremost among these factors are policies and practices regarding group size, physical spaces, use of time, caregiver education, and the interactions between adults and children.<sup>12</sup> Although the effects of these factors on children's cognitive and social skills have been widely studied,<sup>13</sup> very little research has examined the ways that preschool policies/practices and quality of care affect the physical activity behavior of preschool children. Therefore, the purpose of this study was to determine if physical activity levels of preschool children vary with differences in policies/practices, and overall quality of preschools.

## METHODS

### Preschools

All preschools in Columbia, South Carolina, with enrollments of 60 or more children in the 3- 5-year-old age range were identified. Each preschool was categorized by type (private, church-related, or Head Start), and the percentage of white and African American children who attended each school was determined. Preschools were randomly selected from the

three types and invited to participate in the study. If they were not interested in participating, another preschool was randomly selected. Nine preschools (three of each type) were enrolled into the study.

### Subjects

A total of 277 children (approximately 30 from each preschool) were enrolled in the study. Eligible children spent at least six hours per day, five days per week at the preschool, and only one child from a family was enrolled into the study. A total of 266 children were observed (Table 1). The study was approved by the University of South Carolina Institutional Review board, and parents of participating children provided informed consent.

### Demographic Variables

Parents completed a written questionnaire on which they reported the age, race/ethnicity and sex of their child. Height and weight were measured in a private setting with children dressed in light clothing. Height was measured to the nearest 1.0 cm using a portable stadiometer. Weight was measured to the nearest 0.1 kg using high-precision electronic scales. Body mass index (BMI) was calculated as body mass in kilograms divided by height in meters squared ( $\text{kg}/\text{m}^2$ ).

**TABLE 1**

Characteristics of 266 Preschool Children

<i>Characteristic</i>	<i>N</i>	<i>Percent</i>
Sex		
Males	126	47.4
Females	140	52.6
Age		
3	68	25.6
4	126	47.4
5	72	27.1
Race		
African American	166	62.4
White	87	32.7
Other	13	4.9

### Physical Activity

The observation system used in this study, Observation System for Recording Activity in Preschools (OSRAP), was modified from the Children's Activity Rating Scale (CARS),<sup>14</sup> which was developed to record the intensity of physical activities of young children. Children were observed for one hour on 2 to 3 days, and none of the observations occurred during scheduled nap times. Observation times for each child were selected with a goal of including times from the morning and afternoon for each child. A research assistant observed the activity of a selected child for 15 seconds, then recorded the observed activity during the following 15 seconds. Activity level was scored on a 1 to 5 scale where—1 = stationary and motionless; 2 = stationary with movement of limbs or trunk; 3 = slow, easy movement; 4 = moderate movement; and 5 = fast movement. The highest activity level observed during the 15-second interval was recorded. Also, the child's physical location (inside classroom, outside playground, indoor play area, eating area, or outside general) was coded. All data were entered directly into a Palm Vx hand-held computer with the aid of Pendragon forms software (3.1) (Pendragon Software Corporation). For this study, moderate to vigorous physical activity (MVPA) was calculated as the percent of time the child was observed at levels 4 or 5. Percent of time at levels 1 or 2 was categorized as sedentary. Percent of time in MVPA and sedentary activity were reported for the total observed time and for the time spent outdoors on the playground.

Prior to data collection, two research assistants completed over 20 hours of training. Inter-observer agreement at the mid-point of the study was assessed by simultaneous field-observations of the same child. Intra-class correlation coefficients (ICCs) for the mean activity rating ranged from 0.91 to 0.98. Percent agreement for the five activity categories ranged from 75% to 99%.

### School Policies and Practices

A structured interview was conducted with an administrator in each participating preschool. The interview was designed to determine the physical activity and sedentary activity policies and practices of the preschool. It was composed of questions with multiple parts, which allowed the interviewer to probe for further detail (such as number of times per day or week). Topics included whether there were field trips that allowed the children to be physically active; if one or more community organizations supported or provided physical activity programs at the preschool;

and whether or not the preschool had policies regarding television/video viewing and computer use, the amount of time allowed for free play, and the amount of time spent outside per day. For each policy/practice, the preschools were divided into two groups, those that had a policy/practice that was hypothesized to promote physical activity (PA) and those that did not have such a policy/practice (NPA). For example, three preschools offered four or more field trips per month to sites such as the park, zoo or places to skate or bike and were considered to be in the PA group for this policy/practice. The other six preschools offered few field trips and were in the NPA group for this practice.

### **Preschool Quality**

The number of children enrolled per classroom and the educational backgrounds of the teachers were determined. In addition, one classroom at each preschool was evaluated using the Early Childhood Environment Rating Scale-Revised Edition (ECERS-R).<sup>15</sup> The ECERS-R evaluates quality based on current understanding of the recommended practice and research relating practice to child outcomes. The ECERS-R has seven dimensions which evaluate space and furnishings, personal care routines, language-reasoning, activities, interaction, program structure, and parent and staff needs. The scale includes 43 items that are rated from 1 to 7 on a Likert-type scale, with a score of 1 for inadequate and 7 for excellent. The global score ranges from 43 to 301, with higher scores indicating better quality of preschool classrooms. The complete psychometric properties of the ECERS-R have been reported elsewhere.<sup>15</sup> For this study, preschools with scores in the upper quartile of possible scores were considered to be higher quality. A research assistant was trained to administer the ECERS-R by studying a procedures manual and practicing with a videotape.<sup>16</sup>

### **Statistical Analysis**

Mixed model ANOVA procedures were used to compare percent of time spent in MVPA and sedentary pursuits between the two groups of preschools (PA and NPA) for each policy/practice and quality considered. The groups were generally composed of 3 or 4 preschools that reported a PA policy/practice (PA group) and 5 or 6 that reported an absence of such a policy (NPA group). Proc Mixed (SAS, version 8.1)<sup>17</sup> was used, with preschool nested within group treated as a random factor.

All analyses were performed both with and without adjustment for demographic variables of age, sex, race, and BMI. These analyses were

conducted both for MVPA and sedentary pursuits for the total observation period and for time on the playground alone. Because not all children were observed while on the playground, we adjusted for this by adding a dichotomous variable (playground, yes or no) when analyses were conducted for the total observed period.

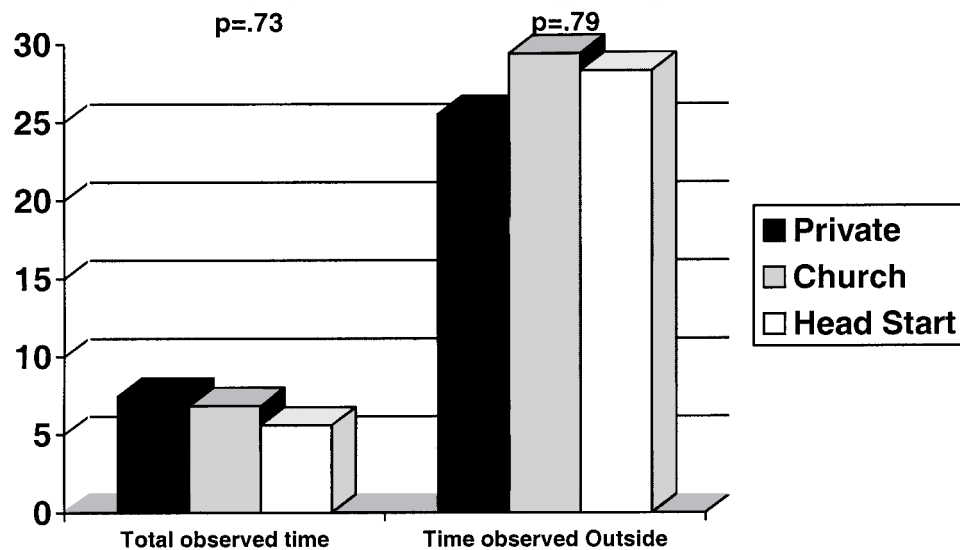
**RESULTS**

Sixty percent of the children were African American, 47% were four years of age, and 53% were female (Table 1). The average BMI for girls was 16.2 (SD = 2.0), slightly higher than the 15.8 (SD = 1.3) for boys (p = .06). There were no significant differences in the percent of observed time spent in MVPA by children in the different types of preschools (private, church-related, or Head Start) (Figure 1).

Table 2 presents the percentage of time spent in MVPA by children in preschools categorized according to policies/practices and overall quality. Means, standard errors and p-values are provided for total observed time and for time observed on the playground, both unadjusted and ad-

**FIGURE 1**

Percentage of observed time spent in moderate to vigorous physical activity by children in three types of preschools.



justed for selected covariates. For total observed time, children in preschools that reported four or more physical activity-related field trips per month spent significantly more time in MVPA than children in preschools that participated in fewer trips ( $p = .001$ ). Time in MVPA was higher in children attending preschools with smaller classes than in their counterparts in preschools with larger class size, but the difference was marginally significant ( $p = .08$ ). After adjusting for age, sex, race, BMI and whether the child was observed on the playground, the significance levels remained largely unchanged ( $p = .01$  for trips and  $p = .07$  for class size). When observed on the playground, children attending preschools that permitted more time outdoors and more free time, demonstrated a significantly lower percentage of time in MVPA ( $p = .04$ ) than did children attending preschools that permitted less free time and less time outdoors. Children attending preschools in which the majority of teachers were college educated demonstrated a higher percentage of playground time in MVPA than those attending preschools with fewer college-educated teachers. This difference was only significant after adjusting for age, sex, race, and BMI ( $p = .03$ ). Support from community organizations, television watching/computer use, and preschool quality were not associated with MVPA levels either overall or on the playground.

The percentage of time spent in sedentary pursuits by children in preschools categorized by policies/practices and quality are shown in Table 3. Both prior to and after adjustment for covariates, children attending preschools in which the majority of teachers were college-educated tended to spend more time in sedentary activity than did children attending preschools with fewer college educated teachers. However, both prior to and after adjustments for covariates, this difference just failed to reach statistical significance ( $p = .06$ ). Children attending preschools with overall higher quality spent significantly ( $p = .05$ ) less time in sedentary activity than did children attending lower quality preschools. This difference remained significant after adjustment for age, sex, race and BMI ( $p = .04$ ). The number of monthly field trips, involvement with community organizations, television/computer time, time spent outdoors, amount of free time, and class size were not associated with sedentary activity either overall or when children were on the playground.

## DISCUSSION

The present study endeavored to determine some of the characteristics of preschools that may influence the physical activity of children at-

TABLE 2

Percent of Time in MVPA With and Without Adjustment for Covariates Comparing Preschool Policies/  
Practices or Quality that were Physical Activity Promoting (PA) or Not (NPA) (Mixed Model ANOVA)

Measure	Preschools	Total Observed Time			Adjusted*			Playground Only			Adjusted§		
		N	Mean (SE)	p	Mean (SE)	p	N	Mean (SE)	p	Mean (SE)	p	Mean (SE)	p
Field trips (Times/month)													
PA ≥ 4	3	94	9.7 (0.7)	.001	7.8 (0.8)	.01	87	24.5 (3.3)	.25	23.6 (3.3)	.21		
PA = 1-3	6	172	5.1 (0.5)		4.3 (0.6)		122	29.7 (2.5)		29.8 (2.8)			
Community Organizations													
PA = Yes	4	115	6.0 (1.3)	.52	4.9 (1.0)	.46	86	30.5 (3.1)	.27	30.7 (2.7)	.12		
NPA = No	5	151	7.2 (1.2)		6.0 (0.9)		123	25.7 (2.6)		24.3 (2.4)			
TV/Computer/video (Minutes/ Day)													
PA < 45	3	83	5.7 (1.6)	.49	4.8 (1.2)	.48	63	26.3 (3.9)	.66	27.1 (3.9)	.95		
NPA ≥ 45	6	183	7.1 (1.1)		5.9 (0.9)		146	28.4 (2.7)		27.4 (2.7)			
Outside (Minutes/Day)													
PA ≥ 90	3	88	7.8 (1.5)	.36	6.3 (1.2)	.42	76	22.2 (2.7)	.04	22.5 (3.0)	.10		
NPA < 90	6	178	6.0 (1.1)		5.1 (0.9)		133	30.6 (2.0)		30.0 (2.4)			



Free time (Minutes/Day)											
PA ≥ 120	3	88	7.8 (1.5)	.36	6.3 (1.2)	.42	76	22.2 (2.7)	.04	22.5 (3.0)	.10
NPA < 120	6	178	6.0 (1.1)		5.1 (0.9)		133	30.6 (2.0)		30.0 (2.4)	
Class size (Number of children)											
PA 14-17	3	92	8.7 (1.3)	.08	7.1 (1.0)	.07	78	26.1 (3.7)	.60	25.7 (3.7)	.60
NPA 19-30	6	174	5.6 (0.9)		4.6 (0.7)		131	28.6 (2.7)		28.2 (2.8)	
Teacher Education (Percent with College Degree)											
PA ≥ 50%	3	86	5.0 (1.4)	.20	4.3 (1.1)	.19	64	32.1 (3.3)	.15	33.3 (2.9)	.03
NPA < 50%	6	120	7.4 (1.0)		6.1 (0.8)		145	25.6 (2.2)		24.3 (1.8)	
Preschool Quality											
Upper quartile	4	116	8.0 (1.2)	.17	6.4 (1.0)	.27	101	24.9 (3.7)	.38	25.6 (3.9)	.61
Lower 3 quartiles	5	150	5.6 (1.1)		4.7 (1.0)		108	29.1 (2.6)		28.2 (2.9)	

\*Controlling for age, sex, race, BMI and if observed on the playground (1 = yes, 0 = no).

§Controlling for age, sex, race, and BMI.

**TABLE 3**  
 Percent of Time in Sedentary Behavior With and Without Adjustment for Covariates,  
 Comparing Preschools with Policies/Practices or Quality that were Physical Activity Promoting (PA)  
 or Not (NPA) (Mixed model ANOVA)

Measure	Preschools	Total Observed Time			Adjusted*			Playground Only			Adjusted§		
		N	Mean (SE)	p	Mean (SE)	p	Mean (SE)	p	N	Mean (SE)	p	Mean (SE)	p
Field trips (Times/Month)													
PA ≥ 4	3	94	50.3 (3.6)	.06	54.7 (3.5)	.15	87	14.4 (2.5)	.62	16.2 (2.2)	.96		
NPA = 1-3	6	172	60.3 (2.6)		61.7 (2.5)		122	16.5 (3.3)		16.4 (2.0)			
Community Organizations (Yes/No)													
PA = Yes	4	115	60.1 (3.8)	.31	61.8 (3.2)	.31	86	15.9 (3.1)	.77	15.6 (2.1)	.66		
NPA = No	5	151	54.4 (3.4)		57.2 (2.9)		123	14.7 (2.7)		16.9 (1.8)			
TV/Computer/video (Minutes/Day)													
PA < 45	3	83	57.5 (4.8)	.90	59.2 (4.0)	.98	63	17.5 (3.4)	.45	17.3 (2.5)	.65		
NPA ≥ 45	6	183	56.7 (3.4)		59.3 (3.1)		146	14.1 (2.4)		15.9 (1.6)			
Outside (Minutes/Day)													
PA ≥ 90	3	88	55.4 (4.7)	.69	58.5 (4.0)	.82	76	20.1 (2.5)	.05	19.1 (2.0)	.12		
NPA < 90	6	178	57.8 (3.3)		59.7 (2.9)		133	12.6 (1.9)		14.4 (1.7)			

Free time (Minutes/Day)													
PA ≥ 120	3	88	55.4 (4.7)	.69	58.5 (4.0)	.82	76	20.1 (2.5)	.05	19.1 (2.0)	.12		
NPA < 120	6	178	57.8 (3.3)		59.7 (2.9)		133	12.6 (1.9)		14.4 (1.7)			
Class size (Number of children)													
PA 14–17	3	92	51.4 (4.0)	.13	54.9 (3.4)	.15	78	16.1 (3.4)	.74	16.0 (2.2)	.86		
NPA 19–30	6	174	59.8 (2.9)		61.6 (2.5)		131	14.7 (2.4)		16.6 (1.9)			
Teacher Education (Percent with College Degree)													
PA ≥ 50%	3	86	63.6 (3.7)	.06	64.7 (3.0)	.06	64	18.5 (3.3)	.27	19.0 (2.4)	.22		
NPA < 50%	6	120	53.6 (2.6)		56.5 (2.2)		145	13.6 (2.3)		15.3 (1.5)			
Preschool Quality													
Upper quartile	4	116	51.5 (3.1)	.05	54.7 (2.6)	.04	101	16.3 (3.5)	.71	13.6 (2.2)	.18		
Lower 3 quartiles	5	150	61.3 (2.8)		63.3 (2.4)		108	14.6 (2.5)		17.9 (1.6)			

\*Controlling for age, sex, race, BMI and if observed on the playground (1 = yes, 0 = no).

§Controlling for age, sex, race, and BMI.

tending those schools. To do this, we compared the percent of observed time in MVPA and sedentary behavior in young children attending different types of preschools (private, church-related and Head Start) and preschools that differed in selected policies/practices and overall school quality. Notably, when types of schools were compared there were no differences in the percent of time spent in MVPA in the total observed time or in the time observed outside on the playground. There were however, significant physical activity differences between preschools that differed on certain policies and practices. In particular, offering frequent field trips and employing college-educated teachers was associated with significantly higher levels of MVPA. In addition, greater school quality as measured by ECERS-R scale was associated with lower levels of sedentary behavior.

An important finding of the present study was the influence of field trips on children's physical activity behavior. Children in preschools that reported four or more physical activity-related field trips per month spent more time in MVPA than children in preschools that participated in fewer trips. The children were not observed while they were on the trips but only at the preschool. Field trips included going to zoos, parks, skating facilities, and nature trails. Preschools that offer more trips for activity may have social and physical environments that encourage more active play both indoors and on the playground. These preschools may also have better resources, such as vans for transportation and more playground equipment.

Another notable finding of this study was that children in preschools that had more college-educated teachers spent significantly more observed time in MVPA while on the playground as compared to children in preschools where fewer of the teachers had college degrees. The college-educated teachers more so than other teachers may structure their classroom time to emphasize fine motor skills, social skills and academic concepts.<sup>18</sup> It has been noted that when children lack the opportunity to play or be active for a period of time, they will compensate later when there is an opportunity to be active.<sup>19</sup> On the other hand, college-educated teachers may have added structure to play time (increasing opportunity), and encouraged the children to be more active.

It is noteworthy that children in preschools with higher overall quality scores spent significantly less time in sedentary activity compared to children in preschools with lower scores. This difference remained significant after adjustment for demographic variables. ECERS-R measures several dimensions of the preschool environment that could contribute to a child being more physically active.<sup>14</sup> These items include better furnishings and adequate space, quality of activities offered, and program structure and interactions among the children and between the children and

teachers. Again this suggests that children may be more active in preschools that have more resources.

It has been recommended that preschool children accumulate at least 60 min of daily structured physical activity.<sup>20</sup> In the present study, when children were observed on the playground, they were engaged in MVPA about 27% of the time. This means that on average children would be expected to receive about 32 min of MVPA for preschools that have two play periods lasting an hour each. Experts have recommended that, to meet the recommended 60 min of daily physical activity, planned physical activity should be incorporated into the daily preschool schedule. Structured activity sessions should be short, about 15 to 20 min in length<sup>21</sup> and should emphasize a wide variety of movement experiences.<sup>20,21</sup> This could include simple noncompetitive games and activities that involve movement accompanied by music.

A limitation of the present study is that only nine preschools were included. A similar study with more preschools is needed to replicate the findings of this investigation. Other limitations include the cross-sectional study design and the limited number of policies and practices related to children's participation in physical activity. Clearly, other policies and practices not considered in this study may influence children's physical behavior in the preschool setting. Nevertheless, even with a relatively small number of schools, higher levels of physical activity were found in preschools with policies/practices that promoted physical activity.

In summary, children attending preschools with more resources and better educated teachers demonstrated significantly higher levels of MVPA. In addition, greater preschool quality as measured by the ECERS-R was associated with significantly less sedentary activity during the preschool day. Similar levels of physical activity were observed in private, church-based and Head-start preschools. On average, the children in this study failed to meet current recommendations for participation in physical activity. To insure adequate accumulation of MVPA by the young children in their care, preschools should consider adding structured physical activity to their programs.

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