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## Child Care Center Characteristics Associated With Preschoolers' Physical Activity

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### Abstract

**Introduction**—Despite children spending long hours in child care centers, it is unknown what center characteristics are associated with children's moderate to vigorous physical activity (MVPA) at the center and over the 24-hour day.

**Methods**—Mixed model ANOVA evaluated associations between 23 center characteristics (e.g., policies, facilities, practices, and staff training) and time in MVPA, measured with accelerometers, at the child care center and over the 24-hour day among 388 preschoolers from 30 randomly selected child care centers in Cincinnati, Ohio. Data collection occurred from November 2009 through January 2011; data analyses occurred in 2012–2014.

**Results**—Ninety percent of centers reported scheduling two or more outdoor sessions daily, yet only 40% of children had two or more outdoor sessions; 32% had no time outdoors. Eighty-three percent of centers reported scheduling 60 minutes outdoors; 28% of children experienced this during observation. Children spent a mean (SE) of 2.0 (0.06) minutes/hour in MVPA. Children with 60 minutes outdoor time had 0.6 minutes/hour more MVPA in child care ( $p=0.001$ ), and 0.5 minutes/hour over the 24-hour day ( $p=0.001$ ) than those who did not. Presence of an indoor play space, large outdoor playground, portable or fixed play equipment, staff PA training, weather and clothing policies, and TV/computer use were not related to children's MVPA.

**Conclusions**—Outdoor time occurred less frequently than scheduled. Children with 60 minutes of outdoor time at the center were more active than children without. Centers may increase preschoolers' PA by adhering to the scheduled 60 minutes of outdoor time daily.

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## Introduction

Daily physical activity (PA) is essential for children's growth and development. It improves cardiovascular and bone health and has been linked to improved mood, attention, and cognitive performance.<sup>1-5</sup> PA is critical in preventing obesity, especially during the preschool years,<sup>6,7</sup> yet few preschoolers meet daily PA recommendations.<sup>8,9</sup>

The majority of U.S. preschoolers (56%) spend time in child care centers.<sup>10</sup> Many spend long hours in these settings or lack a safe place to play at home, thus children's only opportunity for PA may occur in these settings. PA opportunities vary widely among child care centers, with center-level attributes accounting for 27% 48% of the variance in PA levels.<sup>11-13</sup>

Children's PA in child care centers has been linked to the number and types of portable play equipment available (e.g., balls, tricycles)<sup>14-16</sup>; an outdoor playground that is large, has natural elements, and minimal fixed equipment<sup>14-18</sup>; the presence of an indoor space for active play (e.g., gym or muscle room)<sup>13,19</sup>; less electronic media use in classrooms<sup>14,15</sup>; teacher PA training<sup>14,15</sup>; and time allotted for outdoor play.<sup>13,18,20,21</sup> It remains unknown if center characteristics remain predictive of children's PA levels over the entire 24-hour day, as children who are more or less active while at the center may compensate when they get home.

The objective of this study was to determine which child care center characteristics are associated with preschool children's moderate to vigorous PA (MVPA) while in the center and over the 24-hour day. The authors hypothesized a priori that eight child care center attributes would be positively associated with children's MVPA:

1. ample quantities and variety of portable play equipment outdoors;
2. ample quantities and variety of portable play equipment indoors;
3. indoor space available for active play (henceforward referred to as —muscle room );
4. large onsite playground with natural elements and minimal fixed equipment;
5. staff trained in PA promotion;
6. PA-promoting policies and daily schedule;
7. no TV or computer use; and
8. centers providing at least 60 minutes of outdoor play on the day of observation.

## Methods

### Study Design

The Preschool Eating and Activity Study (PEAS) was a cross-sectional study of center environments and children's 24-hour PA in two randomly selected preschool classrooms in 30 randomly selected child care centers (N=60 classrooms). All data collection occurred during a mutually agreed-upon study week for 1 full day each classroom (first classroom on

Tuesday, second on Wednesday) from November 2009 through January 2011, providing temperature variation. Assessment materials were adapted from published instruments<sup>22,23</sup> and are available on request from the corresponding author.

## Participants

Centers were eligible if they offered full-day care to preschool children. Center directors were recruited from a randomly ordered list of all centers in Hamilton County, Ohio. All children aged 36–72 months enrolled in each of the randomly selected classrooms for at least 1 month, present on the day of observation, and who did not have a disability prohibiting MVPA, were eligible to participate. Only one child per family was eligible. Center directors and parents provided written informed consent. The IRB at Cincinnati Children's Hospital Medical Center approved the study.

Research staff measured child's height and weight (in light clothing, no shoes) in duplicate using a SECA stadiometer and Health-O-Meter scale. BMI z-scores were calculated using age and sex-matched norms.<sup>24</sup> A parent was given a self-administered questionnaire regarding child's date of birth, sex, race, ethnicity, eligibility for the Child and Adult Care Food Program, receipt of public health insurance, household income, and parental education to be completed on the evening the child wore the accelerometer.

## Measures

Independent variables were dichotomized at the median value to define PA promoting (Table 1). The authors computed three measures of portable play equipment for outdoor and indoor sessions: number of balls and pieces of riding equipment, and number of types of portable play equipment from a list of 15.<sup>16</sup> Muscle rooms were assessed for presence and size (5-point scale, very small to very large). Research staff measured playground square footage and noted the number of natural elements (e.g., garden, sand play area, trees)<sup>17</sup> and pieces of fixed equipment from a list of 18.

The percentage of staff reporting specialized training in PA for preschool children was assessed by a questionnaire completed by directors and child care providers from the observed classrooms ( $n=149$  of 168 eligible staff members). Centers directors also completed a telephone interview (ELEPhANTS<sup>25</sup>) about their weather and clothing policies for PA and daily schedules for outdoor and indoor active time<sup>25</sup>:

1. children permitted outside in temperatures  $<32^{\circ}\text{F}$ ;
2. children permitted outside in light rain;
3. children permitted outside in snow;
4. children permitted outside with snow on playground;
5. children permitted outside when playground is wet or muddy;
6. children not permitted to wear flip-flops on playground;
7. children not permitted to wear sandals on playground; and
8. directors keep extra clothing (e.g., coats, mittens, socks) for loan.

Research staff observed the presence of TVs and computers available for child use, and recorded the minutes these devices were used by individual children during the day of observation. Three child- and center-level variables were computed for any TV, computer, or screen (TV or computer) use on either observation day.

Staff recorded the actual time children spent outdoors and in the muscle room on the day of observation. The authors hypothesized that 60 minutes outdoors, in the muscle room, or total active time (outdoors + time in the muscle room) would be associated with higher PA levels.<sup>26</sup> Research staff recorded precipitation and temperatures during active sessions with a portable thermometer placed outdoors in the shade, or checked national weather service records at [www.ncdc.noaa.gov/](http://www.ncdc.noaa.gov/).

Research staff placed an Actical uniaxial accelerometer (MiniMitter®, USA) (15-second epoch) fitted with an elastic belt on each child's right hip upon arrival at the center on the observation day, and removed it the following morning. Established cut offs for counts per minute<sup>27</sup> were used to quantify time (minutes/hour) spent in MVPA, light activity, and sedentary activity for five periods: the 24-hour day, while at the child care center, while outdoors at the center, while in the muscle room at the center, and when home. Sleep and non-wear times were removed from these periods. Parents recorded non-wear and sleep times at home in a sleep and accelerometry diary; research staff recorded the child's arrival and departure times, nap periods, and active play periods on the playground and muscle room while in child care. The authors interpreted 120 consecutive epochs (30 minutes) with zero counts as non-wear time.

### Statistical Analysis

A mixed model ANOVA was used to evaluate differences in time spent in MVPA by center characteristics. All models included the following covariates chosen a priori: age, sex, BMI, parental education (treated ordinally with categories listed in Table 2), and child care center, the latter treated as a random effect. Independent variables and the timeframe(s) for the dependent variables are specified in Table 1. As each child could be exposed to multiple outdoor or indoor active sessions, with varying amounts of portable play equipment, portable play variables were examined at the session level. Similarly, size of the muscle room was evaluated for all children who had an indoor active session, and size and quality of the outdoor playgrounds were evaluated during outdoor sessions. All independent variables were tested separately to evaluate their association with time spent in MVPA over the child care day. Variables significant at  $p < 0.05$  in these models were candidates for entry in multivariable models (full models). Once these independent candidate variables were selected, models were run removing variables one at a time and examining the effect on the model. Once the final model was determined, diagnostics were run looking for influential observations and assessing residuals. The final multivariable model retained all covariates and only independent variables with a  $p$ -value of  $< 0.05$ . Outdoor time and total active time (in muscle room or on playground) were evaluated separately owing to collinearity. The following were also modeled as continuous variables: weather/clothing score; number of balls; pieces of riding equipment; portable play types; pieces of fixed equipment; and minutes of TV, computer, and overall screen time for individual children. Results for

continuous analyses are presented only if differed from categorical. Data analyses were conducted from 2012 to 2014.

## Results

Thirty randomly selected child care center directors gave consent to participate (10% refusal rate), two classrooms in each center were randomly selected (no refusals), and all children in selected classrooms were approached for participation. Of the 579 children potentially eligible, 447 (77%) families gave consent to participate, 415 children were present on the day of observation, and 27 children were excluded (nine refused to wear an accelerometer, one withdrew, 13 did not remain in the child care center for at least 5 hours, three accelerometers malfunctioned, and one accelerometer was not returned). Sample characteristics of the resultant 388 children are described in Table 2.

Most (80%) center directors reported a typical schedule for going outside twice daily (range, twice times/week to four times/day), for a median of 60 (30–107) minutes outdoors daily. As observed, 153 (40%) children had two or more outdoor sessions, 109 (28%) children had only one outdoor session, and 126 (32%) in eight centers had no outdoor sessions. There was a median of 23 (0–167) minutes per day of outdoor time across the 30 centers. There was no precipitation during any outdoor session, and the mean (SD) temperature was 73 (16)°F (range, 29–95°F). It was raining or snowing during 22% of the indoor active sessions and the mean (SD) outside temperature was 47 (22)°F (range, 15–96°F). Other conditions limiting outdoor play included: playground construction (two centers), no playground (one center), snow on playground (six centers), and playground wet and muddy (two centers). All 30 centers and 378 of 388 children had at least some active time, either indoors or outdoors (median, 68 minutes).

Children watched TV at 12 centers for a median of 28.5 (3–184) minutes. Computers were available at 22 centers and used by children for a median of 17 (2–72) minutes. A total of 168 children had any screen time (median, 27 minutes; range, 2–196 minutes). At the child level, 78% of children watched no TV, 70% did not use a computer, and 57% had no screen use at the center.

Participants wore the accelerometer for a mean (SD) of 23.5 (2.5) hours and spent 8.4 (1.2) hours in child care. PA levels are reported in Table 3. Children were most active in the muscle room and playground (9.0 and 7.3 minutes/hour, respectively), and least active at home (1.6 minutes/hour). Over the average 700 minutes/day (11.7 hours) awake, children spent a mean (SE) of 2.0 (0.06) minutes/hours in MVPA.

None of the hypothesized facility variables (portable and fixed equipment, size of active spaces, natural elements) were significantly associated with time spent in MVPA on the playground or in the muscle room. Table 4 includes all variables that were significantly associated with MVPA over the child care or 24-hour day in initial models. In the final multivariable model, only >60 minutes outdoors and >60 minutes total active time were associated with MVPA in the child care center; these were associated with a 0.5- and 0.6-minute/hour increase in MVPA, respectively over the child care day. Time spent outdoors in

child care and total active time in child care were also associated with time in MVPA over the 24-hour day. Children with 60 minutes outdoor active time engaged in 0.5 minutes/hour more MVPA over the 24-hour day than those that did not ( $p=0.001$ ). Children with 60 minutes any active time (indoors or outdoors) engaged in 0.4 minutes/hour more MVPA over the child care day than those that did not ( $p=0.003$ ). The authors also considered whether any of the 23 hypothesized variables were associated with time spent in sedentary activity over the child care day or 24-hour day, but none were significant in multivariable models (data not shown).

## Discussion

In this first study of child care center attributes associated with children's MVPA over the 24-hour day, time provided outdoors and total active time were the only two consistent modifiable predictors of children's PA levels. Children with at least 60 minutes of outdoor or active time were more active than children without (0.4–0.6 minutes/hour more time in MVPA), even after including PA at home. Although this difference is modest in minutes/hour, over the 24-h day, this would add up to an additional 10–14 minutes spent in MVPA, which may help put children over the threshold to achieve the recommended 60 minutes per day spent in MVPA.<sup>8</sup> These findings of a significant effect of 60 minutes of outdoor time or total active time are consistent with other reports<sup>20,21</sup> and add support for child care guidelines,<sup>26</sup> which recommend at least 60–90 minutes of outdoor time daily. The full 24-hour day is important when evaluating center influences on children's PA, as it takes into account whether children compensate at home for their level of activity in the center. The findings that center effects persist when including home activity levels are novel, and suggest that what happens in the center has important and lasting effects for children's total daily levels of activity.

Importantly, this study found a difference between scheduled versus observed sessions and time outdoors. Outdoor time occurred much less frequently than scheduled. One quarter of centers and one third of children had no outdoor time on the day of observation. This discrepancy between scheduled and observed outdoor time has been observed in other studies,<sup>21,28</sup> and underscores the importance of assessing actual practice.

Weather may have been an important factor.<sup>29</sup> Outdoor sessions occurred under primarily sunny and moderately warm conditions whereas indoor sessions occurred in cooler and overcast conditions. The authors previously reported<sup>30</sup> that child care providers cite their preferences about weather as a barrier to children's outside time. The present findings suggest that the scheduled 60 minutes of active play time outdoors does not occur consistently if cold or inclement conditions are common.

Contrary to others,<sup>13–19</sup> this study did not find any significant effect of facilities—including size of indoor or outdoor play space, natural elements, and fixed equipment—on children's MVPA. It also did not find staff PA training or portable play equipment to be associated with PA levels indoors or outdoors. There may have been insufficient outdoor or indoor time with portable play equipment to detect an effect in this sample. The literature on the effect of portable play equipment is mixed, with those using a measure that combines number and

variety of types of equipment finding significant effects,<sup>13–15,31</sup> whereas those who separate number and types of portable play equipment finding few<sup>16</sup> or no<sup>18,32</sup> significant effects. Equipment availability is incumbent on teachers, who must retrieve it,<sup>30</sup> and children may not use it unless teachers prompt them or model its use.<sup>33</sup> This study was unable to determine teacher's influence on equipment availability or enticement in this study. More research is needed to understand what types and quantities of portable play equipment significantly facilitate children's PA, and how teachers may influence its availability and effectiveness.

This study did not find a significant relationship between TV or computer use at either the center or child-level and children's MVPA or sedentary activity, as others have found.<sup>14,15</sup> Overall, TVs were used at 40% of centers for a median of 63 minutes, which is higher screen time usage than reported elsewhere.<sup>28</sup> This study is among the first to report computer usage in child care centers, and found relatively high penetration (73% of centers). Though the majority of children did not have any screen time in child care, there were a few—super users that accounted for most of the screen time. The negative health, behavioral, and cognitive effects of TV among preschoolers has been widely reported,<sup>34–38</sup> but the effects of computer use are unknown for this age group.

### Limitations

The study was limited to a single day of observation in a single county, limiting its generalizability. However, the sample was racially and socioeconomically diverse. Though a single day of observation is insufficient to determine usual PA levels among preschool children, the study was designed to assess center effects on children's PA across four seasons. The inclusion of two winters during data collection likely contributed to lower overall PA levels, but these temperatures occur for one fourth of the year. The authors were unable to assess home environments or the role teachers may have played in making decisions to go outside or use portable play equipment. Lastly, although the study controlled for relevant confounders such as parental education and child BMI, sex, and age, there may have been residual confounding that affected the results. Future research should test the effect of providing two or more sessions of active time totaling 60 minutes to preschoolers on days when temperatures or precipitation might otherwise preclude active opportunities. An RCT of two additional 30-minute recess periods did not increase MVPA in a temperate climate.<sup>39</sup>

### Conclusions

Children in child care centers with at least 60 minutes of outdoor time or active time were more active over 24 hours than those without these opportunities. Outdoor sessions occurred less frequently than scheduled, particularly during winter and precipitation. This was the first study to examine center influences on children's PA over the full 24-hour day and over a wide range of weather conditions. To ensure that children receive adequate opportunities to be active, centers that regularly face inclement conditions should make better use of indoor spaces and encourage teachers to take children outdoors briefly even on cold days. These opportunities may be especially important for children who lack opportunities to be



active at home. Findings suggest that child care centers play a pivotal role in children's PA levels.

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**Table 1**

## Characteristics of Child Care Centers Hypothesized to Promote Physical Activity

Independent variable <sup>a</sup>	Sessions n (%)	Child-sessions n (%)	Time period(s) of dependent variable (MVPA) in models <sup>b</sup>
<b>1. Portable play equipment outdoors</b> Denominator (N) <sup>c</sup> = 69 outdoor sessions in 22 centers; 437 child-sessions			
2 balls	31 (45%)	214 (49%)	Outdoor sessions
2 pieces of riding equipment	32 (46%)	197 (45%)	Outdoor sessions
4 total types of portable play equipment <sup>d</sup>	29 (42%)	193 (44%)	Outdoor sessions
<b>2. Portable play equipment indoors</b> Denominator (N) = 71 indoor active sessions in 22 centers; 448-child sessions			
4 balls	32 (45%)	193 (43%)	Indoor active sessions
1 piece of riding equipment	32 (45%)	197 (44%)	Indoor active sessions
6 total types of portable play equipment <sup>d</sup>	33 (46%)	215 (48%)	Indoor active sessions
Independent variable	Centers n(%)	Children n(%)	Time period(s) of dependent variable (PA) in models
<b>3. Indoor active space (muscle room)</b> Denominator (N) = 30 centers; 388 children			
Muscle room present	23 (77%)	295 (76%)	Child care day, 24-h day Indoor active session.
Large muscle room size	14 (47%)	186 (48%)	Child care day, 24-h day
<b>4. Outdoor facilities/playground</b> Denominator (N) = 29 centers with a playground; 377 children			
Playground size 3,750 sq ft	14 (48%)	184 (49%)	Outdoor session. Child care day, 24-h day
>1 natural elements <sup>e</sup>	14 (48%)	175 (46%)	Outdoor session. Child care day, 24-h day
<9 pieces of fixed equipment <sup>f</sup>	13 (45%)	169 (45%)	Outdoor session Child care day, 24-h day
<b>5. Physical Activity Training</b> Denominator (N) = 30 centers; 388 children			
>50% reporting of staff/directors reporting any specialized training in children's physical activity	15 (50%) centers	181 (47%) children	Child care day, 24-h day
<b>6. Policies</b> Denominator (N) =30 centers; 388 children			
>60 min planned outdoor time	14 (47%) centers	191 (49%) children	Child care day, 24-h day
5 Weather and clothing Policies promoting physical activity <sup>g</sup>	17 (57%)	223 (57%)	Child care day, 24-h day
<b>7a. Sedentary Environment in child care: center-level</b> Denominator (N) = 30 centers; 388 children 2 days observation in each center.			
No TV viewing on either observation day	18 (60%)	226 (58%)	Child care day, 24-h day
No computer use on either observation day	8 (27%)	98 (25%)	Child care day, 24-h day
No screen use (TV or computer) on either observation day	5 (17%)	65 (17%)	Child care day, 24-h day
<b>7b. Sedentary Environment in child care: child-level</b> Denominator (N) = 388 children			

Independent variable <sup>a</sup>	Sessions n (%)	Child-sessions n (%)	Time period(s) of dependent variable (MVPA) in models <sup>b</sup>
No TV viewing	N/A	302 (78%)	Child care day, 24-h day
No computer use	N/A	272 (70%)	Child care day, 24-h day
No screen use (TV or computer)	N/A	220 (57%)	Child care day, 24-h day
<b>8. Active time provided on day of observation.</b> Denominator (N)= 30 centers; 388 children			
>60 minutes observed outdoor time	9 (30%)	108(28%)	Child care day, 24-h day
>60 minutes observed indoor active time	7 (23%)	65 (17%)	Child care day, 24-h day
>60 minutes total active time (indoors or outdoors)	21 (70%)	224(58%)	Child care day, 24-h day

<sup>a</sup>Independent variables were dichotomized at the median, as described in the methods. Thus the first column lists the category above or below the median hypothesized to increase the time children spend in MVPA.

<sup>b</sup>The final column indicates time frame(s) for the dependent variable—minutes per hour spent in moderate to vigorous physical activity (MVPA). As described in the methods, each hypothesized independent variable was entered into bivariable mixed model adjusting for age, sex, BMI z-score, parental education and child care center as a random effect. The effect of portable play variables were only explored during the corresponding active periods (indoors or outdoors). The size and quality of indoor and outdoor play spaces were also evaluated during the corresponding active periods. For the all independent variables except portable play variables (which were not evaluated over child care day or 24-h day), significant effects over the 24-h day were only explored in bivariable models if the independent variable was significantly associated with MVPA or sedentary activity during the child care day.

<sup>c</sup>The denominator used for analysis varies by variable, and is listed in the header above each variable. For instance for portable play equipment, the denominators are sessions (71 indoor and 69 outdoor) and child-sessions (n=437 indoor and n=448 outdoor). The number of centers (n=22) that had at least one outdoor session or indoor session is smaller than the total sample of centers (n=30), as 8 centers had no indoor session and 8 centers had no outdoor session, as described in the results. For outdoor facilities variable, the denominator is 29 centers and 377 children that had a playground, as one center (n=11 children) did not have an onsite playground.

<sup>d</sup>Types of portable play equipment included balls, riding toys, art materials, jumping toys, sand/water play toys, hula hoops, push/pull toys, rocking and twisting toys, music and twirling toys, blocks, manipulatives, portable balance beam, parachute, hoses, and other

<sup>e</sup>Natural elements included: sand play area, grass maze, safe stepping stones, rolling/climbing mound, water play area, flower or vegetable garden, easily supervised cozy natural nook, animal habitat, and trees.

<sup>f</sup>Fixed equipment included: climber, slide, swings, tire swing, monkey bars, climbing ropes/chains, tunnels, sandbox, other digging area, water/sensory table, place to sit/quiet activities, dramatic play fixed structure (e.g., playhouse), basketball hoop or other aiming structures, climbing wall, fixed balance beam, fixed rocking/twisting toys, fixed easels, and a storage sheds.

<sup>g</sup>The weather/clothing score was created as the sum of the total number of the following 8 policies and practices centers employed to promote physical activity: children permitted outside in (1) temperatures under 32 degrees Fahrenheit, (2) light rain, (3) snow; when (4) snow on playground and (5) playground wet or muddy; and children *not* permitted to wear (6) flip-flops or (7) sandals on playground; and (8) directors kept extras of at least three of the following types of clothing for children to borrow if needed: coats, hats, mittens, boots, socks, or general clothes for when a child's clothing becomes soiled. Weather/clothing scores (observed range 2 to 8) were dichotomized at the median, with 5 or more policies/practices (the median) as promoting of physical activity.

**Table 2**

## Characteristics of Study Participants and Centers

Variable	Mean (sd) or n (%)	N <sup>a</sup>
<b>Child characteristics</b>		
Age (y)	4.3 (0.7)	388
Sex (Female)	199 (51%)	388
Hispanic ethnicity	13 (3.5%)	372
Race		374
White	162 (43%)	
Black, African-American	150 (40%)	
Other and mixed race	62 (17%)	
BMI (kg/m <sup>2</sup> )	16.3 (1.7)	382
BMI z-score	0.45 (1.1)	367
Time in child care on observation day (h)	8.4 (1.2)	388
Time at home (pick-up day 1 to drop-off day 2) on observation day (h)	15.6 (1.6)	382
<b>Family characteristics</b>		
Household Income		356
<\$25,000	136 (38%)	
\$25K–\$50,000	82 (23%)	
\$50K–\$75,000	32 (9%)	
\$75K–\$100,000	25 (7%)	
\$100K–\$150,000	41 (11%)	
>\$150,000	40 (11%)	
Child eligible for Child and Adult Care Food Program (CACFP)	211 (57%)	370
Child had public insurance	171 (47%)	367
Parent education		372
Less than high school	10 (3%)	
Graduated high school / GED	60 (16%)	
Some college or Associate's degree	135 (36%)	
Technical or trade school	18 (5%)	
Graduated college	84 (23%)	
Advanced degree	65 (17%)	
Parent marital status		370
Married/living with partner	195 (53%)	
Single adult household	175 (47 %)	
<b>Center characteristics (from director survey)</b>		
Total enrollment		
Preschool age (3–5 years)	39 (23)	
Toddler age (18–35 months)	21 (16)	
Infant age (3–17 months)	13 (14)	
Tuition per week for preschool age (\$)	174.73 (33.75)	30
Percent of children on subsidized tuition, median [25%–75% IQR]	85 [30–96.5]	29

Variable	Mean (sd) or n (%)	N <sup>a</sup>
Percent of children participating in CACFP, median [25%–75% IQR]	77.5 [45 – 96]	26
Center type or affiliation(s)		30
For-profit	12 (40%)	
Head Start	8 (27%)	
Religious-affiliated	9 (30%)	
Part of an elementary school	1 (3%)	
Montessori	1 (3%)	

<sup>a</sup>N column indicates number of responses for this item. 375 (97%) questionnaires were returned, some with missing responses for specific items.

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**Table 3**  
Physical Activity Levels During Active Play Periods, Child Care, and Over 24 Hours

Setting /Timeframe	Outdoor sessions on playground	Indoor active sessions in muscle room	Child care center	Home	24-h day
n	262 children; 437 child-sessions	242 children; 448 child-sessions	388 children	388 children	388 children
Total time in setting (accelerometer wear time)(h)	1.0 (0.04)	1.0 (0.04)	8.4 (1.2)	15.6 (1.6)	23.5 (2.5)
Total time in setting excluding sleep periods (min)	60.3 (2.6)	60.6 (2.3)	360 (3.8)	339 (4.6)	700 (4.4)
Moderate-vigorous physical activity MVPA (min/h)	7.3 (0.3)	9.0 (0.4)	2.4 (0.08)	1.6 (0.07)	2.0 (0.06)
Light PA (min/h)	30.8 (0.6)	29.7 (0.6)	21.4 (0.3)	18.0 (0.3)	19.9 (0.2)
Sedentary activity (min/h)	21.9 (0.7)	21.3 (0.7)	36.1 (0.3)	40.4 (0.3)	38.1 (0.2)

Note: Values expressed as mean (sem)

**Table 4**  
 Multivariable Models Predicting Time in MVPA at the Child Care Center and Over the 24-h Day

Independent variable	MVPA (min/h)											
	Child care center				24-h day				Total active time model (indoors or outdoors)			
	Outdoor time model		Total active time model (indoors or outdoors)		Outdoor time model		Total active time model (indoors or outdoors)		Outdoor time model		Total active time model (indoors or outdoors)	
	full	final	full	final	full	final	full	final	full	final	full	final
N	365	365	365	365	365	365	365	365	365	365	365	365
Weather and clothing policies promoting PA	0.2 (0.3) ( <i>p</i> =0.4)		0.3 (0.2) ( <i>p</i> =0.2)		0.08 (0.2) ( <i>p</i> =0.6)		0.2 (0.1) ( <i>p</i> =0.2)					
Muscle room present	0.4 (0.3) ( <i>p</i> =0.1)		0.3 (0.3) ( <i>p</i> =0.2)		--		--		--		--	--
60 min provided outdoors on day of observation	0.5 (0.2) ( <i>p</i> =0.06)	<b>0.5 (0.2) (<i>p</i>=0.03)</b>			<b>0.5 (0.2) (<i>p</i>=0.004)</b>		<b>0.5 (0.2) (<i>p</i>=0.001)</b>					
60 active time provided (indoors or outdoors)			<b>0.6 (0.2) (<i>p</i>=0.004)</b>				<b>0.6 (0.2) (<i>p</i>=0.001)</b>		<b>0.4 (0.1) (<i>p</i>=0.006)</b>		<b>0.4 (0.1) (<i>p</i>=0.003)</b>	
Age (y)	0.1 (0.1) ( <i>p</i> =0.3)	0.1 (0.1) ( <i>p</i> =0.30)	0.1 (0.1) ( <i>p</i> =0.3)	0.1 (0.1) ( <i>p</i> =0.2)	0.2 (0.09) ( <i>p</i> =0.08)	0.2 (0.09) ( <i>p</i> =0.08)	0.2 (0.09) ( <i>p</i> =0.06)	0.2 (0.09) ( <i>p</i> =0.06)	0.2 (0.09) ( <i>p</i> =0.06)	0.2 (0.09) ( <i>p</i> =0.06)	0.2 (0.09) ( <i>p</i> =0.06)	0.2 (0.09) ( <i>p</i> =0.05)
Sex (Female vs. male)	<b>-0.5 (0.2) (<i>p</i>=0.003)</b>	<b>-0.5 (0.2) (<i>p</i>=0.003)</b>	<b>-0.4 (0.2) (<i>p</i>=0.003)</b>	<b>-0.5 (0.1) (<i>p</i>=0.003)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.003)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>	<b>-0.3 (0.1) (<i>p</i>=0.004)</b>
BMI (kg/m <sup>2</sup> )	-0.02 (0.05) ( <i>p</i> =0.6)	-0.03 (0.05) ( <i>p</i> =0.6)	-0.02 (0.05) ( <i>p</i> =0.6)	-0.03 (0.05) ( <i>p</i> =0.50)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.05 (0.03) ( <i>p</i> =0.1)	-0.06 (0.03) ( <i>p</i> =0.09)
Parental education	0.04 (0.06) ( <i>p</i> =0.6)	0.04 (0.06) ( <i>p</i> =0.5)	0.05 (0.06) ( <i>p</i> =0.4)	0.06 (0.06) ( <i>p</i> =0.3)	0.001 (0.04) ( <i>p</i> =0.9)	0.001 (0.04) ( <i>p</i> =0.9)	0.001 (0.04) ( <i>p</i> =0.8)	0.002 (0.04) ( <i>p</i> =0.9)	0.01 (0.04) ( <i>p</i> =0.8)	0.01 (0.04) ( <i>p</i> =0.8)	0.01 (0.04) ( <i>p</i> =0.8)	0.02 (0.0) ( <i>p</i> =0.7)

*Note:* Boldface indicates statistical significance (*p*<0.05). Dash (--) indicates variable was not significant in initial models.